S12A AMENDMENT OF PLAN APPLICATION
APPROVED NGAU TAM MEI
OUTLINE ZONING PLAN NO. S/YL-NTM/12

PROPOSED REZONING FROM "R(C)" TO "G/IC"
FOR A PROPOSED "SOCIAL WELFARE FACILITIES"
(RESIDENTIAL CARE HOMES FOR THE ELDERLY)
(RCHE)

AT LOT 4823 IN D.D.104, 81 SAN TAM ROAD,
SAN TIN, N.T.

Consolidated Planning Statement

(Vol. 2)

RLEE

RLEE Architects (HK) Ltd

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APPENDIX 3

ENVIRONMENTAL IMPACT ASSESSMENT

RLEE

RLEE Architects (HK) Ltd

S12A Amendment of Plan Application,

Approved Ngau Tam Mei Outline Zoning Plan No. S/YL-NTM/12

Proposed Rezoning from "R(C)" to "GIC" for a Proposed "Social Welfare Facilities"

At Lot 4823 in DD 104, 81 San Tam Road, San Tin

Environmental Assessment Report

17 November 2023

Ref No.: C220410W-01

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Disclaimer:

- This report is prepared and submitted by Novox Limited with all reasonable skill to the best of our knowledge, incorporating our Terms and Conditions and taking account of the resources devoted to it by agreement with the client.
- We disclaim any responsibility to the client and others in respect of any matters outside the project scope.
- This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

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1 INTRODUCTION

1.1 BACKGROUND

Wonder Pacific Development Limited (the Applicant) intends to develop an 10-storey Residential Care Home for the Elderly (RCHE) (the Development) at Lot 4823 in D.D. 140 in 81 San Tam Road, San Tin (the Site).

For a proposed amendment to the approved Ngau Tam Mei Outline Zoning Plan No. S/YL-NTM/12, a planning application to the Town Planning Board (TPB) under Section 12A of the Town Planning Ordinance (TPO) is required for rezoning from "R(C)" zone to "G/IC" zone.

To satisfy the Section 12A planning application, Novox Ltd is commissioned to conduct an environmental assessment to evaluate the potential environmental impact based on the latest master layout plan.

1.2 THE PROJECT AREA

The Site area is approximately 736.3m^2 and it is located at Lot 4823 in D.D. 140 in 81 San Tam Road, as shown in **Appendix 1.1.** It locates within the R(C) zone of the OZP. The site is currently an existing House. The Proposed Development is an 10-storey RCHE which comprises a total 142 bed spaces. The anticipated year of construction completion and occupation is 2027.

The floor layout plans, and section diagrams of the Proposed Development are provided in the Planning Statement of the Planning Application.

1.3 OBJECTIVE AND SCOPE OF ENVIRONMENTAL ASSESSMENT

The key objectives of this EA are to identify environmental key issues and constraints of the project, to identify possible environmental impacts, to propose mitigation measures against any unacceptable environmental impacts during the construction and operation phases of the project, including

- Identify all sensitive receivers of the Proposed Development.
- Assess the potential air quality impact at the Proposed Development due to vehicular and any industrial emissions.
- Carry out a Noise Impact Assessment (NIA) during construction and operation of the RCHE Proposed Development.
- Assess the potential impact of water quality and waste management impact due to the Proposed Development.
- Recommend the necessary mitigation measures to alleviate any unacceptable impacts.

2 AIR QUALITY IMPACT ASSESSMENT

2.1 AIR QUALITY STANDARDS

The Air Pollution Control Ordinance (APCO) provides the statutory authority for controlling air pollutants from a variety of sources. The Hong Kong Air Quality Objectives (AQOs), which stipulate the statutory limits of air pollutants and the maximum allowable numbers of exceedance over specific periods should be met. With passage of Hong Kong's Air Quality Objectives (AQOs) in the Air Pollution Control Ordinance (Cap. 311), the latest AQOs as listed in Table 1 have been in effect.

Table 1 Hong Kong Air Quality Objectives

Pollutant	Averaging time	Concentration limit[1] ($\mu g/m^3$)	Allowable number of exceedances
Sulphur Dioxide (SO_2)	10-minute	500	3
	24-hour	50	3
Respirable Suspended Particulates (PM_{10}) [2]	24-hour	100	9
	Annual	50	Not Applicable
Fine Suspended Particulates ($PM_{2.5}$) [3]	24-hour	50	35
	Annual	25	Not Applicable
Nitrogen Dioxide (NO_2)	1-hour	200	18
	Annual	40	Not Applicable
Ozone (O_3)	8-hour	160	9
Carbon Monoxide (CO)	1-hour	30,000	0
	8-hour	10,000	0
Lead (Pb)	Annual	0.5	Not Applicable

Note: [i] All measurements of the concentration of gaseous air pollutants, i.e., sulphur dioxide, nitrogen dioxide, ozone and carbon monoxide, are to be adjusted to a reference temperature of 293Kelvin and a reference pressure of 101.325 kilopascal.
[ii] Respirable suspended particulates means suspended particles in air with a nominal aerodynamic diameter of 10 μm or less.
[iii] Fine suspended particulates means suspended particles in air with a nominal aerodynamic diameter of 2.5 μm or less.

2.1.1 The Site Environment

The existing environment of the proposed development is primarily affected by the local traffic such as San Tin Highway and San Tam Road. A site visit was carried out on 22nd June 2022 and 24th July 2023 within 500m study area of the project, and no chimneys were observed within 200m from the Site boundary during the site visit. The Site is used an existing House of GFA 294.258 m^2 and a plot ratio of 0.4. The uses adjoining to the Site is a small mountain full of greenery to the east, village houses namely Maple Garden and Casa Paradizo with 3 storeys to the north, and the south of the Site. Far away to the west of the Site are scattered building structures surrounding primarily for uses including warehouses,

workshops and with several village houses. As such, local traffic is considered to be the dominant emission source affecting the ambient air quality in these areas.

There is currently an air quality monitoring station operated by Environmental Protection Department (EPD) located outside the Project Site, namely Yuen Long Monitoring Station (situated at Yuen Long District Office, 269 Castle Peak Road). Despite this, in terms of geographical location, this monitoring station is considered the closest to the proposed Project Site. The annual average of air pollutants in $\mu g/m^3$ monitored at this station for the year 2018-2022 are summarized in Table 2 below. In 2022, all measured parameters complied with the AQO except Ozone recorded non-compliance with the 8-hour AQO (160 μg/m3 with allowance of 9 exceedances of AQO limit per year).

Table 2 EPD Air Quality Monitoring Record at Yuen Long Monitoring Station in 2018-2022

Pollutant	Averaging Time	Conc. Limits ($\mu g/m^3$)	No. of Exceedances Allowed	Concentrations ($\mu g/m^3$) [1]					Remarks
				2018	2019	2020	2021	2022	
PM_{10}	24-hour	100	9	75	83	77	73	56	10th highest conc.
	Annual	50	Not Applicable	37	37	30	30	25	/
$PM_{2.5}$	24-hour	50	35	34	34	28	31	30	36th highest conc.
	Annual	25	Not Applicable	20	20	16	17	16	/
NO_2	1-hour	200	18	150	161	135	148	122	19th highest conc.
	Annual	40	Not Applicable	**43**	**44**	32	40	37	/
SO_2	10-minute	500	3	52	42	26	24	21	4th highest conc.
	24-hour	50	3	17	11	10	14	7	4th highest conc.
CO	1-hour	30,000	0	1,720	2,150	1,530	2,090	1,700	1st highest conc.
	8-hour[2]	10,000	0	1,574	1,903	1,279	1,591	1,519	1st highest conc.

O_3	8-hour[2]	160	9	**162**	**200**	154	**178**	**194**	10th highest conc.

Note:
[1] **Bolded** concentrations indicate exceedance of the air quality objectives

2.1.2 Representative Air Quality Sensitive Receivers (ASRs)

All the residential units within the proposed development are identified as sensitive receivers for air quality impact assessment. **Appendix 2.1** shows the locations of Representative ASRs of proposed RCHE development.

2.1.3 Hong Kong Planning Standards and Guidelines (HKPSG)

According to Chapter 9, Environment of the Hong Kong Planning Standard and Guidelines (HKPSG), adequate buffer distance or screening should be provided between sensitive receptors and potential air pollution emitters. For roads that are distinguished as local distributor and truck road for active and passive recreational uses, the buffer distance must be greater than 5m and 20m respectively as shown in Table 3 below.

Table 3 Guidelines on Usage of Open Space Site

Pollution Source	**Parameter**	**Buffer Distance**	**Permitted Uses**
Road and Highways	*Type of Road*		
	Trunk Road and Primary Distributor	>20m	Active and passive recreation uses
		3 - 20m	Passive recreational uses
		<3m	Amenity areas
	District Distributor	>10m	Active and passive recreational uses
		<10m	Passive recreational uses
	Local Distributor	>5m	Active and passive recreational uses
		<5m	Passive recreational uses
	Under Flyovers		Passive recreational uses

2.2 OPERATIONAL VECHICULAR EMISSION SOURCES

2.2.1 Evaluation of Air Quality Impact

The development may be subject to vehicular emission impact from roads nearby during the operational phase of the project. According to the Annual Traffic Census 2022 published by

the Transport Department (TD), San Tam Road is classified as a rural road and San Tin Highway is classified as a trunk road. With reference to HKPSG, 20m buffer distance should be provided for the trunk road (e.g., San Tin Highway). As a conservative approach, San Tam Road is assumed as District Distributor and hence a 10m buffer distance shall be provided in accordance with the HKPSG's requirement. No air-sensitive uses including openable window, fresh air intake and recreational use in the open space is located within the said buffer distances, no adverse air quality impact is anticipated. The buffer distance between the said roads and the proposed RCHE development is shown in **Appendix 2.1**. In order to avoid adverse air quality impact from the traffic emission, a buffer zone is recommended for the Proposed Development with the following requirements:

- No air-sensitive uses including openable window, fresh air intake and recreational uses in open space is allowed within buffer zones.
- With the provision of the buffer zone, the buffer distances recommended in HKPSG will be satisfied. Therefore, no adverse air quality impact on the Site from traffic emission is anticipated.

2.3 OPERATIONAL INDUSTRIAL EMISSION SOURCES

2.3.1 Evaluation of Air Quality Impact

As discussed in Section 2.1.1, it has confirmed in a site visit carried out on 22 June 2022 and 24th July 2023 within 200m study area of the project, that no chimneys were observed within 200m from the Site boundary during the site visit. The uses adjoining to the Site is a small mountain full of greenery to the east, village houses namely Maple Garden and Casa Paradizo with 3 storeys to the north, and the south of the Site. To the west of the Site are scattered building structures surrounding primarily for uses including warehouses, workshops and with several village houses. It is confirmed that there is no air and odour emission sources in 200m study area by site survey. As such, local traffic is considered to be the dominant emission source affecting the ambient air quality in these areas. Thus, no adverse air quality impact to the proposed RCHE development due to industrial source emissions is anticipated.

2.4 CONSTRUCTION DUST EMISSION SOURCES

2.4.1 Evaluation of Air Quality Impact

The potential air quality impacts include the dust and exhaust emissions arising from the construction (e.g., demolition, site formation, foundation and formworks etc.). The nearest ASRs are Casa Paradizo Block C1 to C7 (i.e., 2m to 11m between the Site and ASR). The constructional works of the proposed project will impose potential air quality impacts on the nearby ASRs during the constructional stage (Figure 2.1.2 refers).

Given that the distance between the Site boundary and Casa Paradizo Block C1 to C7 is close (i.e., below 10m distance), the Site should erect higher hoarding (e.g., at least 3m high at the near side facing Casa Paradizo) to minimise the construction dust impact.

However, other ASRs are not immediately located besides the Project Site (e.g., 40m

between Site boundary and Maple Gardens Block G2&3) and the Site Area is only about 736m^2 which is a very small footprint. Considering the size of site formation and excavation is in a small scale, the amount of excavated material and number of dump trunk would be limited. No significant dust impact from the construction works is anticipated.

In order to further minimize the potential dust emissions and for good site practice, relevant mitigation measures under the Air Pollution Control (Construction Dust) Regulation should be incorporated in the relevant works contracts.

- Good practice and mitigation measures to be implemented during the construction phase are as follows:
- Regular watering to reduce dust emissions from exposed site surfaces and unpaved roads, particularly during dry weather.
- Frequent watering for particularly dusty areas and areas close to ASRs.
- Open stockpiles shall be avoided or covered. Where possible, prevent placing dusty material storage piles near ASRs.
- Side enclosure and covering of any aggregate or dusty material storage piles to reduce emissions. Where this is not practicable owing to frequent usage, watering shall be applied to aggregate fines.
- Tarpaulin covering of all dusty vehicle loads transported to and from the Site.
- Establishment and use of vehicle wheel and body washing facilities at the exit points of the Site.
- Use of water sprinklers at the loading area where dust generation is likely during the loading process of loose material, particularly in dry weather.
- Provision of not less than 2.4m high hoarding from ground level along site boundary where adjoins a road, streets or other accessible to the public except for a site entrance or exit.
- Imposition of speed controls for vehicles within the Site.
- Where possible, routing of vehicles and positioning of construction plant should be at the maximum possible distance from off-site ASRs.
- Every stock of more than 20 bags of cement or dry Pulverised Fuel Ash (PFA) should be covered entirely by impervious sheeting or placed in an area sheltered on the top and the 3 sides.
- Electric power supply shall be provided for on-site machinery as far as practicable to minimize aerial emissions.

It is also suggested that the contractor should set up a communication channel (e.g. regular meeting) with the management office of Casa Paradizo to have a better dust control

management, if necessary. With implementation of the recommended mitigation measures, no adverse air quality impacts during construction are anticipated.

No concurrent project in the surrounding area. Given that there is no adverse air quality impact during the construction, no cumulative air quality impact due to the project thus be anticipated.

2.5 OPERATION AIR QUALITY IMPACT

2.5.1 Evaluation of Air Quality Impact

Odour Impact from the proposed on-site STP

The proposed on-site Sewage Treatment Plant (STP) with sewage treatment capacity storage time greater than 60 days is a potential source of odour impact to residents and the public in the vicinity during operation phase. The Proposed Development only have a total 142 bed spaces (far below than 2000 population). In addition, according to the STP design calculation in Appendix 4.3, the treatment capacity of the on-site STP is 77.5cu.m/day and serving 250head/Day.

Hence, EPD's Guidelines for the Design of Small Sewage Treatment Plant shall be followed for the STP as follows:

The STP should be sited with good buffering distance from houses, and enclosed to minimize adverse impact.

Ventilation exhaust pipes should be taken to roof level.

In order to reduce the odour nuisance from STP, a deodorization adsorption system (as shown in **Appendix 2.2**) is proposed to install for removal of odour from generated sources. The deodorization adsorption system will have minimum odour removal efficiency of 99.5% for H_2S. The deodorization adsorption system will have minimum service life for 12 months continuous operation for 5ppm H_2S loading. Replacement of the deodorizing filter will be taken place annually. Sufficient adsorption capacity of activated carbon will be installed. The odour removal air from the outlet of deodorization adsorption system will be exhausted through the air duct to high level. In addition, a wet sludge transfer pipe will be installed to draw wet sludge from the sludge holding tank at STP to the collection point adjacent to the entrance of development in fully close system for tanker collection of wet sludge to dispose to Government sewage treatment plant. No odour will be released during the wet sludge disposal process.

The tentative location of the STP exhaust has been designed as far away as possible from all nearby ASRs. Considering that the scale of the proposed STP is small and at source mitigation measures (e.g. deodorization adsorption system) would be applied, no adverse odour impact from the proposed on-stie STP is anticipated.

With reference to the EIA Report of Expansion of Sha Tau Kok Sewage Treatment Works (STKSTW), the treatment capacity is about 10,000m^3/day at ADWF with 99.5% removal efficiency, the nearest ASR (20m from the boundary of STKSTW) is 0.13 OU/m^3. Given that the capacity of the Project is far below than the STKSTW, it is anticipated that the odour

impact generated from the Project would not greater than the SKTSTW with same odour removal efficiency of 99.5%. With reference to contour map of averaged odour concentration (Figure 3.4 – 3.5) of the said EIA Report, no average odour concentration is found >5 OU/m^3. Therefore, it is anticipated that no adverse impact from the Project is anticipated.

Cooking Fume/odour from the proposed kitchen.

Kitchen will be provided at the Proposed Project. Oily fume and cooking odour emissions will potentially arising from the kitchen. In order to minimise the potential oily fume and odour emissions from the canteen/kitchen, the following considerations of positioning the exhaust outlets of the kitchen as recommended in the Control of Oil Fume and Cooling Odour from Restaurants and Food Business published by the Environmental Protection Department (EPD) shall be considered during the detailed design stage:

- locate the outlets at such a place where the ventilation is good and the emissions from them can be adequately dispersed without hindrance.
- provide sufficient separate distance from any sensitive receptor in the vicinity so that the emissions will not cause, or contribute to, an odour nuisance or other type of air pollution to the public.
- ensure the emission from the exhaust system will be directed vertically upwards, unless it can be demonstrated by an environmental professional that other direction is more advantageous in preventing the emission from causing air pollution problems.
- ensure the emission from the exhaust system will not be restricted or deflected by, for example, the use of plates or caps.

In order to minimise the impact of oily fume and cooling odour, the Applicant is committed to install a grease filter (as shown in **Appendix 2.3**) to control oily fume and cooking odour. Operation and maintenance of the exhaust system as well as the air pollution control equipment should be carried out by competent staff with sufficient training and relevant skills, and should be done in accordance with the manufacturer's specifications and specified procedures. To ensure proper performance, qualified professionals should be employed to undertake regular monitoring, inspection, cleaning and maintenance of components.

The tentative location of the Kitchen exhaust has been designed as far as possible all nearby ASRs. Considering that at source mitigation measure (e.g. grease filter) would be applied, no adverse odour impact from the proposed kitchen is anticipated.

3 NOISE IMPACT ASSESSMENT

3.1 NOISE ENVIRONMENT

3.1.1 The Site Environment

The Subject Site is surrounded by mainly low-rise residential development, including Maple Garden and Casa Paradizo. San Tin Highway is located near the western side of the development nearby which will generate road traffic noise impact. There exists operation for sales of building materials with open storage to the west as observed in onsite survey. No existing noise sources are operating at night time.

3.1.2 Representative Noise Sensitive Receivers (NSRs)

All the residential units within the proposed development are identified as sensitive receivers for noise impact assessment. Representative Noise Sensitive Receivers (NSRs) at each flat was selected for the quantitative traffic noise impact assessment, their locations and room sizes are shown in **Appendix 3.1**. The assessment points include all openable windows in habitable rooms such as living rooms and bedrooms. Windows in noise tolerance spaces such as toilets, bathroom and staircases are excluded.

There is no diagnostic rooms / wards in the proposed RCHE development. The Multi-Function Areas will not rely on operable window for ventilation.

The assessment points have been taken to be situated at 1.2 m above floor slabs and at 1 m away from the external facade of openable windows of habitable room of the flats.

3.2 ENVIRONMENTAL LEGISLATION AND STANDARDS

3.2.1 Road Traffic Noise Assessment Criteria

Noise standards are recommended in the *Hong Kong Planning Standards and Guidelines* (HKPSG) for planning against noise impact from road traffic. As stated in Table 4.1 of Chapter 9 of HKPSG, the criterion for road traffic noise impact on domestic premises (habitable rooms) is L_{10}(1-hour) 70dB(A). This criterion applies to uses which rely on openable windows for ventilation.

3.2.2 Fixed Noise Sources Assessment Criteria

Impacts of fixed noise sources within the Proposed Development on nearby noise sensitive buildings is governed by the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM) issued under the Noise Control Ordinance ("NCO") and sections of Chapter 9 of HKPSG.

In setting the ANL, reference has to be made to the Area Sensitive Rating ("ASR") in Table 1 of IND-TM reflecting the type of area where the noise sensitive receivers ("NSRs") are situated. The proposed development and surrounding existing residential developments are considered low density residential area. Future noise sensitive uses of the proposed

development are expected to be directly affected by San Tin Highway with Annual Average Daily Traffic ("AADT") in excess of 30,000 (i.e. influencing factor, IF). An ASR of "C" is considered representative of the noise sensitive uses. For NSRs without direct line of sight to San Tin Highway, An ASR of "B" is adopted. ANL and operation noise criteria for different Area Sensitivity Ratings (ASRs) are summarized in **Table 3-1** and **Table 3-2**.

According to the HKPSG, the level of the intruding noise at the façade of the nearest sensitive use should be at least 5 dB(A) below the appropriate ANL shown in the IND-TM or, in the case of the background being 5 dB(A) lower than the Acceptable Noise Level (ANL), the predicted noise level should not exceed the background.

Background noise level in terms of L_{90}(1-hr) will be measured onsite by future contractor so that it can be adopted for determining necessary noise mitigation measures to meet the requirement. Regarding the identified existing NSR discussed above, it is close to and directly affected by road traffic along San Tin Highway so that the background noise level is more likely to be higher than ANL-5.

Table 3-1 Area Sensitivity Rating (ASR)

Type of Area Containing NSR \ Degree to which NSR is affected by IF	Not Affected	Indirectly Affected	Directly Affected
(i) Rural area, including country parks or village type developments	A	B	B
(ii) Low density residential area consisting of low-rise or isolated high-rise developments	A	**B**	**C**
(iii) Urban area	B	C	C
(iv) Area other than those above	B	B	C

Table 3-2 Acceptable Noise Levels (ANLs)

Time Period \ ASR	A	B	C
Day (0700 to 1900 hours)	60	**65**	**70**
Evening (1900 to 2300 hours)			
Night (2300 to 0700 hours)	50	**55**	**60**

Remarks:

1) Prevailing background noise level to be measured by future contractor. Prevailing background noise level or ANL-5 will be finally adopted.

3.2.3 Construction Noise Assessment Criteria

The main piece of legislation controlling environmental noise nuisance impact is the *Noise Control Ordinance (NCO)*. The NCO enables regulations and Technical Memoranda (TM) to be made, which introduce detailed control criteria, measurement procedures and other

technical matters.

Construction noise is governed under the following TMs:

- Technical Memorandum on Noise from Percussive Piling (PP-TM).
- Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM).
- Technical Memorandum on Noise from Construction Work in Designated Areas (DA-TM).

During "Restricted Hours", defined as 7pm to 7am from Monday to Saturday and all day on public holidays, the construction contractor must apply for and receive a Construction Noise Permit (CNP) from EPD for percussive piling (at any time) or any other construction activities conducted. While there is no planned construction works to be carried out during the restricted hours, the relevant TMs should be followed in case there is any need to carry out works in such time period in future.

3.3 ROAD TRAFFIC NOISE ASSESSMENT

3.3.1 Assessment Model

The U.K. Department of Transport's procedure *"Calculation of Road Traffic Noise"* (CRTN) is used to predict the hourly L_{10}(1-hour) noise levels generated from road traffic at selected representative NSRs using proprietary noise prediction software CadnaA. Road traffic noise impacts on various floor levels on the respective residential blocks/houses have been predicted. Practicable environmental mitigation measures will be recommended where necessary. The predicted noise levels are compared with the relevant HKPSG noise standards (i.e. L_{10}(1-hour) 70dB(A)).

The assessment methodology was implemented using noise prediction software CadnaA, which is a graphically based computer programs in full compliance with the noise prediction methodologies as set out in CRTN.

This proprietary modeling software is capable of simulating various road traffic conditions, road conditions and the form of noise mitigation measures. All the topographic effect, distance information, view angle information, shielding effects, ground absorption and façade reflection can be accurately illustrated and computed.

Topographic barrier including surrounding building structures, retaining walls, and natural terrains etc. all provide screening or reflection effect to the noise source. This information is retrieved from the latest digital map data provided by Lands Department and digitized in the road traffic noise model.

For the propagation of noise, a worst-case hard ground as defined in CRTN was assumed throughout the Study Area.

A +2.5dB(A) correction for façade reflection was applied at receptor locations in accordance with CRTN.

3.3.2 Traffic Flow Data

The road layout defines the road width, opposing traffic lane separation, road surface type, traffic mix, traffic flow and design speed. For the purpose of this road traffic noise impact assessment, traffic flows have been forecasted for all major roads within 300m of the proposed development. The road network was divided into discrete segments, each of which was assigned a segment number.

The proposed development is scheduled for construction completion and operation in year 2027. Traffic forecast for year 2042 representing the worst situation within 15 years from the operation of the residential care home is provided by project traffic consultant and included in **Table 3-3**. The traffic forecast was conducted by the Project's traffic consultant and agreed with Transport Department (TD) and Planning Department (PlanD) as shown in **Appendix 7.1**.

Table 3-3 Year 2042 Traffic Forecast for Noise Impact Assessment

Road ID.	Road Name	Direction	Road Surface	Road Speed [km/h]	AM Peak		PM Peak	
					Traffic Flows [veh/hr]	% of HV *1	Traffic Flows [veh/hr]	% of HV *1
A	Geranium Path	Two-way	Impervious	50	30	10%	30	10%
B	Royal Palms Boulevar	Two-way	Impervious	50	580	10%	564	10%
C1	Castle Peak Road - Mai Po	NB	Impervious	50	770	34%	690	30%
C2	Castle Peak Road - Mai Po	SB	Impervious	50	1185	34%	640	23%
D1	Castle Peak Road - Mai Po	NB	Impervious	50	940	25%	900	19%
D2	Castle Peak Road - Mai Po	SB	Impervious	50	1490	20%	790	18%
E1	Castle Peak Road - Mai Po	NB	Impervious	50	915	23%	870	17%
E2	Castle Peak Road - Mai Po	SB	Impervious	50	1515	21%	815	20%
F1	San Tin Highway	NB	Pervious	100	4700	26%	4030	25%
F2	San Tin Highway	SB	Pervious	100	4815	30%	5025	20%
G1	San Tam Road	NB	Impervious	50	740	17%	595	10%
G2	San Tam Road	SB	Impervious	50	950	22%	650	20%
H1	San Tam Road	NB	Impervious	50	700	15%	670	10%
H2	San Tam Road	SB	Impervious	50	1005	20%	585	20%
I1	San Tam Road	NB	Impervious	50	685	15%	665	10%
I2	San Tam Road	SB	Impervious	50	1005	20%	585	20%
J	Access Road	Two-way	Impervious	50	25	10%	30	10%
K	Maple Gardens 5th Street	Two-way	Impervious	50	30	10%	30	10%
L	Maple Gardens 4th Street	Two-way	Impervious	50	30	10%	30	10%
M	Maple Gardens 6th Street	Two-way	Impervious	50	30	10%	30	10%

N	Maple Gardens 6th Street	Two-way	Impervious	50	30	10%	30	10%
O	Maple Gardens 6th Street	Two-way	Impervious	50	30	10%	30	10%
P	Maple Gardens 5th Street	One-way	Impervious	8	30	10%	30	10%
Q	Access Road	Two-way	Impervious	50	55	10%	55	10%
R	Access Road	Two-way	Impervious	50	55	10%	55	10%

Remarks:

1) HV includes Light Van, Public Light Bus, Light Goods Vehicle, Medium Goods Vehicle, Heavy Goods Vehicle and Container/Tractor, Coach and Bus.

3.3.3 Road Surface Conditions

The CRTN modelling method uses emission level adjustments to take into account the influence of various road surfaces and gradients on noise emission level. A -1dB correction to the basic road source noise level is applied to impervious road surface with traffic speed below 75km/hr, and -3.5dB correction to the basic road source noise level for pervious road surface.

3.3.4 Road Traffic Noise Impact for Baseline Scenario

Quantitative road traffic noise impact assessment has been carried out and compared against the criterion. Noise levels were calculated for the baseline scenario without noise mitigation in place. Predicted maximum traffic noise levels for each assessment point are shown in table below. The detailed noise model and contour map are shown in **Appendix 3.1** for reference. The assessment is based on conservation assumption of hard reflecting ground surface over the entire Study Area.

In the baseline scenario the building layout and orientation has been duly considered with respect to traffic noise impact. Whereas practicable, the housing units are oriented away from major roads. Noise tolerant facades are used for self-screening. Notwithstanding the above, there is still slight noise exceedance. Noise mitigation measures are necessary.

Table 3-4 Predicted Road Traffic Noise Impact for Unmitigated Scenario

Window ID	Predicted Noise Level $L_{10,\ 1\ hour}$, dBA						Noise Criteria, dBA
	2/F	3/F	4/F	5/F	6/F	7/F	
W01	77.8	76.7	76.7	76.8	76.8	76.9	70
W02	76.7	76.9	77.0	77.0	77.1	77.1	70
W03	76.9	76.8	76.9	76.9	77.0	77.0	70
W04	76.9	76.6	76.6	76.7	76.8	76.9	70
W05	76.8	63.9	64.8	66.0	67.2	68.3	70
W06	76.6	54.5	54.8	55.2	56.1	57.7	70
W07	57.2	54.0	54.2	54.6	55.6	57.3	70
W08	53.9	57.9	58.5	58.7	59.2	60.1	70

W09	52.9	64.8	66.6	66.9	67.0	67.2	70
W10	53.3	69.3	71.8	72.1	72.2	72.2	70
W11	54.8	72.4	75.3	75.9	76.0	75.9	70
W12	59.2	69.6	73.4	74.2	74.3	74.3	70
W13	62.0	68.1	72.4	73.3	73.4	73.5	70
W14	63.9		71.4	72.4	72.5	72.6	70
W15	62.0		71.0	72.2	72.4	72.4	70
W16	60.8		71.2	71.5	71.6	71.6	70
W17	59.5		67.3	67.3	67.4	67.6	70
W18			68.7	68.8	68.9	69.0	70
W19			68.7	68.8	68.9	69.0	70
W20			68.7	68.7	68.8	69.0	70

Remarks:

North Façade

East Façade

Void in South Façade

3.3.5 Road Traffic Noise Impact for Mitigated Scenario

Practicable noise mitigation noise measures have been incorporated in the building layout design, in accordance with Practice Note on Application of Innovative Noise Mitigation Designs in Planning Private Residential Developments against Road Traffic Noise Impact (PN_INMD), including:

At the northern façade, vertical architectural fin is provided. The fin extends 1.7m from the building façade.

At the eastern façade, a vertical architectural fin is provided at the southeast corners. The fin extends 1.5m from the building façade.

At the southern façade, NSRs are located within a building void with self noise screening. Yet there are still some NSRs having direct line of sight towards San Tin Highway, thus a vertical architectural fin is provided at entrance towards the building void to block the line of sight. The fin extends 0.9m from the building façade.

The maximum noise reductions by architectural fins are capped at 3dB for conservatism. For receivers with still having residual noise impact with the above architectural fins in place, acoustic window will be provided. An additional window layer is introduced to the conventional side-hung window in a staggering position. The outer window is a conventional push-pull type window whilst the inner one consists of a half-size sliding window. Making reference to PN_INMD, the proposed acoustic window configuration can offer an additional traffic noise reduction of 6dB(A). In detail design stage, mock-up test will be conducted to demonstrate that adequate noise reduction will be achieved.

Sound absorption material is proposed on the back side of architectural fin. Additional SAM are proposed at the entrance to the void area, as indicated in Figure 3.1.6 and 3.1.7. The proposed SAM would be in the form of 50mm thick rockwool covered in waterproof acoustic transparent member and perforated panel.

The location and details of mitigation measures are illustrated in **Appendix 3.1.**

With the above mitigation measures in place, predicted maximum traffic noise levels for each assessment point are shown below. Since all the noise assessment points comply with the HKPSG noise standard, the residual noise impact is considered to be satisfactory.

Table 3-5 Predicted Road Traffic Noise Impact for Mitigated Scenario

Window ID	Predicted Noise Level $L_{10,\ 1\ hour}$, dBA						Noise Criteria, dBA
	2/F	3/F	4/F	5/F	6/F	7/F	
W01	68.8	67.8	67.8	67.8	67.9	68.0	70
W02	67.8	68.0	68.1	68.1	68.2	68.4	70
W03	68.3	69.6	69.7	69.8	69.9	70.0	70
W04	69.0	69.8	69.8	69.9	70.0	70.0	70
W05	69.7	63.0	63.8	65.2	66.6	67.8	70
W06	69.8	52.7	52.7	53.0	54.3	56.5	70
W07	56.4	52.3	52.3	52.6	54.0	56.3	70
W08	53.2	55.4	56.0	56.2	56.6	57.4	70
W09	52.4	62.4	64.1	64.3	64.4	64.6	70
W10	52.2	66.6	69.0	69.3	69.4	69.5	70
W11	52.2	64.8	68.5	69.2	69.3	69.3	70
W12	56.7	69.1	66.7	67.4	67.5	67.5	70
W13	59.3	65.6	65.7	66.5	66.6	66.7	70
W14	63.2		64.7	65.5	65.7	65.7	70
W15	60.4		64.3	65.3	65.5	65.5	70
W16	58.2		69.9	64.1	64.2	64.3	70
W17	56.9		64.6	64.7	64.8	64.9	70
W18			66.2	66.3	66.4	66.7	70
W19			66.1	66.2	66.3	66.4	70
W20			66.0	66.1	66.2	66.3	70

Remarks:

- *Noise reduction by acoustic fin is capped at 3dB(A) for conservatism.*

North Façade

East Façade

Void in South Façade

68.8 *Underlined cells indicate façades with acoustic windows*

3.4 FIXED SOURCE NOISE ASSESSMENT

3.4.1 Assessment Model

Standard acoustical principles in accordance with *"ISO 9613-2:1996 Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation"* will be adopted for prediction of fixed noise impact. The general equation used to calculate the equivalent continuous sound pressure level at a receiver location arising from each individual noise source is described below:

$$L_{eq} = L_w + D_c - A_{div} - A_{atm} - A_{gr} - A_{bar} - A_{misc}$$

Where

L_w is the sound power level of the noise source;

D_c is the directivity factor of the noise source;

A_{div} is the attenuation due to geometrical divergence;

A_{atm} is the attenuation due to atmospheric absorption;

A_{gr} is the attenuation due to ground effect;

A_{bar} is the attenuation due to barrier;

A_{misc} is the attenuation due to miscellaneous other effects.

The prediction methodology described in ISO 9631-2 is implemented via noise prediction software CadnaA. A 3D model was constructed taking into account the topology and site layout plan. CadnaA is proprietary software for noise mapping of road traffic, railway as well as fixed industrial plants, etc. It has been used for city-scale Strategic Noise Mapping in Europe according to the EC Directive 2002/49/EC, the reliability has been well verified and accepted.

Topographic barrier including surrounding buildings, retaining walls, and natural terrains etc. all provide screening effect to the noise source. This information is retrieved from the latest digital map data provided by Lands Department.

The noise barriers within the proposed development include self-screening by noise tolerant building blocks and architectural fins. These barriers are constructed in the 3D model based on latest master layout plan. For calculation of barrier screening effect, maximum insertion loss is capped at 20dB for single barrier, 25dB for double barrier, according to ISO 9613.

For the propagation of noise, a worst-case hard ground was assumed throughout the Study Area. No ground attenuation effect is applied.

A +3.0dB(A) correction for façade reflection was applied at receptor locations.

3.4.2 Identified Existing Fixed Noise Sources

Site survey has been conducted on 22 June 2022 to identify any presence of industrial/fixed noisy facilities/activities. There exists operation for sales of building materials with open storage to the west as observed in onsite survey.

According to the onsite survey, there is no noticeable noise observed from open storage. The noise environment is dominated by road traffic, apparently from San Tin Highway.

To summarise, potential fixed/industrial noise sources were identified to the west of the Subject Site. Particulars of the identified fixed noise sources are presented below. No existing noise sources are operating at night time. The location of the noise sources are taken at nearest workshop areas where forklift, cranes and saw cuts would normally operate.

Table 3-6 Identified Fixed Noise Sources for Noise Impact Assessment

ID	Source Description	Source Location		Assumed SWL, dB(A)	Operation?		Reference
		Easting	Northing		0700-2300	2300-0700	
S1	盈豐倉庫 (Storage)	22.48355	114.05799	92	Y	N	Transitional Housing Development at Lots 111 (Part), 116 to 119 in D.D. 108 and Adjoining Government Land, Fan Kam Road, Pat Heung, N.T. - Environmental Assessment
S2	松輝木業公司 (Industrial)	22.48313	114.05794	92	Y	N	Transitional Housing Development at Lots 111 (Part), 116 to 119 in D.D. 108 and Adjoining Government Land, Fan Kam Road, Pat Heung, N.T. - Environmental Assessment

3.4.3 Identified Fixed Noise Source Generated by the Project

Planned fixed noise sources within the Proposed RCHE Development are identified as shown in **Appendix 3.2**

Among the identified sources, the dominate sources are two nos. of cooling towers located on the open rooftop having direct line of sight to NSRs. The noise may potentially affect Casa Paradizo and Maple Garden in the close proximity.

Most of the Mechanical and Electrical (M&E) equipment, such as chiller, water pumps, lift machines, etc. will be installed in enclosed plant rooms of the Proposed RCHE Development. Transformers and Sewage Treatment Plant will be located in the basement level and placed inside enclosed structure. The guidance of "Good Practices on Ventilation System Noise Control" and "Good Practices on Pumping System Noise Control" issued from EPD shall be referred to. Appropriate mitigation measures, where necessary, shall be provided to comply with the noise criteria.

Small power rating split type air conditioning systems will be installed for individual room. However, the noise impact of those small power rating outdoor units shall be minimal, and the contribution is hence not considered in the noise impact assessment.

3.4.4 Allowable Sound Power Level

At this stage the cooling towers for the project had not been confirmed as which shall be designed in future by the design and build contractor. As such the maximum allowable sound power level will be determined by back calculation from the separation distance between the noise source and nearby representative nearest noise sensitive receivers are given in table below.

A catalogue of low noise type cooling towers as shown in **Appendix 3.2** for reference. The Sound Power Level (SWL) of this cooling tower model is 93dB which is adopted in the noise model. The sound power level and noise mitigation requirements will be stipulated in the project contractor specification governing the equipment selection by the design and build contractor.

Table 3-7 Proposed Fixed Source Noise Mitigation Treatment

Noise Sources	Allowable SWL	Noise Mitigation Description (refer to Appendix 3.2)
Cooling Tower (Intake)	73 dB(A)	- Low noise type cooling tower - Intake silencer with IL of 20dB(A), the silencer is typically 900 to 1200 long subject to supplier model selection
Cooling Tower (Discharge)	93 dB(A)	- Low noise type cooling tower - No silencer to be provided since fan noise is directed upward in the open rooftop and not affecting low rise residential premises

3.4.5 Fixed Plant Noise Assessment Results

Based on the allowable SWL and two cooling towers in full load operation, the noise impact at the worst affected façade at nearby representative NSRs are tabulated below.

Table 3-8 Predicted Fixed Source Noise Impact to Surroundings

ID	NSR	Predicted Noise Level at Worst Façade, dB(A)	Nighttime Noise Criteria, ANL-5 dB(A)
N01	Maple Garden G3	34.8	55
N02	Casa Paradizo A18	32.4	55
N03	Casa Paradizo C7	39.7	50

As such, provided the fixed plant noise generation at the cooling tower does not exceed the allowable SWL, fixed plant noise impact towards the affected NSRs will not exceed the noise criteria stipulated in the HKPSG.

3.4.6 Fixed Plant Noise Assessment Results

There are also existing industrial fixed noise sources operating during daytime. The cumulative fixed noise impact is included in the fixed noise impact assessment for compliance check. Fixed plant noise impact towards the affected NSRs will not exceed the ANL noise criteria.

Table 3-9 Predicted Cumulative Fixed Source Noise Impact

ID	NSR	Predicted Noise Level at Worst Façade dB(A)			Day & Evening Criteria, ANL dB(A)
		Planned Fixed Plant Noise	Existing Fixed Plant Noise	Cumulative Noise	
N01	Maple Garden G3	34.8	47.2	47.4	70
N02	Casa Paradizo A18	32.4	49.0	49.1	70
N03	Casa Paradizo C7	39.7	37.9	41.9	65

3.5 CONSTRUCTION NOISE IMPACT

Various construction activities will be the key noise sources generated during the construction phase. In particular, the use of PME and the vehicle movement within the Site are the major potential noise sources. Construction shall be carried out during non-restricted hours as far as practicable. The mitigation measures recommended in ProPECC PN2/93 should be implemented where applicable. In addition, the following measures and on-site practice are recommended in order to minimize the potential construction noise impacts during daytime:

- Quiet PME and construction method should be adopted if possible.
- The Contractor shall devise and execute working methods to minimise the noise impacts on the surrounding sensitive uses, and provide experienced personnel with suitable training to ensure that those methods are implemented.
- Switch off idling equipment.
- Regular maintenance of equipment.
- Fit muffler or silencer for equipment.
- Noisy equipment and noisy activities should be located as far away from the NSRs as is practical.
- Use quiet construction method, e.g. use saw-cut or hydraulic crusher instead of excavator mounted percussive breaker.
- PME should be kept to a minimum and the parallel use of noisy equipment / machineries should be avoided.
- Erect noise barriers or noise enclosure for the PME if appropriate.

- Implement good house-keeping and provide regular maintenance to the PME.
- Spot check resultant noise levels at nearby NSRs.

If construction work involving use of PME will be required during restricted hours, a CNP shall be applied for under the NCO. The noise criteria and assessment procedures for obtaining a CNP are specified in GW-TM.

With the implementation of the abovementioned mitigation measures, adverse construction noise impact is not anticipated.

4 WATER QUALITY IMPACT ASSESSMENT

4.1 INTRODUCTION

This section reviews the water quality impacts from the Project. The potential environmental impacts from construction effluent generated by the proposed works and operation of the proposed residential home for elderly are assessed. Standards, guidelines and legislation, recommended mitigation measures and the disposal strategy are reviewed.

4.2 LEGISLATIONS, STANDARDS AND GUIDELINES

The following relevant Hong Kong legislations/guidelines governing water pollution control have been referenced in carrying out the assessment:

- Environmental Impact Assessment Ordinance and EIAO-TM (Annex 6 and 14);
- Water Pollution Control Ordinance (WPCO) (Cap. 358) (as amended by the Water Pollution Control (Amendment) Ordinance 1990 and 1993);
- Water Pollution Control (General) Regulations (as amended by the Water Pollution Control (General) (Amendment) Regulations 1990 and 1994);
- Water Pollution Control (Sewerage) Regulation;
- Water Quality Objectives (WQOs) for relevant Water Control Zones (WCZs);
- Practice Note for Professional Persons ProPECC Note PN1/94, Construction Site Drainage; and
- Practice Note for Professional Persons ProPECC Note PN 5/93, Drainage Plans subject to Comment by the Environmental Protection Department.
- ETWB TC(W) No. 5/2005 "Protection of Natural Streams/Rivers from Adverse Impacts Arising from Construction Works

4.3 IDENTIFICATION OF WATER SENSITIVE RECEIVERS

The project site is located within the Northwest of New Territories and within the catchment of the Deep Bay Water Control Zone.

No communal foul sewer connection is available for the project area.

The quality of effluent during the construction and operation phase of the projects will be bounded by the discharge standard of Deep Bay Water Control Zone, subject to the estimated discharge quantity. Standards for effluents discharged into the coastal waters of Deep Bay Water Control Zone is annexed in Cap. 358AK Technical Memorandum on Effluent Standards.

For the marine environment, the nearest EPD Water Quality Monitoring Station (WQMS) to 81 San Tam Road is DM1. The latest summary of baseline condition of subject WQMS

in 2022 is extracted, reference from "Marine Water Quality in Hong Kong in 2022" by EPD.

In 2022, the overall WQO compliance rate for the Deep Bay WCZ was 67%, as compared with ten-year average of 47% in 2009-2018. Overall, with the measures under the Deep Bay Water Pollution Control Joint Implementation Programme taken progressively by the governments of Hong Kong and Shenzhen, there have been significant water quality improvements in Deep Bay. In particular, there has been full compliance of the NH3-N WQO in the past seven years. Although Deep Bay, as compared with other WCZs, shows higher nutrient levels with annual depth-averaged TIN levels exceeding the respective TIN WQOs, a noticeable long-term decrease in TIN levels since mid-2000s has been seen.

Summary of water quality statistics for the Deep Bay WCZ in 2022

Parameter	DM1 (Nearest to the Stie)
Temperature (°C)	24.8 (17.9 - 32.4)
Salinity	14.9 (0.5 - 23.3)
Dissolved Oxygen (mg/L)	6.5 (4.9 - 9.2)
Dissolved Oxy gen (% Saturation)	85 (63 - 123)
pH	7.4 (7.0 - 8.5)
Secchi Disc Depth (m)	1.1 (0.9 - 1.6)
Turbidity (NTU)	85.9 (9.8 - 288.0)
Suspended Solids (mg/L)	27.6 (7.0 - 58.0)
5-day Biochemical Ox y gen Demand (mg/L)	1.8 (<0.1 - 6.0)
Ammonia Nitrogen (mg/L)	0.538 (0.088 - 1.200)
Unionised Ammonia (mg/L)	0.008 (0.002 - 0.024)
Nitrite Nitrogen (mg/L)	0.161 (0.094 - 0.420)
Nitrate Nitrogen (mg/L)	1.200 0.840 - 1.800)

Total Inorganic Nitrogen (mg/L)	1.90 (1.13 - 2.61)
Total Kjeldahl Nitrogen (mg/L)	0.93 (0.46 - 2.10)
Total Nitrogen (mg/L)	2.29 (1.40 - 3.37)
Orthophosphate Phosphorus (mg/L)	0.120 (0.018 - 0.180)
Total Phosphorus (mg/L)	0.26 (0.16 - 0.41)
Silica (as SiO2) (mg/L)	5.74 (1.70 - 8.90)
Chlorophy ll-a (µg/L)	8.8 (2.1 - 45.0)
E.coli (count/100mL)	500 (31 - 4900)
Faecal Coliforms (count/100mL)	1200 (88 - 24000)

Water Sensitive Receivers (WSRs) are defined as those users of the aquatic/marine environment whose use of the environment could be impaired as a result of the proposed project. When WSRs that are potentially affected by the construction and operation of the Project are identified, further study will be conducted. The Water Sensitive Receivers (WSRs) identified within 500m of the Project boundary that may potentially be affected are shown in **Appendix 4.2** and the representative WSRs are listed below –

WSR1	Agricultural Land
WSR2	Fishpond (Pond 13 to Pond 28)
WSR3	Abandoned Fishpond (Pond 1 to Pond 11)
WSR4	Nullah
WSR5	Drainage Channel
WSR6	Water Course

4.4 WATER QUALITY IMPACTS AND MITIGATIONS DURING CONSTRUCTION PHASE

Potential Impact

Proposed construction works mainly involve excavation of soil, piling and building

construction works. Key water pollution sources include:

General Construction Activities

General construction activities, including wheel washing, dust suppression from excavation and pilling works, concrete casting and utility installation, may generate wastewater which would contain high concentration of SS. Various construction works may also generate debris and waste such as packaging, construction materials and general refuse. Uncontrolled discharge of site effluents and waste generated from the construction works would lead to deterioration in water quality. Adoption of the guidelines and good site practices for handling and disposal of construction discharges as specified in **below mitigation section** would minimize the potential impacts.

Surface Runoff from Rainfall and Wind Erosion

In particular, surface runoff into receiving water courses during and immediate after rainstorm events is of major concern. During rainstorms, site runoff would wash away the soil particles on unpaved lands and areas with exposed topsoil. Sediment lade runoff and wind-blown dust would result in deteriorating water quality with increase of SS levels and turbidity and may result in induced effects on aquatic ecological resources. It is important that proper site practice and good site management (as specified in the ProPECC PN 1/94 "Construction Site Drainage") to be followed to prevent site runoff with high level of SS from entering the surrounding waters. With the implementation of appropriate measures to control runoff and drainage from the construction site, disturbance of water bodies would be avoided and deterioration in water quality would be minimal.

Spillage of Chemicals

Accidental spillage and the storage of chemicals used on-site, such as petroleum products, surplus adhesives, spent lubrication oil, grease and mineral oil, spent acid and alkaline solutions/solvent and other chemicals, may contaminate the surface soils. The contaminated soil particles may be washed away by construction site runoff or stormwater drainage and eventually may affect nearby water bodies. The potential impacts could however be mitigated by practical mitigation measures and good site practices as given in **below mitigation section**.

Sewage from the Construction Workforce

Sewage effluents will arise from the sanitary facilities provided for the on-site construction workforce. The characteristics of sewage would include high levels of BOD5, Ammonia and E. coli counts. This temporary sewage can be handled by providing adequate portable chemical toilets. Provided that sewage is not discharged directly into storm drains or inland waters adjacent to the construction site, and temporary sanitary facilities are used and properly maintained, it is unlikely that sewage generated from the sites would have a significant water quality impact.

Construction Works in Close Proximity of Nearby Water Bodies

Construction activities within or in close vicinity to nearby water bodies may affect the water quality due to potential release of wastewater which is generally with high

concentration of SS and elevated pH. Mitigation measures shall be implemented to control the release of wastewater into the adjacent water environment. With proper implementation of appropriate construction runoff control practices as referred to ProPECC PN 1/94 "Construction Site Drainage" and the provision of mitigation measures as described in the ETWB TC (Works) No. 5/2005 "Protection of natural streams/rivers from adverse impacts arising from construction works", it is anticipated that no unacceptable water quality impacts would be arising from the construction works nearby the water bodies.

Mitigation Measures

Dust Suppression

Water used in dust suppression should as far as practicable be re-circulated after sedimentation. When there is a need for final disposal, the wastewater should be leaded to silt removal facilities before being discharged to the storm drain.

Wheel Washing Water

All vehicles and plant should be cleaned before they leave a construction site to minimize the deposition of earth, mud, debris on roads. A wheel washing facility should be provided at every site exit if practicable and wheel-wash overflow shall be directed to silt removal facilities before being discharged to the storm drain. The site boundary between the wheel washing facility and the public road should be placed with sand bunds to prevent wheel-wash overflow from entering public road drains.

Wastewater from Concrete Casting

Wastewater generated from the washing down of mixing trucks and drum mixers and similar equipment should whenever practicable be recycled. The discharge of wastewater should be kept to a minimum. To prevent pollution from wastewater overflow, the pump sump of any water recycling system should be provided with an on-line standby pump of adequate capacity and with automatic alternating devices. Under normal circumstances, surplus wastewater may be discharged into foul sewers after treatment in silt removal.

Rubbish and Litter

Good site practices should be adopted to remove rubbish and litter from construction sites so as to prevent the rubbish and litter from spreading from the works area. It is recommended to clean the construction sites on a regular basis. Adequate refuse collection points shall be provided on-site.

Construction Site Runoff

The site practices outlined in ProPECC PN 1/94 "Construction Site Drainage" should be followed as far as practicable to minimise surface runoff and the chance of erosion. It is expected that the following measures recommended will effectively control runoff from the works sites and avoid water pollution downstream and shall be implemented during construction phase.

Surface runoff from construction sites should be discharged into storm drains via sand/silt

removal facilities such as sedimentation basin/tank. The treated effluent discharge from construction stages should be sited away from natural water course. Earth bunds or waterfilled barriers with geotextile sheet should be provided on site boundaries to intercept surface runoff from outside the site so that it will not wash across the site and to prevent surface runoff flowing out of the site. Bunds or sandbags should also be used within the site to direct surface runoff into the silt removal facilities. Stagnant surface runoff should be pumped to the silt removal facilities before discharged into storm drains.

Manholes (including newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris from getting into the drainage system without having previously passed through sedimentation tank, and to prevent storm runoff from getting into foul sewers. Discharge of surface runoff into foul sewers must always be prevented in order not to unduly overload the foul sewerage system.

Silt removal facilities and manholes should be maintained and the deposited silt and grit should be removed regularly, at the onset of and after each rainstorm to prevent local flooding.

Surface excavation should be carefully programmed to avoid wet-season operation. If it is unavoidable, any exposed top soils should be covered with a tarpaulin or other means. For the purpose of preventing soil erosion, temporary exposed slope surfaces should be covered e.g. by tarpaulin, as excavation proceeds. Earthworks final surfaces should be well compacted and the subsequent permanent work or surface protection should be carried out immediately after the final surfaces are formed to prevent erosion caused by rainstorms.

Open stockpiles (e.g. aggregates, sand and fill material) should also be covered with a tarpaulin to avoid erosion during rainstorms. The washing of material from the stockpiles directly into the storm drains should be prevented by passing the runoff through sedimentation tank. Arrangements should always be in place in such a way that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm.

Spillage of Chemicals

Chemical waste, as defined under the Waste Disposal (Chemical Waste) (General) Regulation, includes any substance being scrap material, or unwanted substances specified under Schedule 1 of the Regulation. Substances likely to be generated by construction activities arise from the maintenance of construction plant and equipment of the Project. These include, but not limited to the following:

- Lubricating oil and waste fuel (diesel) from construction plant with improper maintenance;

- Spent solvents from equipment cleaning activities.

Due to the scale of an active work front of the Project, it is anticipated that no maintenance shop for construction plant and equipment would be operated on-site and storage fuel on-site is minimal. Drainage traps such as grease traps and petrol interceptors will be installed at each of the drainage outlets to filter out chemical pollutants from surface runoff.

Mitigation such as providing drip tray/proper storage of chemical containers will be strictly

implemented during the construction works. In case of any leakage on bare ground, oil and grease decontamination kit will be available on-site for clean-up of oil leakage. Any fuels should be stored in bunded areas such that spillage can be easily collected. The contractor shall prepare an oil / chemical clean-up plan in the Waste Management Plan before the commencement of construction works. It should ensure that leakages or spillages are contained and cleaned up immediately. Once spillage is identified on-site, the clean-up procedures should be carried out as below:

- Contact the site agent and/or foreman immediately and report the spillage;
- Identify the source of spillage and determine nature of the material;
- Stop leakage immediately where possible;
- Identify all current and potential affected areas according to the flow of spillage and stop the spillage from flowing to other works areas;
- Contain the surface runoff of spillage by using bunds made from available materials;
- After the surface runoff of spillage is contained, remove the materials (including contaminated soil where necessary) using pumps and/or absorbent materials; and
- Dispose of the materials, including the contaminated soil, as chemical waste

Waste oil should be collected and stored for recycling or disposal, in accordance with the Waste Disposal Ordinance (Cap. 354). The contractor must register as a chemical waste producer if chemical wastes would be produced from the construction activities. The Waste Disposal Ordinance (Cap. 354) and its subsidiary regulations in particular the Waste Disposal (Chemical Waste) (General) Regulation, should be observed and complied with for disposal of chemical wastes. The Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes published under the Waste Disposal Ordinance (Cap. 354) details the requirements to deal with chemical wastes. General requirements are given as follows:

- Suitable containers should be used to hold the chemical wastes to avoid leakage or spillage during storage, handling and transport;
- Chemical waste containers should be suitably labelled, to notify and warn the personnel who are handling the wastes, to avoid accidents; and
- Storage area should be selected at a safe location on site and adequate space should be allocated to the storage area

Sewage Effluent from Construction Workforce

Portable chemical toilets would be provided for handling the sewage effluent generated by the workforce. The number of the chemical toilets required for the construction sites would be subject to later detailed design, the capacity of the chemical toilets, and contractor's site practices. A licensed contractor would be employed to provide appropriate and adequate portable toilets and be responsible for appropriate disposal and maintenance.

Domestic sewage generated by the construction workforce should be appropriately managed to avoid potential adverse impacts of uncontrolled sewage discharge into nearby water courses. Portable chemical toilets shall be appropriately located on-site in proximity to all major works areas where they shall remain and be maintained in good working order for the convenience of the workforce during the construction phase.

The provision of temporary toilet facilities within the water gathering ground, if any, is subject to approval of the Director of Water Supplies. As a minimum requirement, temporary toilet facilities must be located more than 30m from any watercourse.

Notices would be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the nearby environment during the construction phase of the Project. Regular environmental audit on the construction site would be conducted in order to provide an effective control of any malpractices and achieve continual improvement of environmental performance on site.

Construction Works in Close Proximity of Nearby Water Bodies

The practices outlined in ETWB TC (Works) No. 5/2005 "Protection of natural streams/rivers from adverse impacts arising from construction works" should also be adopted where applicable to minimize the water quality impacts upon any natural streams or surface water systems. Relevant mitigation measures from the ETWB TC (Works) No. 5/2005 should be followed. Examples are shown below -

- Construction works close to the inland waters should be carried out in dry season as far as practicable where the flow in the surface channel or stream is low.
- The use of less or smaller construction plants may be specified in areas close to the water courses to reduce the disturbance to the surface water.
- Temporary storage of materials (e.g. equipment, chemicals and fuel) and temporary stockpile of construction materials should be located well away from any water courses during carrying out of the construction works.
- Stockpiling of construction materials and dusty materials should be covered and located away from any water courses.
- Construction debris and spoil should be covered up and/or disposed of as soon as possible to avoid being washed into the nearby water receivers.
- Proper shoring may need to be erected in order to prevent soil or mud from slipping into the watercourses.
- Fencing should be erected on the sides facing the nearest stream course to trap all wind-blown litters such as paper, plastic bags, bottles and boxes within the site from entering the nearby water bodies.

4.5 WATER QUALITY IMPACTS AND MITIGATIONS DURING OPERATION PHASE

Potential Impact

The Project is to build a residential care home for elderly, accommodating at most 142 nos. of bedspaces. Sewage from the residents as well as workers and visitors will be generated from bathing and showers, toilet flushing, pantry, toilet basins, etc.

Mitigation Measures

All storm water/rainwater from both open paved and developed areas of the site will be conveyed to the storm water drain.

The *ProPECC Note PN 5/93* provides guidelines and practices for handling, treatment, and disposal of various effluent discharges to stormwater drains and foul sewers. The design of site drainage and disposal of site effluents generated within the proposed development area should follow the relevant guidelines and practices as given in the *ProPECC Note PN 5/93*.

Since there is no communal foul sewer connection, an onsite tertiary sewage treatment plant (STP) will be installed to handle all sewage generated from the proposed residential care home before discharging offsite. Preliminary design of the on-stie tertiary STP according to Guidelines for the Design of Small Sewage Treatment Plants by EPD, including the amount of sewage flow generated per day (from residents, staff, facilities, etc.), the size of the STP, mitigation measures to prevent discharge/ overflow of untreated raw sewage, etc. are annexed in **Appendix 4.3**. The major parameter of the STP is listed in below -

Total Daily Flow	77.5m^3/day
Average Hourly Flow (DWF)	3.23m^3/hr
Peak Hourly Rate (6 x DWF)	19.38 m^3/hr
Size of MBR Tank	34.97 m^3/hr
Size of Equalization Tank	19.38 m^3/hr

Proper operation and maintenance should be provided for the STP. Storm water/rainwater should be separated from the sewage collection network to avoid overload to the STP. The effluent standards are listed below

Parameter	Tertiary Effluent Standard (Upper Limit)*
BOD5	10mg/L
TSS	10mg/L
TN	20mg/L
TP	2mg/L
Ammonia N	5mg/L
E coli	100cfu/100ml

Note (*) – Depending on the water body receiving the discharge, the more stringent set of the effluent standards (those listed on the WPCO TM) should be adopted as appropriate.

Sewage will be treated by the onsite STP before discharge. The proposed discharge point is shown in **Appendix 4.3.** The detailed location of proposed discharge point would be finalized during the detailed design stage. The treated effluent discharge from operational stages should be sited away from natural water course.

The disposal of the treated effluent shall comply with relevant statutory requirements and guidelines such as Water Pollution Control Ordinance (Cap. 358), etc. All discharges during the operation phase of the proposed development are required to comply with the Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS) issued under Section 21 of the Water Pollution Control Ordinance (WPCO). The TM-DSS defines acceptable discharge limits to different types of receiving waters. Under the TM-DSS, effluents discharged into the drainage and sewerage systems, inland and coastal waters of the Water Control Zones (WCZs) are subject to pollutant concentration standards for specified discharge volumes. These are defined by the Environmental Protection Department (EPD) and are specified in licence conditions for any new discharge within a WCZ. Therefore, no adverse water quality impact on WQO is anticipated.

All storm water/rainwater from open paved and developed areas of the site will be conveyed to the storm water drain via properly designed surface drainage. Facilities such as standard gully grating, with spacing which is capable of screening off large substances such as fallen leaves and rubbish should be provided at the inlet of drainage system. Good management measures such as regular cleaning and sweeping open paved area of the site is suggested during operational phase to reduce the suspended solid or other unwanted pollutants or waste fall into the stormwater drain.

During operation phase, stormwater runoff from paved surfaces within the Project Sites will be directed to a managed stormwater drainage system. Runoff from the roofs of buildings and road surfaces within the Sites may carry suspended solids and other pollutants such as fuel, oils and heavy metals that could enter nearby surface water bodies or storm drains if uncontrolled. With implementation of stormwater best management practices including provision of trapped gullies and catch-pits, adverse impacts to the water quality is not anticipated.

Similar to that during the construction phase, a water discharge license should be obtained for the operation of the proposed residential care home for elderly. All the requirements and conditions as stipulated on the license shall be observed and complied with.

5 WASTE MANAGEMENT

5.1 INTRODUCTION

This section reveals and discusses types of wastes generated from the Project during construction and operation phases. Hence, proper waste management strategies are recommended to reduce, reuse, recycle and dispose of wastes.

5.2 LEGISLATIONS, STANDARDS AND GUIDELINES

The following relevant Hong Kong legislations and guidelines governing waste disposal and management have been referenced in carrying out the assessment:

- Waste Disposal Ordinance (Cap. 354);
- *A Guide to the Chemical Waste Control Scheme;*
- *A Guide to the Registration of Chemical Waste Producers;*
- Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes; and
    - *Code of Practice for the Management of Clinical Waste – Small Clinical Waste Producers.*

5.3 WASTE MANAGEMENT IMPLICATIONS OF THE CONSTRUCTION PHASE

Major construction activities for the Project include demolition of existing property, site clearance, piling, construction of substructure and superstructure. Considering the small scale of the Project, it is anticipated not much waste would be generated though the exact quantity will be subject to detailed construction methods.

Wastes generated from the Project during the construction phase generally consist of:

- Construction and demolition (C&D) waste;
- General refuse; and
- Chemical waste.
- Possible wastes generated from the Project are detailed in Table 5-1.
- Table 5-1 Possible Waste Generated During the Construction Phase

WASTE TYPE	POSSIBLE WASTE GENERATED FROM THE PROJECT
INERT C&D WASTE	• CONCRETE FROM DEMOLITION OF EXISTING PROPERTY • EXCAVATED MATERIALS (EXCLUDING TOPSOIL)

WASTE TYPE	POSSIBLE WASTE GENERATED FROM THE PROJECT
NON-INERT C&D WASTE	• FELLED TREES • REMOVED PLANT • TOPSOIL • DISCARDED FURNITURE • DAMAGED SCAFFOLDING BAMBOO • WOOD FORMWORK • USED PACKAGING MATERIALS
GENERAL REFUSE	• WASTEPAPER • FOOD DEBRIS • PACKAGING MATERIAL
CHEMICAL WASTE	• SPENT LUBRICATING OIL • PAINT

A Waste Management Plan (WMP) will be prepared to outline the estimated types and quantities of waste generated in the Project and formulate the approaches in dealing with them. Typical hierarchy of waste management, i.e., avoid, minimize, recycle and disposal as the last resort, will be adopted for the Project. The aims of the WMP are to:

- improve the resource efficiency.
- increase the waste and materials awareness of staff; and
- help to discharge duty of care obligations.

5.3.1 Waste Avoidance

To avoid generation of waste during the construction phase, good and detailed planning and smart procurement is crucial. The following approaches are suggested:

- avoid excess order;
- arrange delivery of goods according to construction progress;
- reject and return damaged goods;
- keep protective packaging on and ensure storage areas are secure and weatherproofs;
- minimize movement of goods to lower the chance of damage to goods; and
- eliminate over packaging and liaise with suppliers to return packaging materials to them.

5.3.2 Construction and Demolition Materials

Excavated materials, such as soil and rock, and demolition concrete should be reused for backfilling on site as far as practicable. Surplus materials of these inert types should be delivered to the Civil Engineering and Development Department (CEDD) managed public

fill reception points and/or sorting facilities. Prior licensing is required from the CEDD.

Non-inert C&D wastes, in particular steel bars and used cables from demolition works of this project, are recyclables and should be delivered to proper outlets for recycling. On the other hand, felled trees, removed plant and topsoil are normally not reusable and should be delivered to the landfill for disposal.

Considering that there are many types of wastes generated, proper sorting and segregation of various C&D wastes could minimize cross contamination and enhance waste recovery quantity.

A trip ticket system will be implemented for any wastes disposal to the public fill reception points, sorting facilities and landfills. All the disposal records should be properly maintained.

5.3.3 Chemical Waste

Chemicals, including lubricating oil, paint, thinner, etc. will be used in the Project. Should there be any chemical wastes generated in the Project, the Contractor is required to register as chemical waste producer pursuant to the Waste Disposal (Chemical Waste) (General) Regulation. Proper containers, labels and storage areas must be provided in accordance with the aforesaid regulation.

All the chemical waste should be collected by licensed chemical waste collector for disposal at the Chemical Waste Treatment Centre (CWTC) at Tsing Yi or other licensed chemical waste treatment/disposal facilities.

5.3.4 General Refuse

General refuse includes wastepaper, packaging materials and food debris generated by the workforce on site. No canteen will be provided on site during the construction phase. The quantity of general waste is anticipated minimal in view of the small scale of the construction works. Nonetheless, before offsite disposal, they should be segregated into recyclable and non-recyclable wastes and kept in different covered storage areas/bins, where all of them should be sufficiently maintained and cleaned, to avoid attracting vermin and pests. All the general refuse will be collected on-site, separately from C&D materials by an appropriate waste collector employed by the contractor to the landfill.

Training should be provided for all site workers about the concepts of site cleanliness and appropriate waste management procedure, including waste reduction, reuse and recycling. The training is expected to ensure their awareness of good waste management and the specific measures used at the site.

5.4 WASTE MANAGEMENT IMPLICATIONS OF THE OPERATIONAL PHASE

The project site will be converted into a residential care home for elderly. Wastes generated during operation phase includes:

- General refuse; and
- Clinical waste.

5.4.1 General Refuse

General refuse during the operation phase mainly comes from daily living of residents in the care home, e.g., food waste, packaging of goods, used plastic and glass bottles, bedding and blankets, etc., which are similar to those from general households. Considering the number of residents is low, the quantity of general waste should not be significant.

Solid waste should be properly kept in covered containers/storage areas to avoid attracting of vermin or pests. Recycling containers are recommended to be provided at suitable locations to encourage recycling in the care home.

5.4.2 Clinical Waste

Residential care home for elderly is considered as a small clinical waste producer. It is likely that some types of clinical wastes, particularly needles and sharps, would be generated from its operation. As such, the Operator of the care home should complete the "*Clinical Waste Producer Premises Code Request Form*" and manage the clinical waste in accordance with the *Code of Practice for the Management of Clinical Waste – Small Clinical Waste Producers*.

Clinical waste should be segregated from other wastes. Used needles and sharps are classified as Group 1 clinical waste and should be stored safely in sharps box, before transferring to a disposal site. Colour of the sharps box should be either in yellow or a combination of yellow and white and sealed with proprietary closure.

The care home operator shall engage the service of licensed collectors to collect and transport clinical waste to the CWTC for proper disposal. Alternatively, the clinical waste may also be delivered by a health professional under the clinical waste producer, if there is any, and subject to compliance of additional requirements as stipulated in the *Code of Practice for the Management of Clinical Waste – Small Clinical Waste Producers*.

The care home operator must also keep all the records of the clinical waste consigned to a licensed collector or delivered to a collection point or licensed disposal facility. To achieve it, it is suggested to retain the Waste Producer Copy of the Clinical Waste Trip Tickets of each delivery.

5.5 LAND CONTAMINATION

The subject lot is virgin land before existing development. Referring to the FSD's reply dated 6 December 2022, neither records of dangerous license, nor incidents of spillage / leakage of dangerous goods were found. Also, EPD has no record of any reported chemical spillage / leakage incident at the captioned locations as shown in Appendix 5.1. There was no record of chemical waste producers' registration found as per record inspection at EPD Territory Control Office dated 5 July 2022. Considering the historical land use of the site, it is confirmed that land contamination assessment was not required.

S12A AMENDMENT OF PLAN APPLICATION
APPROVED NGAU TAM MEI
OUTLINE ZONING PLAN NO. S/YL-NTM/12

PROPOSED REZONING FROM "R(C)" TO "G/IC"
FOR A PROPOSED "SOCIAL WELFARE FACILITIES"
(RESIDENTIAL CARE HOMES FOR THE ELDERLY)
(RCHE)

AT LOT 4823 IN D.D.104, 81 SAN TAM ROAD,
SAN TIN, N.T.

6. LANDFILL GAS HAZARD ASSESSMENT REPORT

October 2023

RLEE

RLEE Architects (HK) Ltd

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1 Introduction

1.1 Background

1.1.1.1 The project is a re-development of an existing Single Family House into a RCHE, Plans of which are attached as per Appendix A. (hereafter as "the proposed development") at Lot No. 4823 in D.D. 104, Yuen Long, near the Ngau Tam Mei Landfill (hereafter as "the Site").

1.1.1.2 The Site is located within the 250m consultation zone of the Ngau Tam Mei Landfill (refer to Figure 1.1). With reference to the "*Landfill Gas Hazard Assessment Guidance Note*" (Guidance Note) published by Environmental Protection Department (EPD), a Landfill Gas (LFG) Hazard Assessment should be conducted for both construction and operational stages.

1.1.1.3 A Landfill Gas Hazard Assessment Report for the existing house is submitted and approved by 04/2016. Although the Foot Print of the proposed development is different than before, the protective measure, both at construction and operation stages would be very similar. Those would be re-iterated in this Report.

1.2 Study Objectives

1.2.1.1 The objectives of this LFG Hazard Assessment are:

- To review background information of the Landfill, and particularly environmental monitoring records to identify potential sources of LFG;
- To identify the possible LFG pathways through ground or underground cavities, utilities or groundwater, and evaluate the conditions of these pathways through which the LFG must pass if it is to reach the works areas;
- To identify the elements of the proposed development (targets) that are sensitive to LFG exposure;
- To qualitatively assess the risks that LFG may pose to the target for each of Source-Pathway-Target combination; and
- To recommend suitable LFG protection measures for potential LFG migration and monitoring requirements, as necessary.

1.3 Report Structure

1.3.1.1 The remaining chapters of this report are shown below:

Chapter 2 – Site Context

Chapter 3 – Information of Ngau Tam Mei Landfill

Chapter 4 – Qualitative Source-Pathway-Target Analysis

Chapter 5 – Recommendations and Protection Measures

Chapter 6 – Conclusion

2 Site Context

2.1 Site Location and Its Environs

2.1.1.1 The proposed development located Along San Tam Road and surrounded by Maple Garden to the north, Ngau Tam Mei Landfill to the East, and Casa Paradizo to the south. Royal Palms is located further west to the Site crossing San Tam Road and San Tin Highway. The proposed development is situated in a "Residential Zone (Group C)" according to the Ngau Tam Mei Outline Zoning Plan (OZP S/YL-NTM/12) and proposed to re-zone to "G/IC" to facilitate a RCHE development. The Site area is approximately 730 m^2.

2.1.1.2 Figure 2.1 shows the Site location and its environs.

2.2 Proposed Development

2.2.1.1 The proposed development comprises a Ten-storeys building for a RCHE with various facilities including:

- LG/F Entrance & Carpark
- UG/F Muti-purpose Rooms
- 1/F Wellness Centre + Sky Garden
- 2/F RCHE
- 3/F RCHE
- 4/F-7/F RCHE
- 8/F Admin Office + Staff Quarter

2.2.1.2 The proposed layout plan is shown in Appendix A.

2.2.1.3 According to the latest programme, the occupancy date of the proposed development is expected to be in year 2027.

3 Information of Ngau Tam Mei Landfill

3.1 History of Ngau Tam Mei Landfill

3.1.1.1 The Ngau Tam Mei Landfill is located to the north-east of Yuen Long and to the east of the San Tin Highway. To the west of the landfill is the Maple Gardens residential development and immediately to the south west are the Casa Paradizo and Green Crest residential developments. Ngau Tam Mei Landfill situated in a small valley and prior to the formation of two platforms. It started to receive waste in Year 1973. Ngau Tam Mei Landfill has a total area of 2.0 hectares and an approximately 0.15 million tonnes of, mainly domestic and industrial wastes were deposited prior to its closure in Year 1975.

3.1.1.2 The restoration works generally included installation of a high integrity capping system on the two platforms, a leachate collection system, surface drainage systems, passive LFG management system. The restoration works were completed in Year 2000.

3.2 Landfill Gas Management System

3.2.1.1 At Ngau Tam Mei Landfill, the impermeable cap was installed on the platforms as part of the restoration work. The passive LFG management system constructed is driven by the differential between atmospheric pressure and LFG pressures within the waste. The system is a simple design, with no mechanically or electrically driven operations.

3.2.1.2 Following the completion of the restoration works, the landfill will be subject to a 30-year aftercare period during which a stringent monitoring programme has been implemented to ensure the integrity of the restoration works.

3.3 Leachate Management System

3.3.1.1 After the restoration works, leachate is collected and delivered to the Leachate Treatment Works at Gin Drinker Bay Landfill (GDB Landfill) for treatment and disposal. Prior to transferring of leachate to GDB Landfill, the collected leachate is stored in an underground leachate collection chamber with a capacity of approximately 50 m^3. A leakage detection system has been equipped to provide an early warning to any leakages. No leachate is discharged into the nearby surface waters.

3.4 Landfill Gas Monitoring

3.4.1.1 A post-restoration monitoring programme had been conducted under the restoration contract for the Ngau Tam Mei landfill. LFG (including methane and carbon dioxide) is monitored at the monitoring wells which installed outside the boundary of the landfill. The location of monitoring wells adjacent to the Site is shown on Figure 3.1. Recent gas monitoring data from July 2020 to June 2022 provided by EPD are attached in Appendix B. The Figure show a continuous low level of Methane throughout the period and it could conclude that same extra low Methane level are to be observed after June 2022.

3.4.1.2 According to Figure 3.1, no monitoring wells fall within the site boundary. Project Proponent should avoid interfering with nearby landfill facilities and take care of the nearby area to avoid any damage or interruption to the landfill restoration and aftercare works by EPD.

4 Qualitative Source-Pathway-Target Analysis

4.1 Assessment Methodology

4.1.1.1 A practice note for professional persons "*Landfill Gas Hazard Assessment for Developments adjacent to Landfills*" (ProPECC PN3/96) published by EPD in 1996 to set out the conditions under which a LFG Hazard Assessment may be required. ProPECC PN3/96 also provides guidance to relevant professionals on how to conduct such assessments.

4.1.1.2 Further details of the approach and methodology of the required assessment for LFG hazards are presented in "*Landfill Gas Hazard Assessment Guidance Note*" (Guidance Note).

4.1.1.3 These two documents are referred throughout the LFG Hazard Assessment. The assessment methodology is based on the "Source – Pathway – Target" model. The meaning of these three components are as follows:

- **Source** – location, nature and likely quantities/ concentrations of LFG which has the potential to affect the development.
- **Pathway** – the ground and groundwater conditions, through which LFG must pass in order to reach the development.
- **Target** – elements of the development that are sensitive to the effects of LFG.

4.1.1.4 The LFG source, identified pathway(s), and identified target(s) are then categorised in order to facilitate the assessment process. Having determined into which categories of source, pathway and target, the combination of landfill and development fall a preliminary assessment of the overall risk may be made by reference to Table 4.1.

Table 4.1 Classification of Risk Category

Source	Pathway	Target Sensitivity	Risk Category
Major	Very short/direct	High	Very High
		Medium	High
		Low	Medium
	Moderately short/direct	High	High
		Medium	Medium
		Low	Low
	Long/indirect	High	High
		Medium	Medium
		Low	Low

Source	Pathway	Target Sensitivity	Risk Category
Medium	Very short/direct	High	High
		Medium	Medium
		Low	Low
	Moderately short/direct	High	High
		Medium	Medium
		Low	Low
	Long/indirect	High	Medium
		Medium	Low
		Low	Very low
Minor	Very short/direct	High	High
		Medium	Medium
		Low	Low
	Moderately short/direct	High	Medium
		Medium	Low
		Low	Very low
	Long/indirect	High	Medium
		Medium	Low
		Low	Very low

4.1.1.5 Table 4.2 summarises the implications of each risk category, with reference to Table 4.1 of the Guidance Note.

Table 4.2 Summary of General Categorization of Risk

Category	Level of Risk	Implication
A	Very high (Undesirable)	The type of development being proposed is very undesirable and a less sensitive form of development should be considered. At the very least, extensive engineering measures, alarm systems and emergency action plans are likely to be required.
B	High	Significant engineering measures will be required to protect the planned development.
C	Medium	Engineering measures will be required to protect the planned development.
D	Low	Some precautionary measures will be required to ensure that the planned development is safe.
E	Very low (Insignificant)	The risk is so low that no precautionary measures are required.

4.2 Source

4.2.1.1 The Ngau Tam Mei Landfill has been restored with a capping system together with a passive LFG management system. LFG monitoring was conducted at a number of monitoring wells to detect any sign of off-site LFG migration.

4.2.1.2 The LFG monitoring data in Ngau Tam Mei landfill are obtained from EPD. The location of the LFG monitoring wells and LFG monitoring data are shown in Figure 3.1 and Appendix B respectively. The LFG monitoring data from July 2020 to June 2022) are summarized in Table 4.3.

Table 4.3 Landfill Gas Monitoring Data in Ngau Tam Mei Landfill (July 2020 to June 2022)

Landfill Gas Monitoring Wells	Range of Concentration (% V/V)	
	Methane (CH_4)	Carbon Dioxide (CO_2)
A451	<0.1	0.5 – 9.2
A452	<0.1	0.3 – 14.7
A453	<0.1	1.4 – 4.9
A454	<0.1	5.2 – 17.3
A455	<0.1 – 0.2	0.1 – 10.3
A456	<0.1	0.4 – 5.5
A457A	<0.1	<0.1
A458	<0.1	0.9 – 10.9
A459	<0.1	0.1 – 2.5
A460	<0.1	0.4 – 8.0
A461	<0.1	0.8 – 7.3
DH403	<0.1 – 0.1	0.2 – 12.4
DH405	<0.1	0.3 – 9.8
DH407	<0.1	<0.1 – 7.7
DH408	<0.1	0.1 – 6.9

4.2.1.3 As the concentration of methane in most of the perimeter gas monitoring wells were below the limit of detection of 0.2%, this suggests that off-site migration of methane towards the Site should be insignificant. However, the concentration of carbon dioxide (i.e. <0.1% to 17.3%) were found much higher than the ambient level in many monitoring locations. Owing to the high concentration of carbon dioxide, this may cause the risk of asphyxiation to workers especially those working in excavations or semi-confined spaces. Therefore, the LFG source of the Ngau Tam Mei Landfill is considered as **"Medium"**.

4.3 Pathways

4.3.1.1 LFG is generated under positive pressure as a result of microbial degradation of organic matter in the buried wastes. This will create a pressure gradient, causing migration of the gas to points of lower pressure. Migration pathways will therefore be determined by zones of lowest resistance to gas movement.

4.3.1.2 Based on the available underground services and utilities layout plan (including telephone lines, gas pipeline, water mains, electric cables, foul sewer and stormwater pipe), no existing services or utilities directly linking the Ngau Tam Mei Landfill and the proposed development was identified. The existing services or utilities are primarily associated with the utility entries from San Tam Road, hence can only form a secondary pathway for gas migration into the development via loose packed infill materials or possible open void conduits. The path length between Ngau Tam Mei Landfill and the existing underground services and utilities will be more than 100m. Therefore, the man-made pathways are categorised as **"Long / indirect"**.

4.3.1.3 For the natural pathways, the path length between Ngau Tam Mei Landfill and the proposed development will be more than 100m. Therefore, the natural pathways for the Ngau Tam Mei Landfill is categorised as **"Long / indirect"**.

4.4 Targets

4.4.1.1 In general, potential targets associated with proposed development include:

- Excavations for utilities installation, electric meter room and lower ground sewage treatment plant during construction stage;
- Manholes, inspection chambers or voids of services or utilities, electric meter room and lower ground sewage treatment plant during operational stage;
- Ground floor areas within the building blocks during operational stage.

4.4.1.2 It is anticipated that a shallow excavations for the utilities and garden establishment would be involved during the construction stage of the proposed development. Laying of some electric cables to the proposed development is anticipated, which may be sub-surface or on grade. According to Section 3.18 of the Guidance Note, the level of risk for shallow excavations is categorized as **"Low Sensitivity"**. However, deep excavations for the services including lower ground sewage treatment plant would be involved during the construction stage of the proposed development. According to Section 3.18 of the Guidance Note, the level of risk for deep excavations is categorised as **"Medium Sensitivity"**.

4.4.1.3 During operational stage, some manholes, inspection chambers or voids of services or utilities, electric meter room and lower ground sewage treatment plant will be present within the Site. There is a risk of asphyxiation to persons using poorly ventilated enclosed spaces, where gas is accumulated. However, these areas are restricted to only allow the authorised or well-trained personnel who have been briefed on the potential hazards relating to LFG and the specific safety procedures to be followed. Moreover, the residents and visitors shall not access to these areas during normal operation, and the sign indication and security system will be provided to prevent any unauthorised personnel access to the these

services. The risk level for these targets is also categorised as **"Medium Sensitivity".**

4.4.1.4 The use of Lower Ground Floor as Entrance Lobby & Car Park of the proposed development will be only accessed by the residents and visitor during operation stage. The risk level for the ground floor areas within the building block is therefore categorized as **"Medium Sensitivity"**.

4.5 Summary of Qualitative Source-Pathway-Target Analysis

4.5.1.1 Based upon the sources, pathways and targets classified above, the qualitative LFG hazard assessment for the proposed development is summarised in Table 4.4.

Table 4.4 Source- Pathway-Target Analysis

Source	Pathway	Sensitivity Target	Risk
Ngau Tam Mei Landfill The landfill started to receive waste in 1973. Recently obtained gas monitoring data in general show methane concentrations were below the limit of detection. However, the concentrations of carbon dioxide (range from <0.1% to17.3%)were much higher than ambient level in many monitoring locations. **(Medium Source)**	Man-made Pathways There are no utilities or services directly linking between Ngau Tam Mei Landfill and the proposed development. Natural Pathways The Site is located more than 100m away from the edge of the Ngau Tam Mei Landfill. **(Long / Indirect Pathway)**	Shallow excavations during construction stage Shallow excavation for utilities installation and garden establishment. **(Low Sensitivity Target)**	**Very Low**
		Deep excavations during construction stage Deep excavations for services including lower ground sewage treatment plant. **(Medium Sensitivity Target)**	**Low**
		Maintenance of services during operational stage Manholes or inspection chambers of utilities or services, electric meter room and lower ground sewage treatment plant. **(Medium Sensitivity Target)**	**Low**
		Ground floor areas within building blocks during operational stage Ground floor areas of the proposed development is only accessible to the residents and visitors. **(Medium Sensitivity Target)**	**Low**

4.6 Site Categorisation

4.6.1.1 According to the Guidance Note, for the purpose of categorising a site, the category is based on the highest level of risk nominated for any of the potential impacts identified.

4.6.1.2 Referring to Table 4.4, the overall risk level for the proposed development associated with the Ngau Tam Mei Landfill is classified as "**Low**", which falls into **Risk Category D**. For Risk Category D, "Some precautionary measures will be required to ensure that the planned development is safe" as stated in the Guidance Note. According to Table 4.2 of the Guidance Note, the generic protection measures will include "passive control of gas". The recommended protective measures during the construction and operational stages are provided and presented in the following section.

5 Recommendations and Protection Measures

5.1 Construction Stage

5.1.1 Precautionary Measures

5.1.1.1 In general, the contractor should be informed of the following:

- Potential presence of methane and carbon dioxide in soil voids;
- Physical and chemical nature of LFG;
- Fire and explosion hazard, toxicity effects and health hazards associated with LFG; and
- Methodologies / requirements for LFG monitoring.

5.1.1.2 Precautions should be clearly laid down and rigidly adhered to with respect to:

- Trenching and excavation; and
- Creation of confined or semi-confined spaces at, near to or below ground level such that potential hazards to workers due to LFG.

5.1.1.3 During construction stage, the following precautionary measures and safety clauses should be implemented and specified in tender / contract documentation:

- A properly trained Safety Officer should be present on-site during the construction period to oversee the possible LFG risks and be responsible for first aid, emergency and evacuation;
- The Safety Officer or professional Environmental Consultant should use an intrinsically safe portable instrument(s), appropriately calibrated and capable of monitoring methane, carbon dioxide and oxygen;
- All relevant construction workers who work in, or have responsibility for, "at risk" areas should be briefed of the potential risks associated with LFG and the necessary responses and actions needed;
- There should be proper warning of the potential hazards in the vicinity of excavations and proposals of "method-of-working" statements for these works covering all normal and emergency procedures to minimize the potential risk of LFG for agreement by the Engineer representative and the professional Environmental Consultant;
- There should be proper control of welding, flame cutting and any other hot works within trenches, confined spaces and excavation areas;
- A 'no smoking' policy should be strictly enforced;
- Naked flames are to be prohibited within any excavation or ground-level confined space unless otherwise agreed by the Safety Officer or professional Environmental Consultant;

- At a minimum, no work should be undertaken in the absence of fire extinguishers. There should be adequate provision of fire extinguishing equipment and fire-resistant clothing. Gas detection equipment and appropriate breathing apparatus should be available and used when entering confined spaces or trenches deeper than 2 metres;
- The contractor to propose appropriate locations and designs for mobile offices, equipment stores, mess rooms, etc. in accordance with the followings:
- Mobile offices, equipment stores, mess rooms etc. should be located on an area which has been proven to be gas free (by survey with portable gas detectors) and ongoing monitoring should be carried out to ensure that these areas remain gas free. The use of permanent gas detectors may be appropriate in some circumstances where there is a relatively high risk but for many developments it will be sufficient to have regular monitoring undertaken manually by the safety officer. The particular arrangements to be adopted at a specific site will need to be determined during the risk assessment/design of protection measures;
- Alternatively, such buildings should be raised clear of the ground. If buildings are raised clear of the ground, a minimum, clear separation distance (as measured from the highest point on the ground surface to the underside of the lowest floor joist) should be 500mm;
- Workers should be instructed to adopt good hygiene practices to prevent direct exposure to leachate or leachate-contaminated groundwater, if any. Workers should wash thoroughly after work, eat only in clean area after washing hands, and wear protective gear including gloves and appropriate clothing;
- Utility companies should be advised of the proposed development and cable/pipe laying being in the vicinity of the Ngau Tam Mei Landfill for their attention to observe the relevant regulations and requirements in such regards when inspection or works are being undertaken at the nearby area; and
- Relevant recommendations and requirements as stated in Section 8 of the Guidance Note (provided in Appendix C) should be incorporated in the tender / contract documents.

5.1.2 LFG Monitoring during Construction Stage

5.1.2.1 At a minimum, routine LFG monitoring should be undertaken twice per day at start of work during all excavation works below ground level deeper than 300 mm and/or after prolonged periods of enclosure/not ventilated. All measurements in excavations should be made with the extended monitoring tube located not more than 10 mm from the exposed ground surface. Monitoring should be performed properly to make sure that the area is free of LFG before enter into the area. The LFG monitoring should be undertaken by a trained Safety Officer or professional Environmental Consultant.

5.1.2.2 For excavations deeper than 1 m, measurements should be carried out:

- At the ground surface before excavation commences;
- Immediately before any worker enters the excavation;
- At the beginning of each working day for the entire period the excavation remains open; and
- Periodically through the working day whilst workers are in the excavation.

5.1.2.3 For excavations between 300 mm and 1 m deep, measurements should be carried out:

- Directly after the excavation has been completed; and
- Periodically whilst the excavation remains open.

5.1.2.4 For excavations less than 300 mm deep, monitoring may be omitted, at the discretion of the Safety Officer or Environmental Consultant.

5.1.2.5 Monitoring of methane, carbon dioxide and oxygen should be undertaken using appropriately calibrated portable gas detection equipment. Monitoring equipment should have, as a minimum, the indication ranges set out in Table 5.1:

Table 5.1 Detection Ranges of the Gas Monitoring Instrument

Gas	Range of Detection
Methane	0 - 100% Lower Explosive Limit (LEL) and 0 - 100% v/v
Carbon dioxide	0 - 100%
Oxygen	0 - 21%

5.1.2.6 All measurements should be recorded and kept on-site for ease of inspection. The routine monitoring reports should be endorsed and submitted to EPD by the Authorised Person (AP) or Project Architect for record at least once a month.

5.1.2.7 Depending on the results of the measurements, action required will vary and shall be set down by appropriately qualified person. At a minimum, these shall encompass those actions specified in Table 5.2.

Table 5.2 Action Plan in the Event of Gas being detected (Construction Stage)

Parameter	Measurement	Action
Methane (CH_4)	>10% LEL (i.e. > 0.5 % by volume)	• Prohibit hot works • Ventilate to restore CH_4 to below 10% LEL
Methane (CH_4)	>20% LEL (i.e. > 1 % by volume)	• Stop works • Evacuate personnel / prohibit entry • Increase ventilation to restore CH_4 to below 10% LEL
Carbon Dioxide (CO_2)	>0.5%	• Ventilate to restore CO_2 to less than 0.5%
	>1.5%	• Stop works • Evacuate personnel / prohibit entry • Increase ventilation to restore to less than 0.5%
Oxygen (O_2)	<19%	• Ventilate trench / void to restore O_2 level to more than 19%
	<18%	• Stop works • Evacuate personnel / prohibit entry • Increase ventilation to restore O_2 to more than 19%

5.2 Operational Stage

5.2.1 Protection and Precautionary Measures

5.2.1.1 As per general categorization of risk, the proposed development are in Category D for "Low" level of risk during operational stage.

5.2.1.2 In order to reduce the likelihood of LFG infiltration and accumulation, protection measures have to be adopted. The recommended protection measures are discussed in below.

5.2.1.3 The following passive control measures for proposed development should be included:

- Providing good and effective ventilation for the proposed development including electric meter room and lower ground sewage treatment plant (STP) to prevent the accumulation of landfill gas;

- Providing gas-resistant polymeric membranes which can be incorporated into the floor or wall construction as a continuous sealed layer. The membranes should be able to demonstrate low gas permeability and resistant to possible chemical attack and may incorporate aluminium wafers to improve performance;
- High density concrete can be applied at the lowest ground slab to enhance the resistance of gas permeation; and
- Passive control measures may be used in low and medium risk situations where gas emissions are expected to be at relatively low rates and concentrations and venting to atmosphere is unlikely to cause a hazard or nuisance due to the low concentration or high dilution which will occur.

5.2.1.4 Subsequent excavations or below ground works may be carried out in future years during maintenance stage. Such activities should be carried out with an awareness of the potential presence of LFG in the ground and appropriate precautionary measure as mentioned in Section 5.1 should be followed to guard against any hazard arising.

5.2.1.5 Mechanical ventilation system shall be provided for plant rooms including electric meter room and lower ground sewage treatment plant (STP) to prevent the accumulation of landfill gas. The designed mechanical ventilation rate at the plant rooms are summarised in the Table 5.3.

Table 5.3 Mechanical Ventilation Rate

Plant Room	Air change per hour (ACH)
Electric Meter Room	10
Sewage Treatment Plant (STP)	12

5.2.1.6 The mechanical ventilation system should be sufficient to remove any potential landfill gas build-up in the plant rooms. Moreover, the mechanical ventilation system would be provided with backup / standby units and temporary power supply units to ensure continued operation during maintenance or malfunction of the system.

5.2.1.7 The details of the adopted protective measures such as, the gas-resistant polymeric membranes specifications, construction drawings showing locations of installation, physical sample and construction certification report showing the membranes are installed according to specifications along with photos taken during construction should be endorsed and submitted to EPD by the Authorised Person (AP) or Project Architect during construction stage.

5.2.1.8 The lowest ground floor slab is of high density concrete made of high proportion of cement with a density of 450 kg/m^3 which can make the structure more resistant to gas permeation. Therefore, the potential of landfill gas infiltration through the underground soil into the building envelope should be minimal.

5.2.1.9 The concerned utility companies shall be informed of the proximity of the Site to the landfill and the associated hazards due to LFG. The Project Architect (R Lee Architects (HK) Limited) shall co-ordinate with the concerned contractor or utility companies in the design and maintenance of their facilities.

5.2.1.10 All ducts, chambers and manholes, if any, shall be sealed off from the ground to prevent ingress of LFG and facilitate venting to the atmosphere. Figure 5.1 and Figure 5.2 present typical designs for services passing through the consultation zone and above ground termination of the services within the consultation zone.

5.2.1.11 Vent pipes/ gridded manhole covers/ dense well-compacted concrete materials completed with gas-resistant membranes sealing may be incorporated in the underground utilities manholes or inspection chambers to avoid build-up of gas and provide resistance to gas permeation. Typical design of vented manhole are shown in Figure 5.3. Under all circumstances, care should be taken when accessing any manhole chambers especially those which are not fitted with vents and necessary safety procedures must be followed.

5.2.1.12 During the operational stage, any service voids, manholes, chambers or culvert within the Site, which is large enough to permit access to personnel should be subject to entry safety procedures. Works in confined spaces are controlled by the Factories and Industrial Undertakings (Confined Spaces) Regulation of the Factories and Industrial Undertakings Ordinance and the Safety Guide to Working in Confined Spaces should be followed to ensure compliance with the Regulation.

5.2.1.13 In general, when work is being undertaken in confined spaces, sufficient approved resuscitation equipment, breathing apparatus and safety torches should be made available. Persons involved in or supervising such work should be trained and practiced in the use of such equipment. A permit-to-work system for entry into confined spaces should be developed by an appropriately qualified person and the system should be consistently employed.

5.2.2 LFG Monitoring during Operational Stage

5.2.2.1 To safeguard the users of the proposed development from the possible hazards of asphyxiation effects of LFG, a LFG monitoring program shall be instituted. The objectives of monitoring during the operational stage of the Project are:

- To obtain early warning of potential problematic areas and permit timely remedial actions taken by the restoration contractor of the Landfill;
- To provide reassurance to the public; and
- To include methane, carbon dioxide and oxygen as determinants.

5.2.2.2 The sensitive rooms at the ground floor of the buildings might need to be monitored by gas detection equipment. Besides, there are sewage treatment plant room and manholes at the below ground floor as part of drainage / sewerage systems. Since these locations would be potentially at risk to gas ingress and gas accumulation, it should also be monitored by gas detection equipment and the monitoring work would be under the guidance of qualified safety officer. The performance

requirement of the portable gas detection equipment shall be referred to Section 5.1.2.5 and Table 5.1 of this report. The proposed monitoring locations are shown in Figure 5.4.

5.2.2.3 Table 5.4 presents a recommended LFG monitoring programme for the initial operational stage.

Table 5.4 LFG Monitoring Frequency during the Operational Stage

Period	Monitoring Frequency
First year after completion of the construction stage	Monthly
Second year after completion of the construction stage	Quarterly if LFG is not detected in the first year. Otherwise, the monitoring frequency will be maintained in monthly basis.
Monitoring can be ceased if no LFG is detected in the past 2-years monitoring	

5.2.2.4 A LFG monitoring report which summarises the monitoring results should be endorsed and submitted to EPD by the Authorised Person (AP) or Project Architect within 1 month of completion of the LFG monitoring. The frequency of submission of the LFG monitoring reports should follow Table 5.4.

5.2.2.5 Table 5.5 presents an action plan to specify the actions to be taken in response to gas detection. The future operator shall conduct further investigations and gas monitoring if necessary. A professional Environmental Consultant in this specific field should be engaged to interpret the results. Expert advice from the professional Environmental Consultant should be sought where necessary.

Table 5.5 Action Plan in the Event of Gas being detected (Operational Stage)

Parameter	Actions
All detectable levels	Confirm / verify the reading with a second instrument, monitor the trend of readings and carry out additional monitoring & investigation, if necessary
0.5 % v/v (10% LEL) CH_4 or 0.5% CO_2, whichever is exceeded*	<u>Trigger level:</u> • Stop hot works; • Inform the property management; • Immediate mitigation measures such as mechanical ventilation shall be provided; • Report to EPD; • Further investigation to be undertaken within the Site; • Increase the gas monitoring frequency to weekly.
1 % v/v (20% LEL) CH_4 or 1.5% CO_2, whichever is exceeded*	<u>Action level:</u> • Stop all works; • Evacuate personnel / prohibit entry; • Inform the property management; • Immediate mitigation measures such as mechanical ventilation shall be provided; • Report to EPD; • Further investigation to be undertaken within the Site; • Increase the gas monitoring frequency to daily.

Note: Oxygen (O_2) should also be monitored for reference.
** - CO_2 may be above the trigger / action levels due to decomposition of organic matters. In that case, the monitoring results should be interpreted by the qualified environmental consultant.*

6 Conclusion

6.1.1.1 Since the proposed development will be located within the consultation zone of the Ngau Tam Mei Landfill, this Landfill Gas Hazard Assessment was undertaken to assess the likelihood of LFG migration.

6.1.1.2 The results of the landfill gas hazard assessment shows the overall level of landfill gas risk posed by the Ngau Tam Mei Landfill to the proposed development is "Low".

6.1.1.3 Appropriate protection and precautionary measures including regular landfill gas monitoring during both of the construction and operation of the project have been recommended. Provided that all the recommended protection measures with the monitoring are implemented properly, the safety of the site workers and all personnel presence at the proposed development would be safeguarded and there would be no adverse impact anticipated on the feasibility of the proposed development.

S12A AMENDMENT OF PLAN APPLICATION
APPROVED NGAU TAM MEI
OUTLINE ZONING PLAN NO. S/YL-NTM/12

PROPOSED REZONING FROM "R(C)" TO "G/IC"
FOR A PROPOSED "SOCIAL WELFARE FACILITIES"
(RESIDENTIAL CARE HOMES FOR THE ELDERLY)
(RCHE)

AT LOT 4823 IN D.D.104, 81 SAN TAM ROAD,
SAN TIN, N.T.

FIGURES

Landfill Gas Hazard
Assessment Report

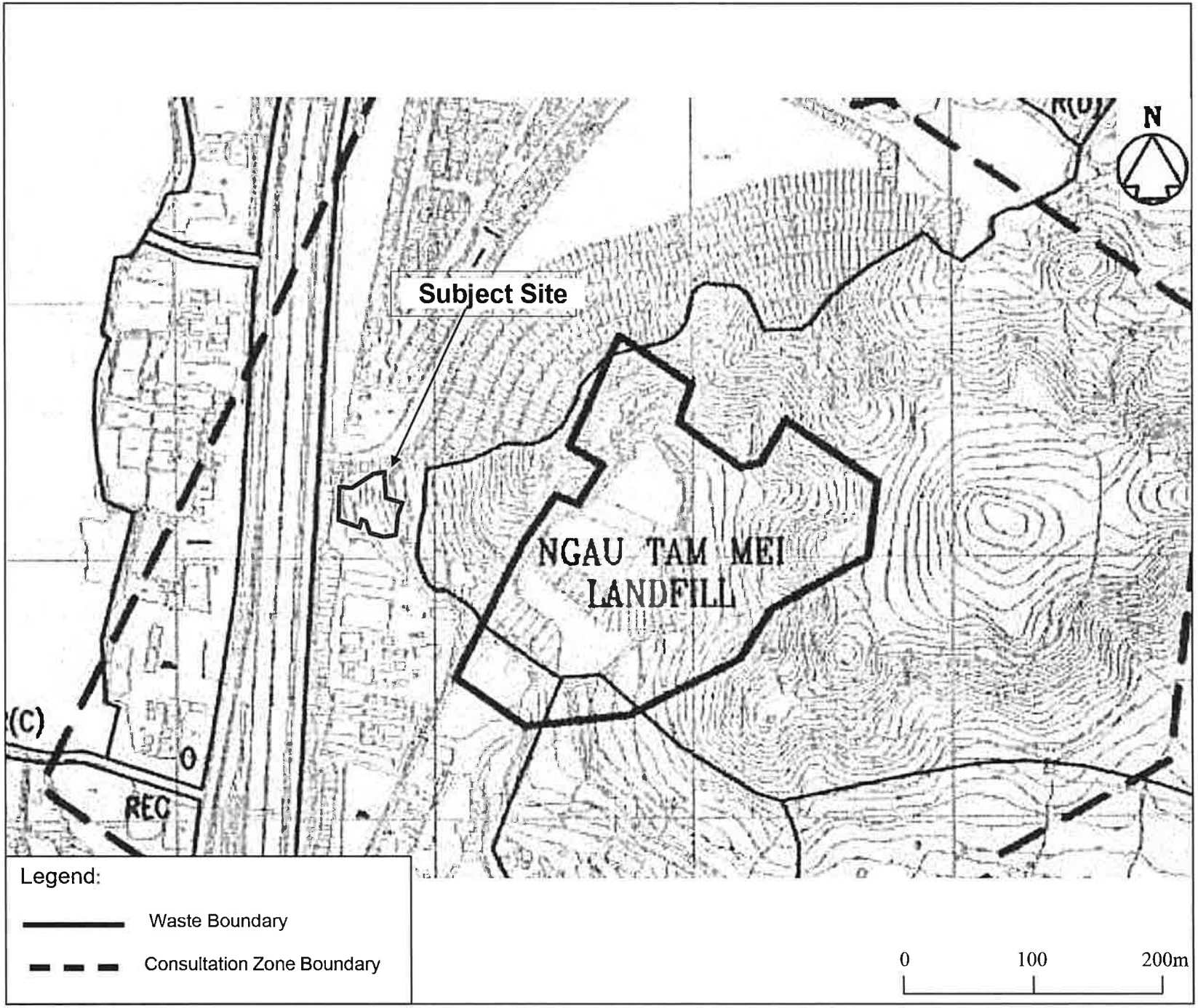
Location of the Proposed Development and Ngau Tam Mei Landfill

Figure 1.1

Scale: As Shown

Date: March 2016

Rev.: 1



Landfill Gas Hazard
Assessment Report

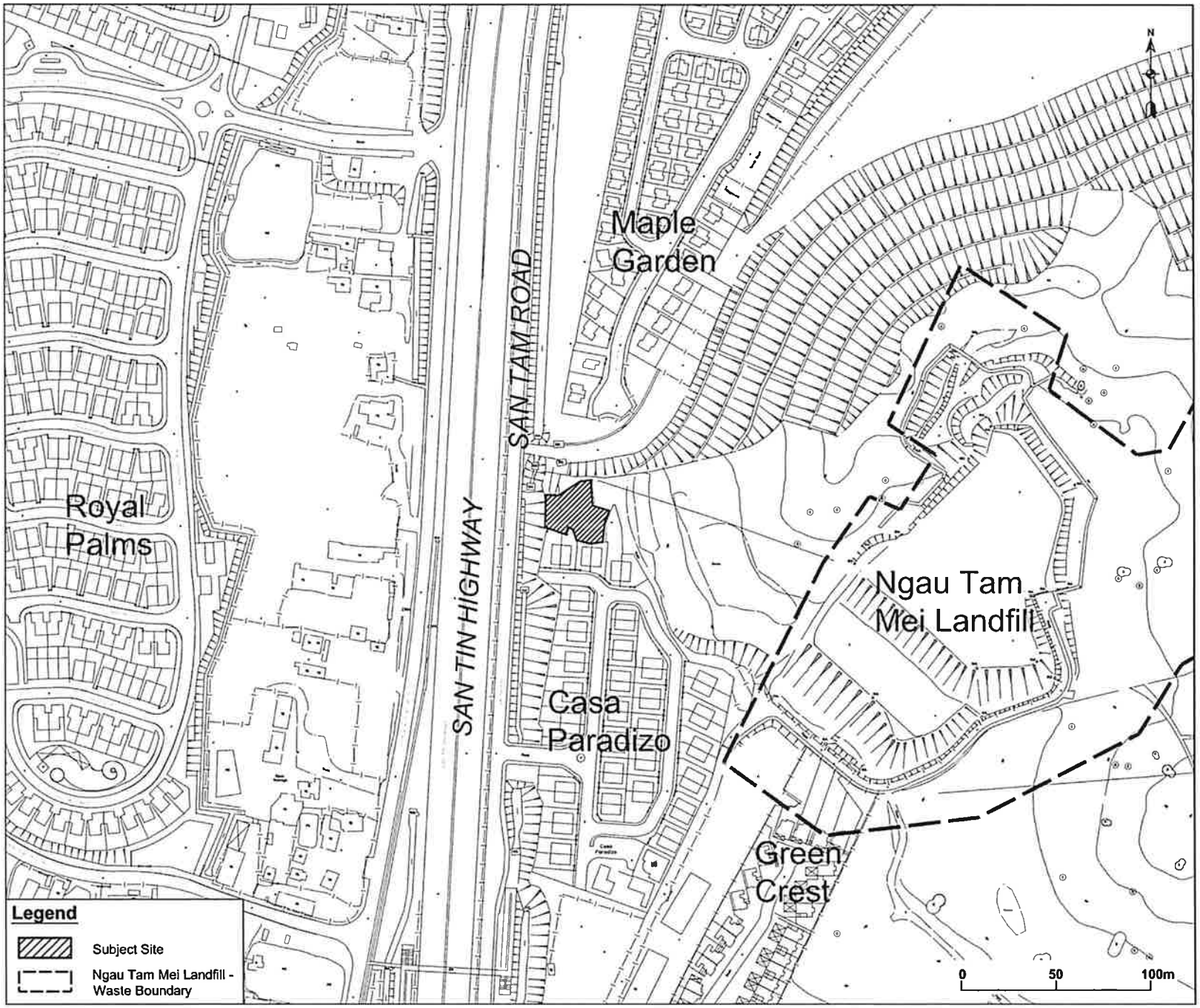
Site Location and Its Environs

Figure 2.1

Scale: As Shown

Date: December 2015

Rev.: 0



Landfill Gas Hazard Assessment Report

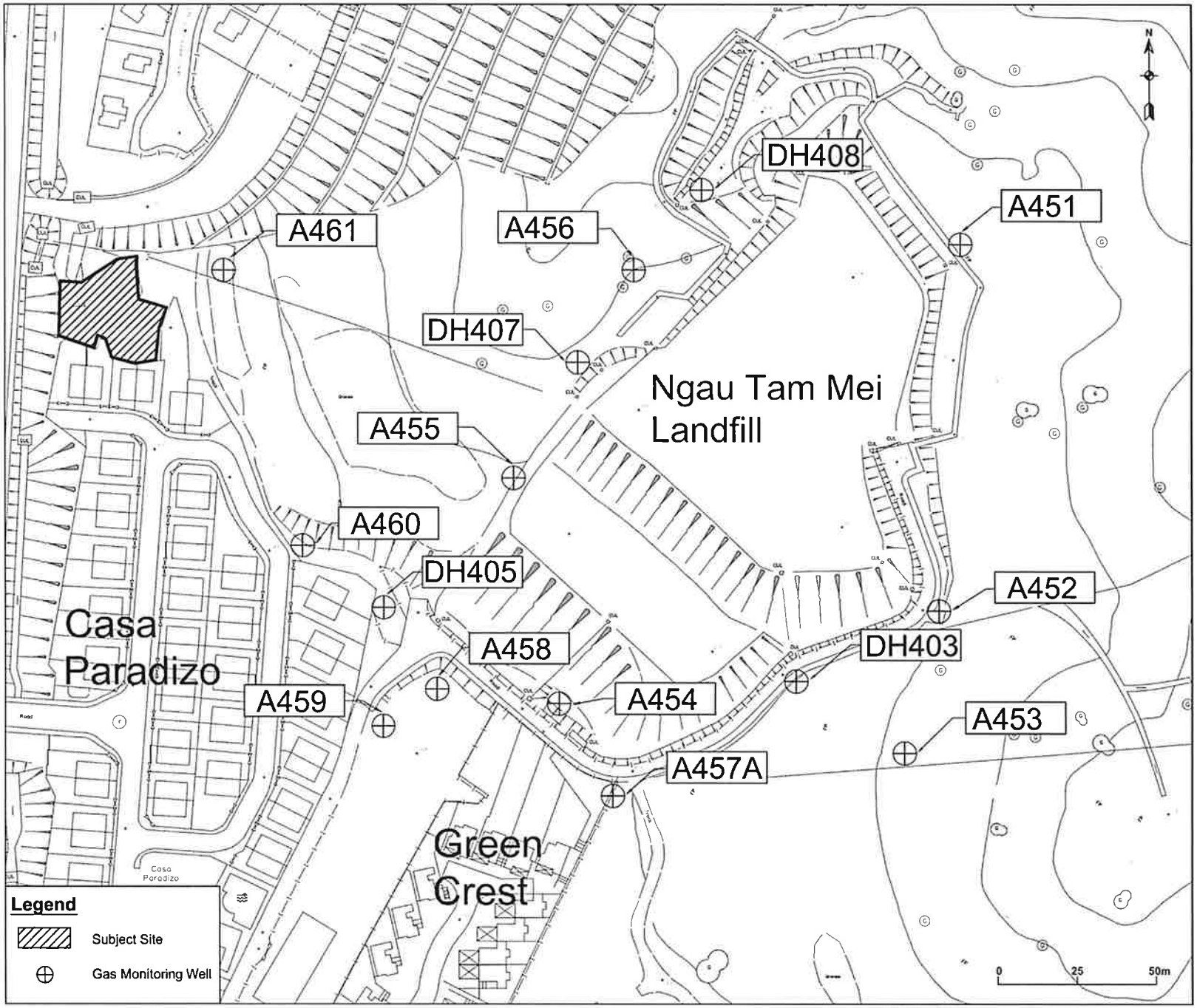
Locations of Relevant Gas Monitoring Wells at Ngau Tam Mei Landfill

Figure 3.1

Scale: As Shown

Date: December 2015

Rev.: 0



Landfill Gas Hazard
Assessment Report

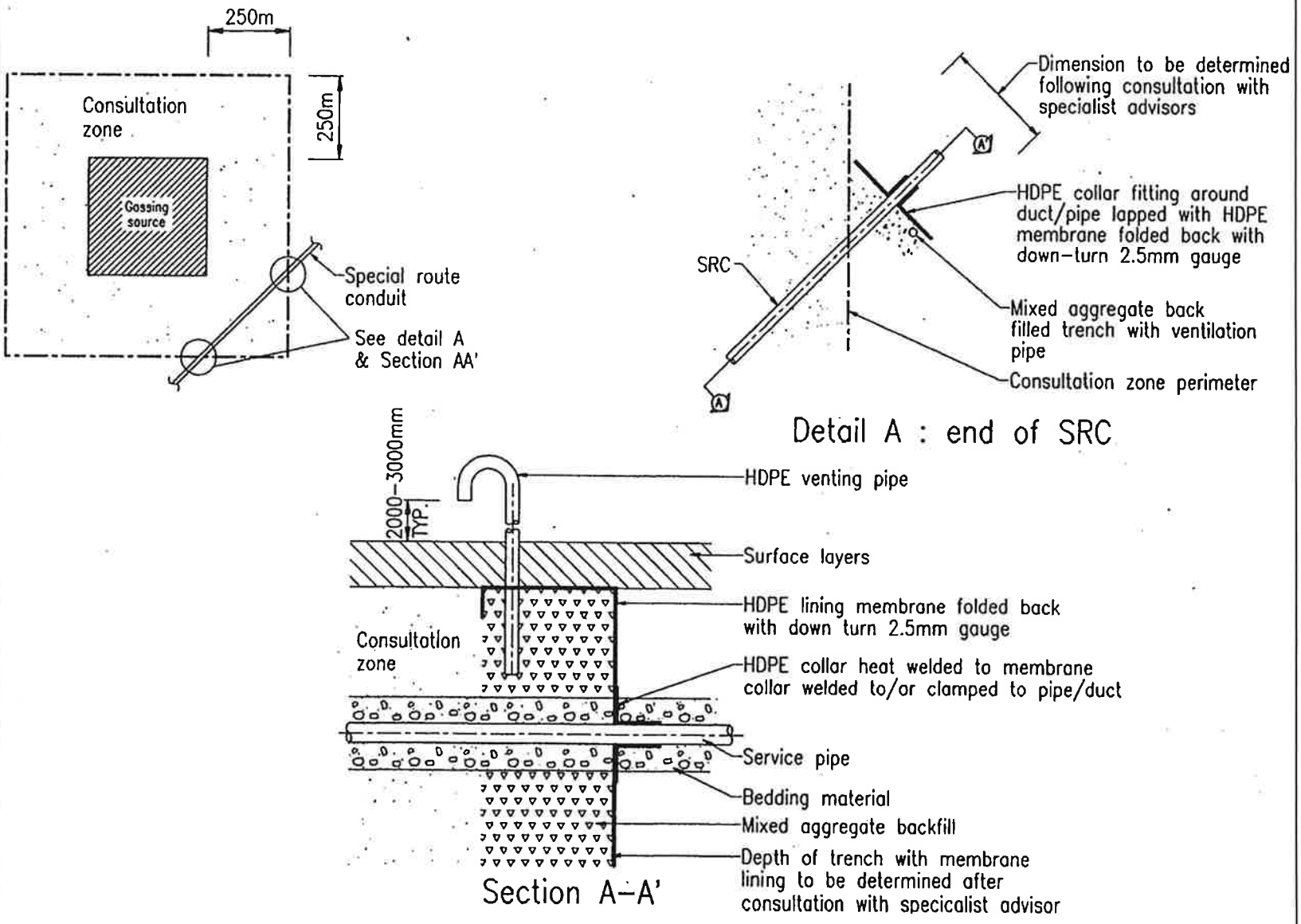
Typical Design for Services Passing Through the Consultation Zone – Special Route Conduit (SRC)

Figure 5.1

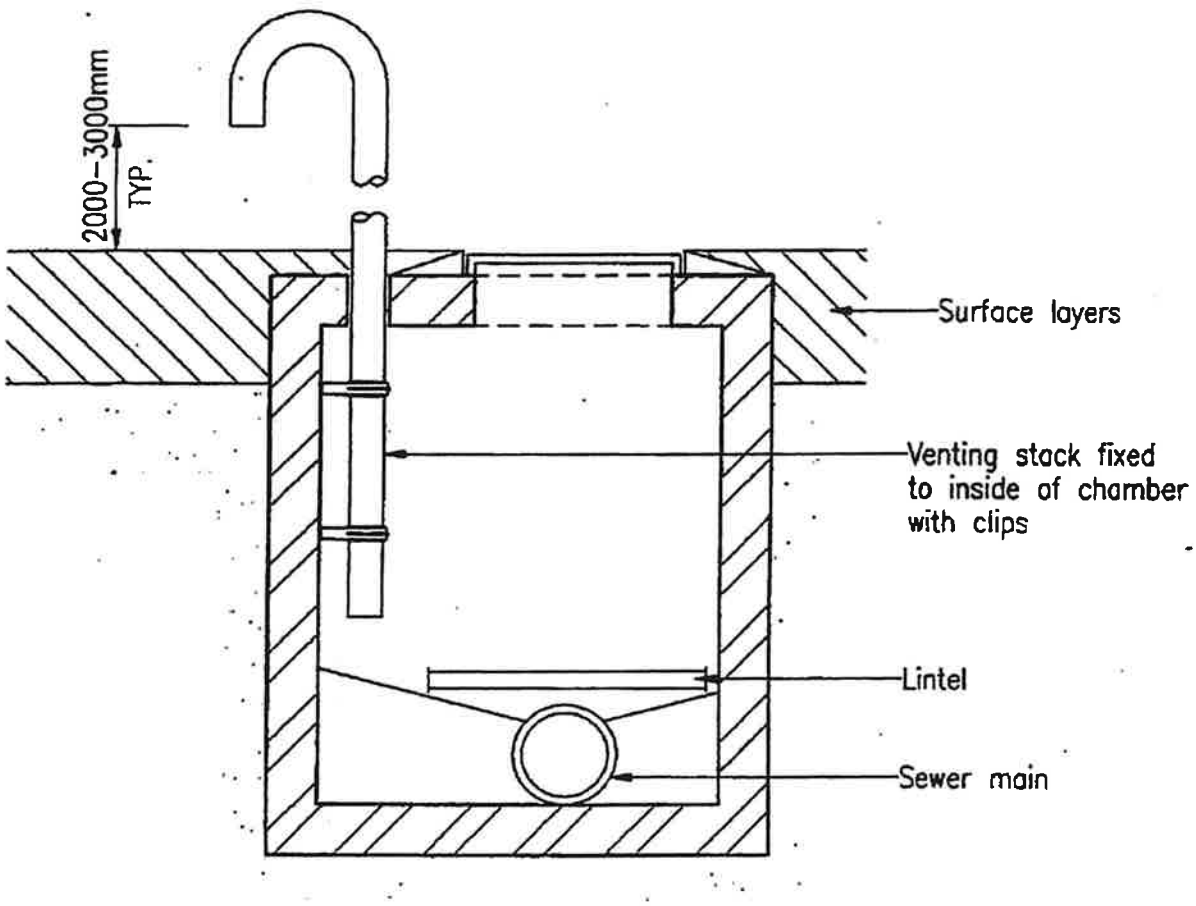
Scale: NTS

Date: December 2015

Rev.: 0



Source: Figure B6 of Landfill Gas Hazard Assessment Guidance Note (published by Environmental Protection Department in 1997)



Source: Figure B3 of Landfill Gas Hazard Assessment Guidance Note (published by Environmental Protection Department in 1997)

Landfill Gas Hazard Assessment Report

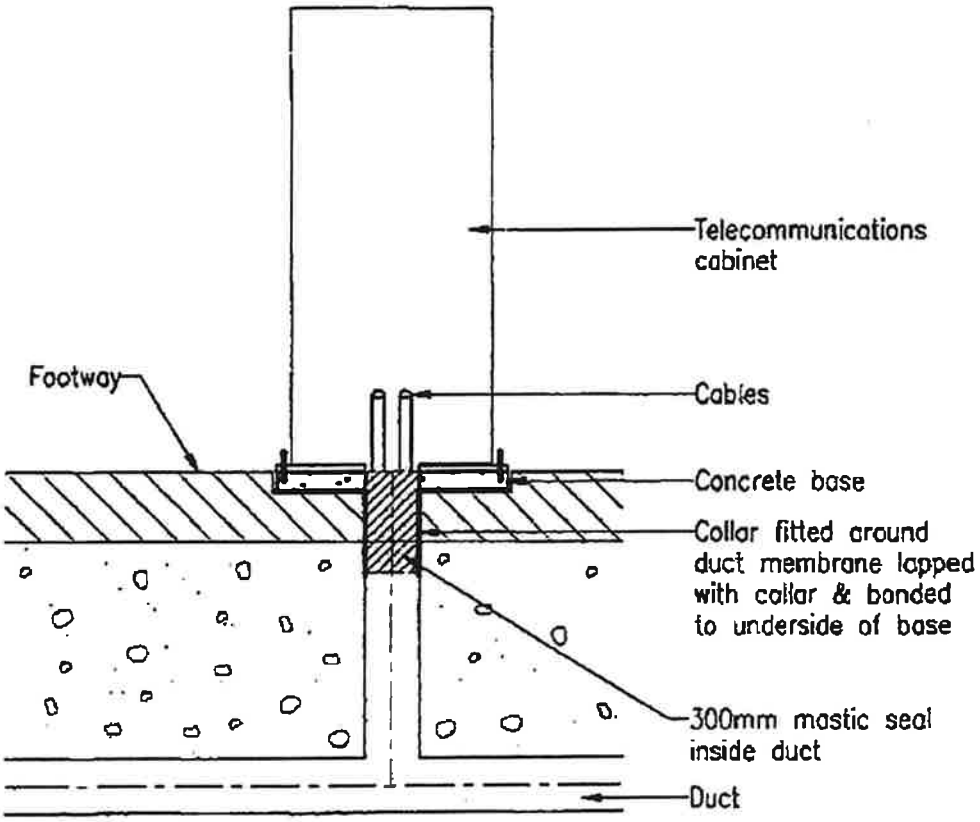
Typical Design of Vented Manhole within Consultation Zone

Figure 5.3

Scale: NTS

Date: December 2015

Rev.: 0



Source: Figure B7 of Landfill Gas Hazard Assessment Guidance Note (published by Environmental Protection Department in 1997)

Landfill Gas Hazard Assessment Report

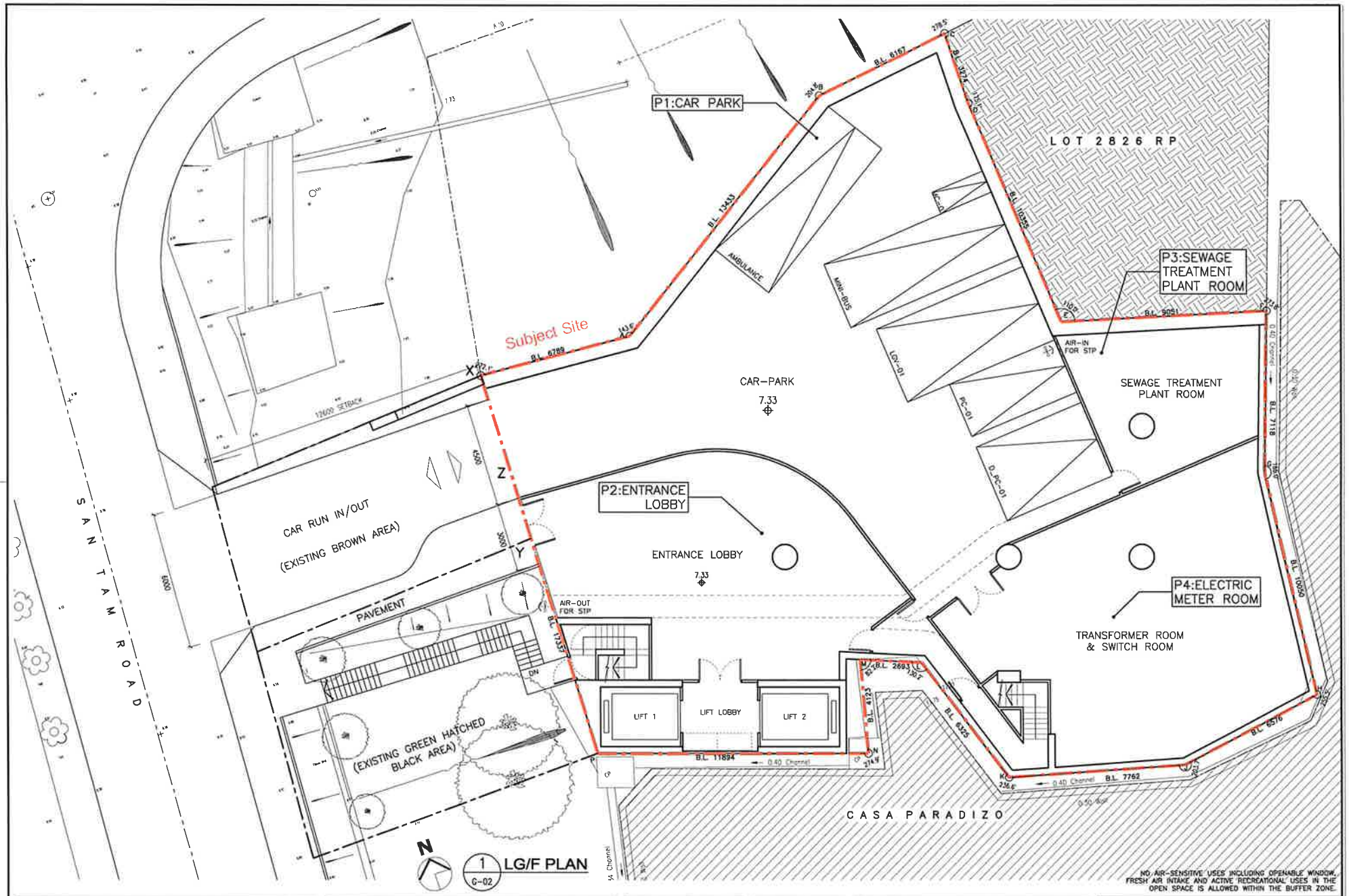
Typical Surface Detail for Above Ground Termination of Services within Consultation Zone

Figure 5.2

Scale: NTS

Date: December 2015

Rev.: 0



2202

PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

PROPOSED LANDFILL GAS MONITORING LOCATION (LG/F)

FIGURE 5.4 1:225 (A4) A DEC. 2022

Do not scale drawing.
Contractors are required to verify exact dimensions on site.
The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate.
The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified.
This drawing is not for construction purposes unless expressedly certified.

RLEE

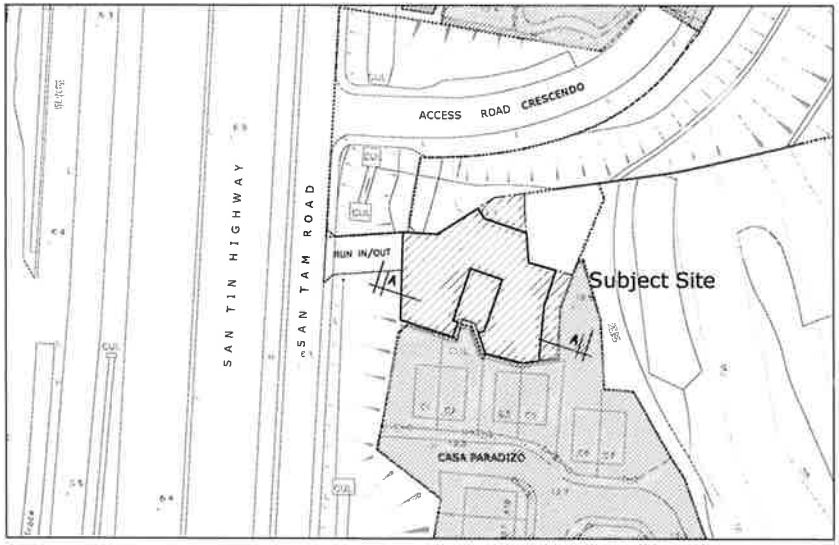
S12A AMENDMENT OF PLAN APPLICATION
APPROVED NGAU TAM MEI
OUTLINE ZONING PLAN NO. S/YL-NTM/12

PROPOSED REZONING FROM "R(C)" TO "G/IC"
FOR A PROPOSED "SOCIAL WELFARE FACILITIES"
(RESIDENTIAL CARE HOMES FOR THE ELDERLY)
(RCHE)

AT LOT 4823 IN D.D.104, 81 SAN TAM ROAD,
SAN TIN, N.T.

APPENDIX A

DEVELOPMENT LAYOUT PLANS



BLOCK PLAN SCALE – 1:1000

DEVELOPMENT SCHEDULE:

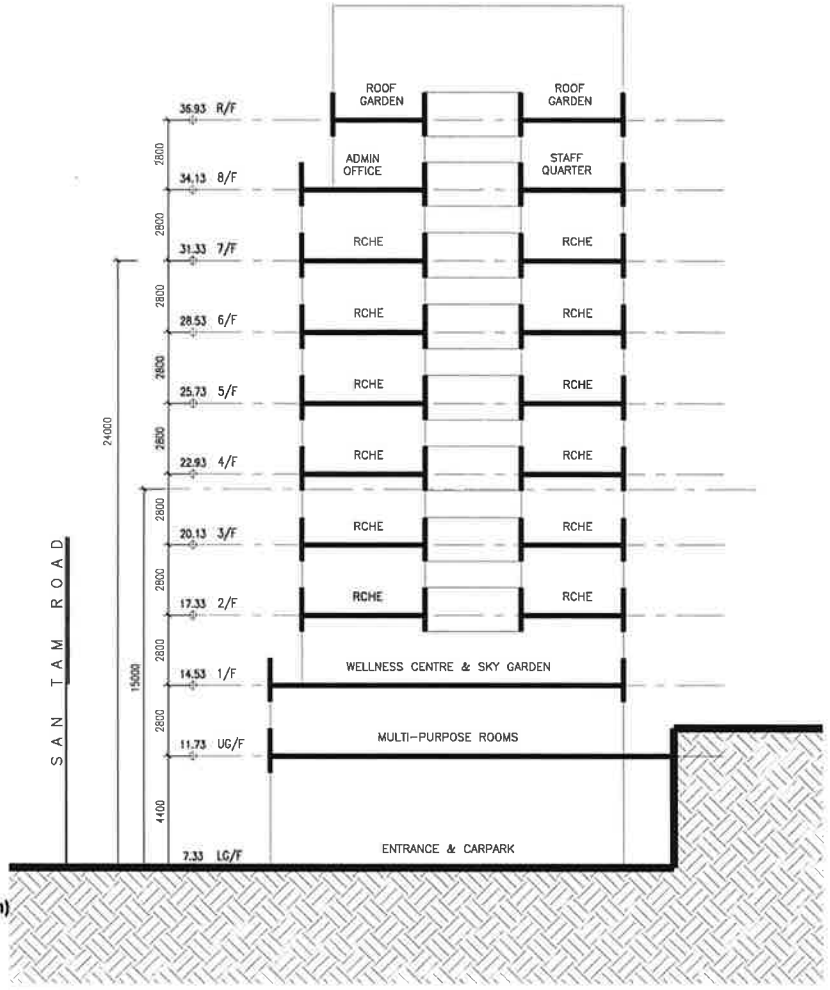
Site Area	:	736.3 m² (7926 ft²)
Class of Site	:	A
Proposed Plot Ratio For Non-Domestic	:	7.33
Proposed Site Coverage above For Non-Domestic (Above 15m)	:	75.558%
Maximum Gross Floor Area	:	5400 m² (58125.6 ft²)
Proposed Building Height	:	36.93 mPD
Absolute Height	:	29.6 m
Proposed No. Of Storey	:	10 STOREYS

Proposed Gross Floor Area

LG/F (ENTRANCE & CARPARK)	:	352.479 m²
UG/F (MULTI-PURPOSE ROOMS)	:	617.819 m²
1/F (WELLNESS CENTRE + SKY GARDEN)	:	626.160 m²
2/F (RCHE)	:	595.090 m² (45 nos. of bed)
3/F (RCHE)	:	556.330 m² (17 nos. of bed + 3 nos. of isolation room)
4/F - 7/F (RCHE)	:	556.330 m² x 4 storeys = 2225.32 m² (20 nos. of bed x 4 storeys)
8/F (ADMIN OFFIC + STAFF QUARTER)	:	426.802 m²
TOTAL	:	**5400.000 m² (142 nos. of bed + 3 nos. of isolation room)**

Parking Spaces :

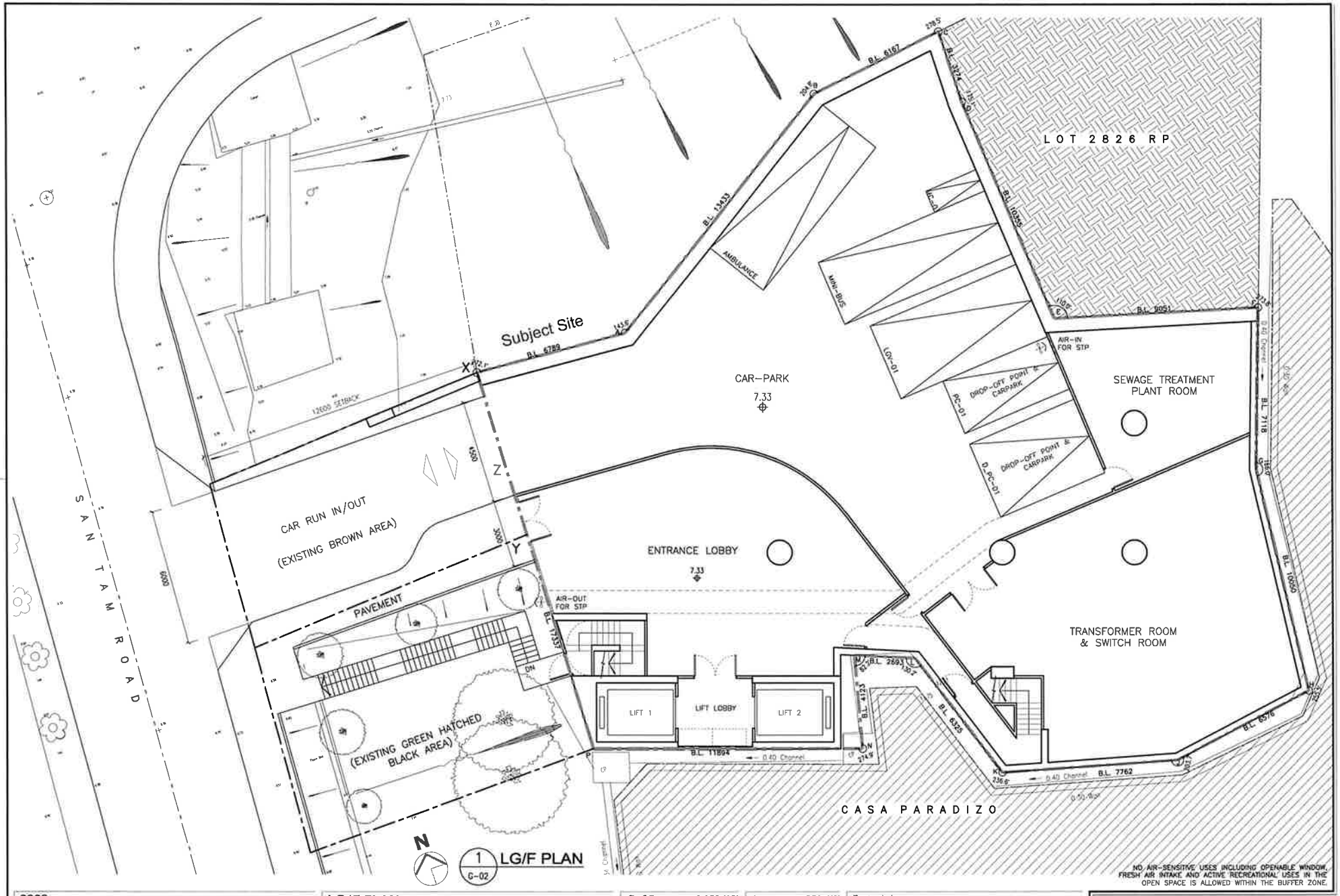
No. of LGV (3.5m x 7m x 3.6m H.)	: 1 Nos.
No. of Minibus (3m x 8m x 3.6m H.)	: 1 Nos.
No. of Private Car Parking (2.5m x 5m x 2.4m H.)	: 1 Nos.
No. of Accessible Private Car Parking (3.5m x 5m x 2.4m H.)	: 1 Nos.
No. of Motorcycle Parking (1m x 2.4m x 2.4m H.)	: 1 Nos.



SECTION A-A SCALE – 1:200

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202 **PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.**	**DEVELOPMENT SCHEDULE & SECTION**	G-01 N.T.S. (A3)	B OCT. 2022 A JULY. 2022	Do not scale drawing. Contractors are required to verify exact dimensions on site. The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate. The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified. This drawing is not for construction purposes unless expressedly certified.	RLEE



NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202

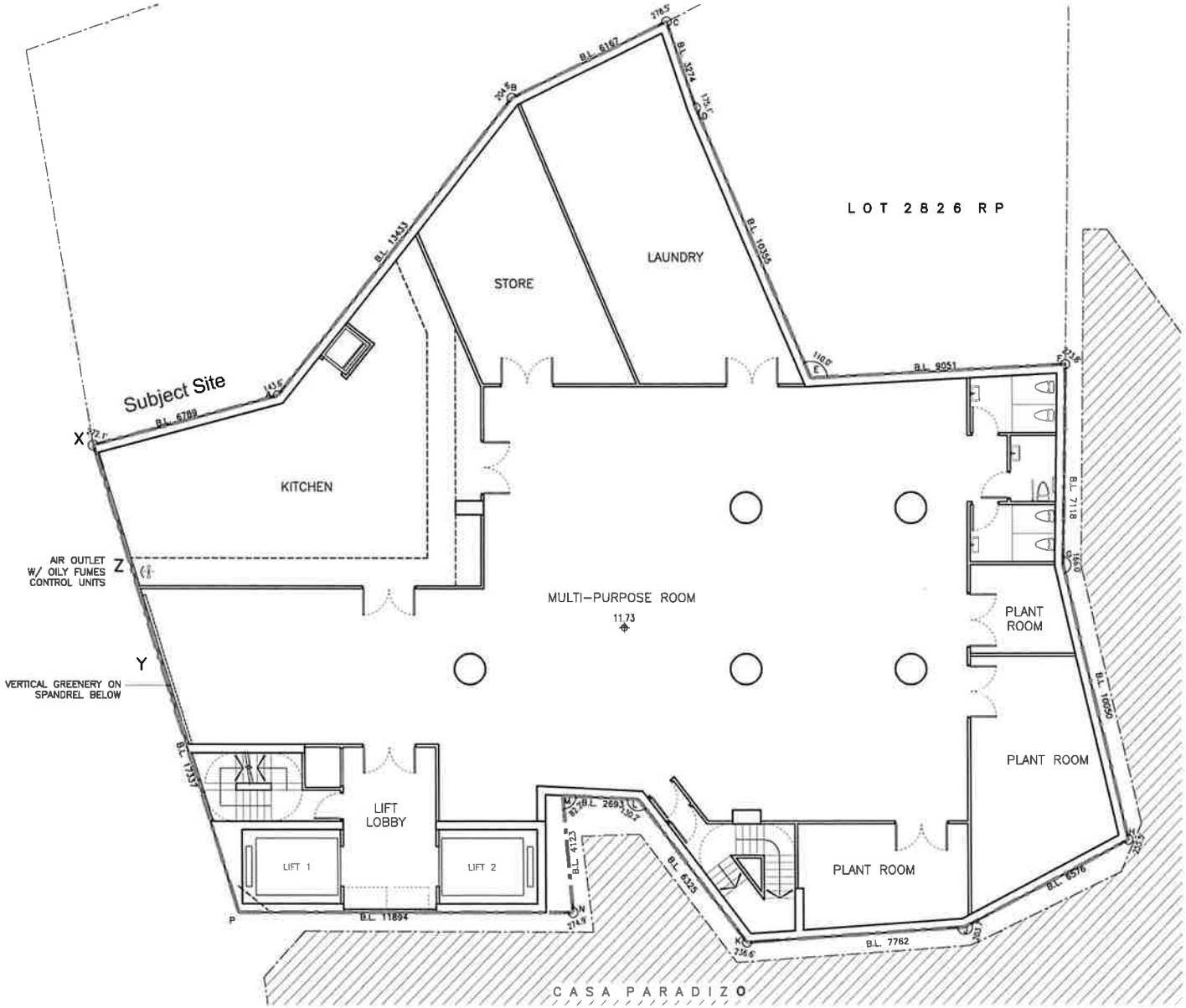
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

LG/F PLAN
ENTRANCE & CARPARK

G-02 | 1:150 (A3) 1:225 (A4)

C	DEC. 2022	
B	OCT. 2022	
A	JULY. 2022	

RLEE



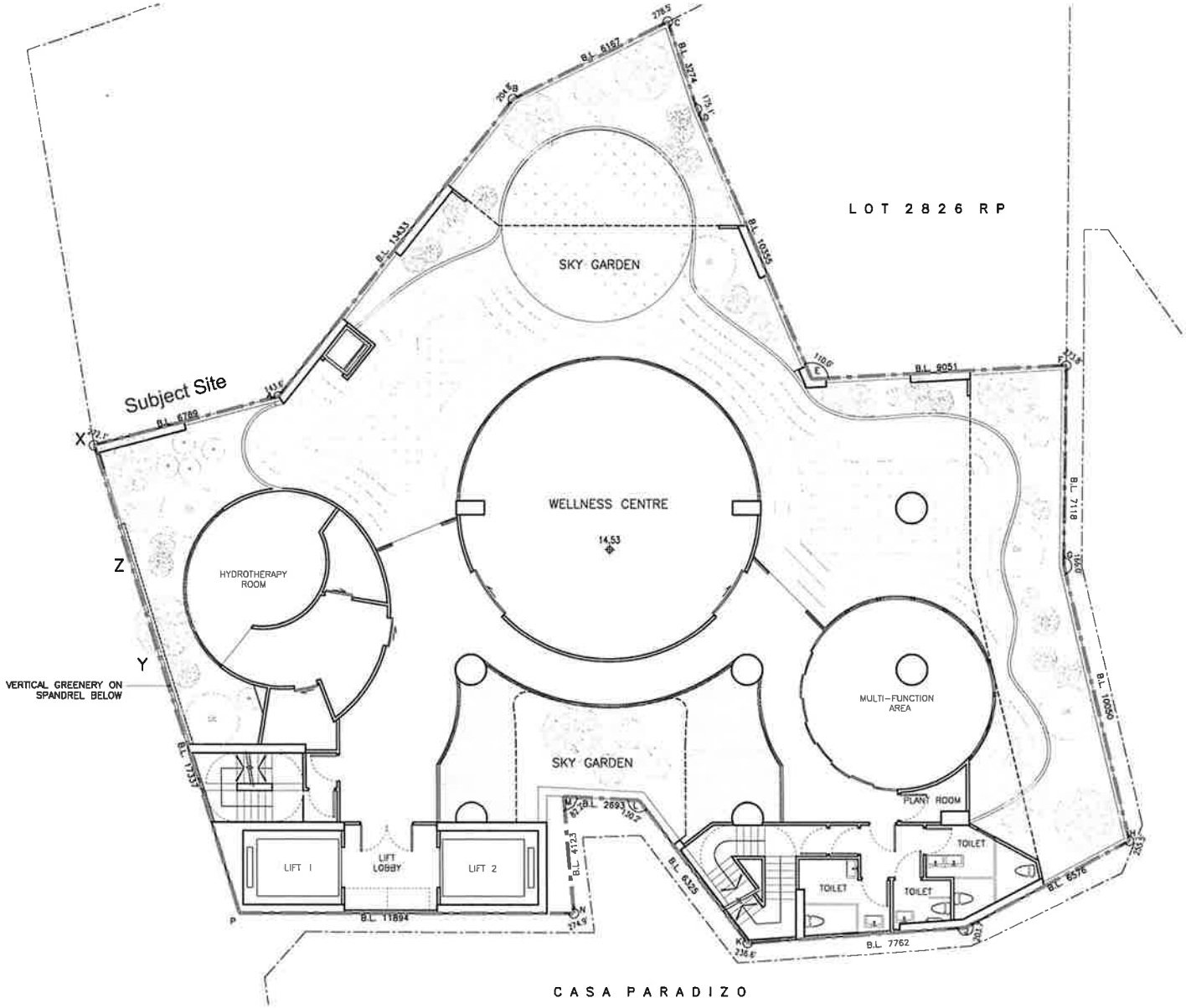
N

1 UG/F PLAN
G-03

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202 PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.	UG/F PLAN MULTI-PURPOSE ROOMS	G-03	1:150 (A3) 1:225 (A4)	B OCT. 2022 A JULY. 2022	Do not scale drawing. Contractors are required to verify exact dimensions on site. The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate. The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified. This drawing is not for construction purposes unless expressedly certified.

RLEE



N

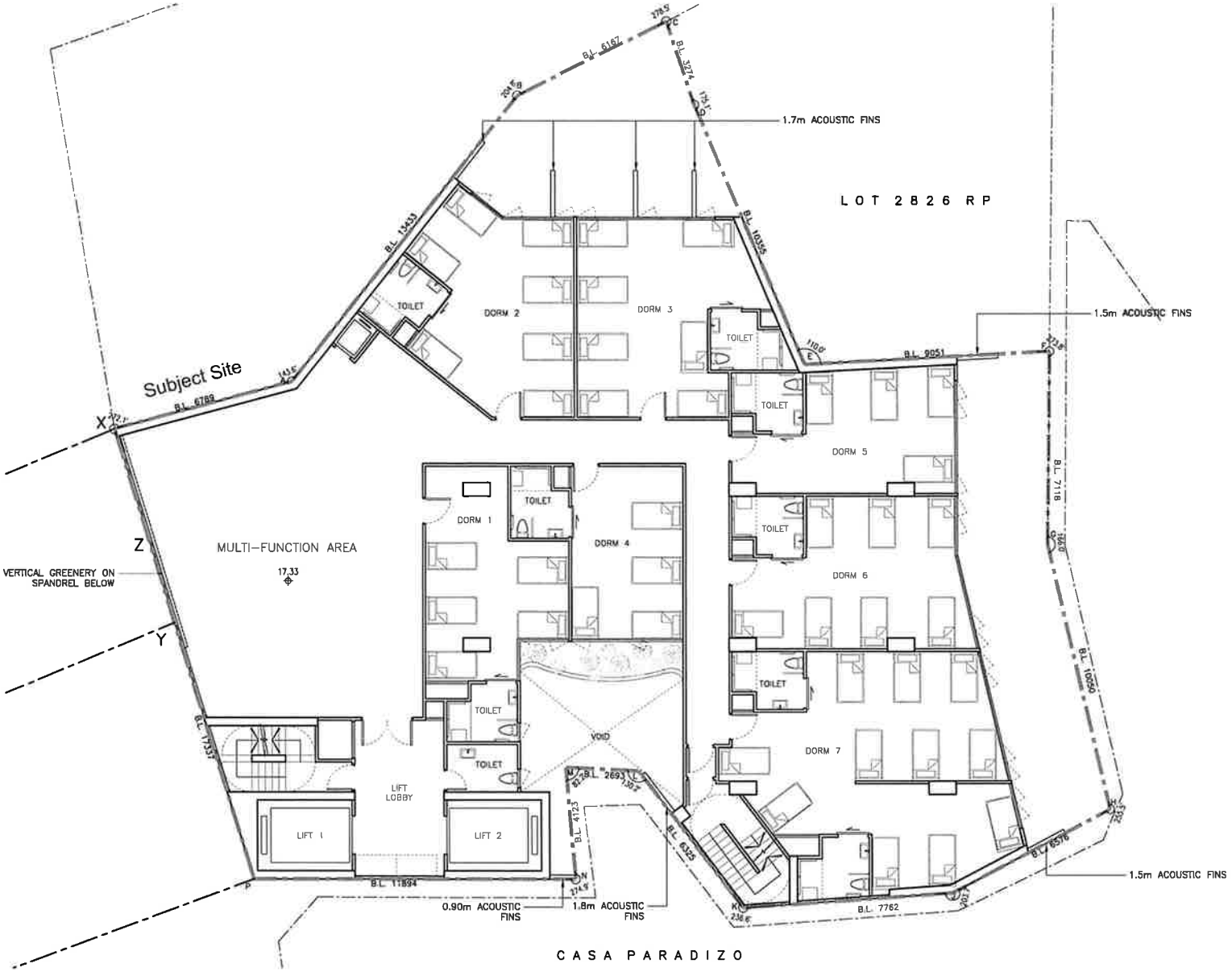
1 / G-04 1/F PLAN

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202 PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.	1/F PLAN WELLNESS CENTRE & SKY GARDEN	G-04	1:150 (A3) 1:225 (A4)	B A	OCT. 2022 JULY. 2022

Do not scale drawing.
Contractors are required to verify exact dimensions on site.
The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate.
The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified.
This drawing is not for construction purposes unless expressedly certified.

RLEE



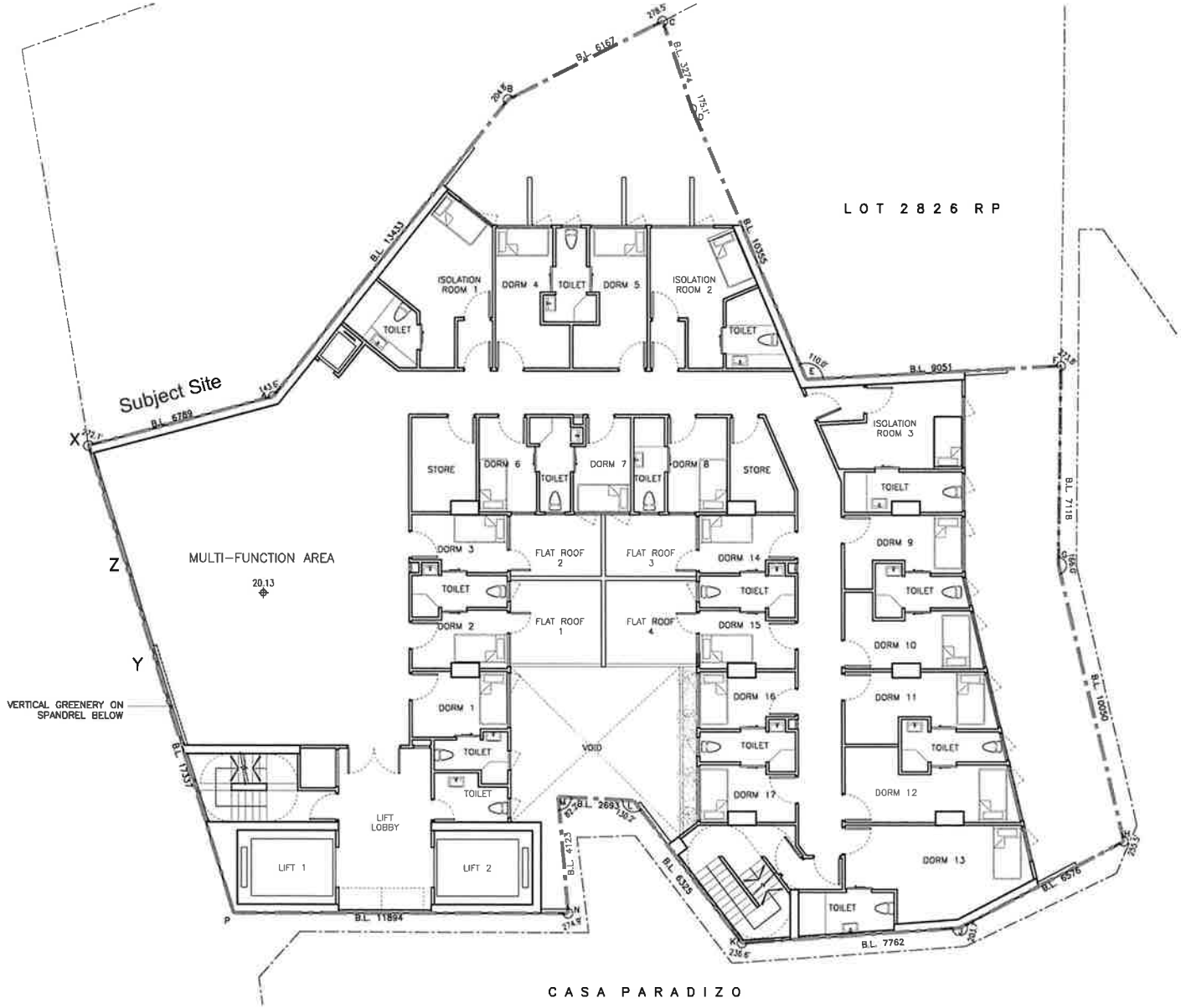
N

1 G-05 2/F PLAN

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202 PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.	2/F PLAN RCHE	G-05	1:150 (A3) 1:225 (A4)	B OCT. 2022 A JULY. 2022	Do not scale drawing. Contractors are required to verify exact dimensions on site. The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate. The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified. This drawing is not for construction purposes unless expressedly certified.

RLEE



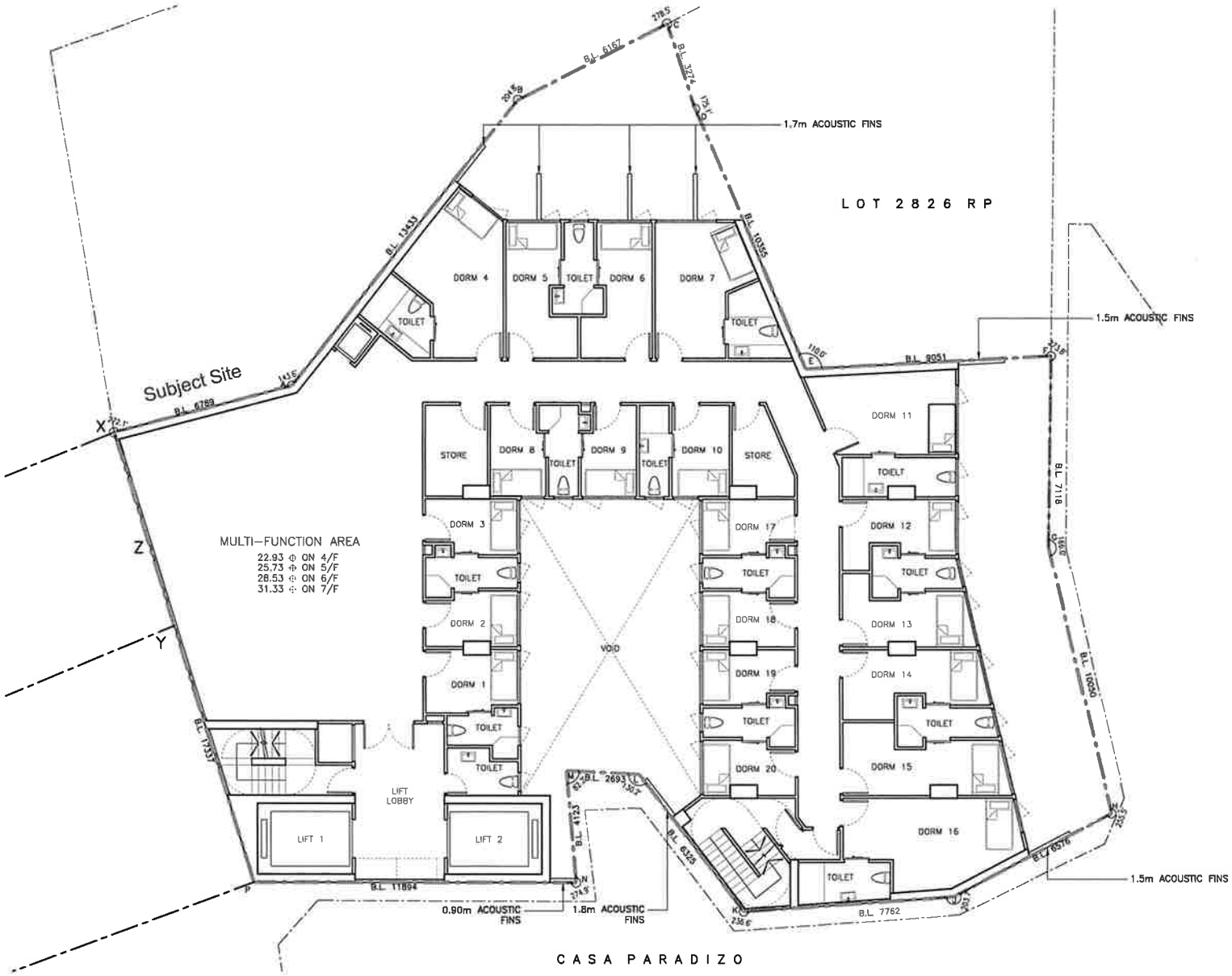
N

1 / G-06 3/F PLAN

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202 PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.	3/F PLAN RCHE	G-06	1:150 (A3) 1:225 (A4)	C DEC. 2022 B OCT. 2022 A JULY. 2022	Do not scale drawing. Contractors are required to verify exact dimensions on site. This drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate. The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified. This drawing is not for construction purposes unless expressedly certified.

RLEE

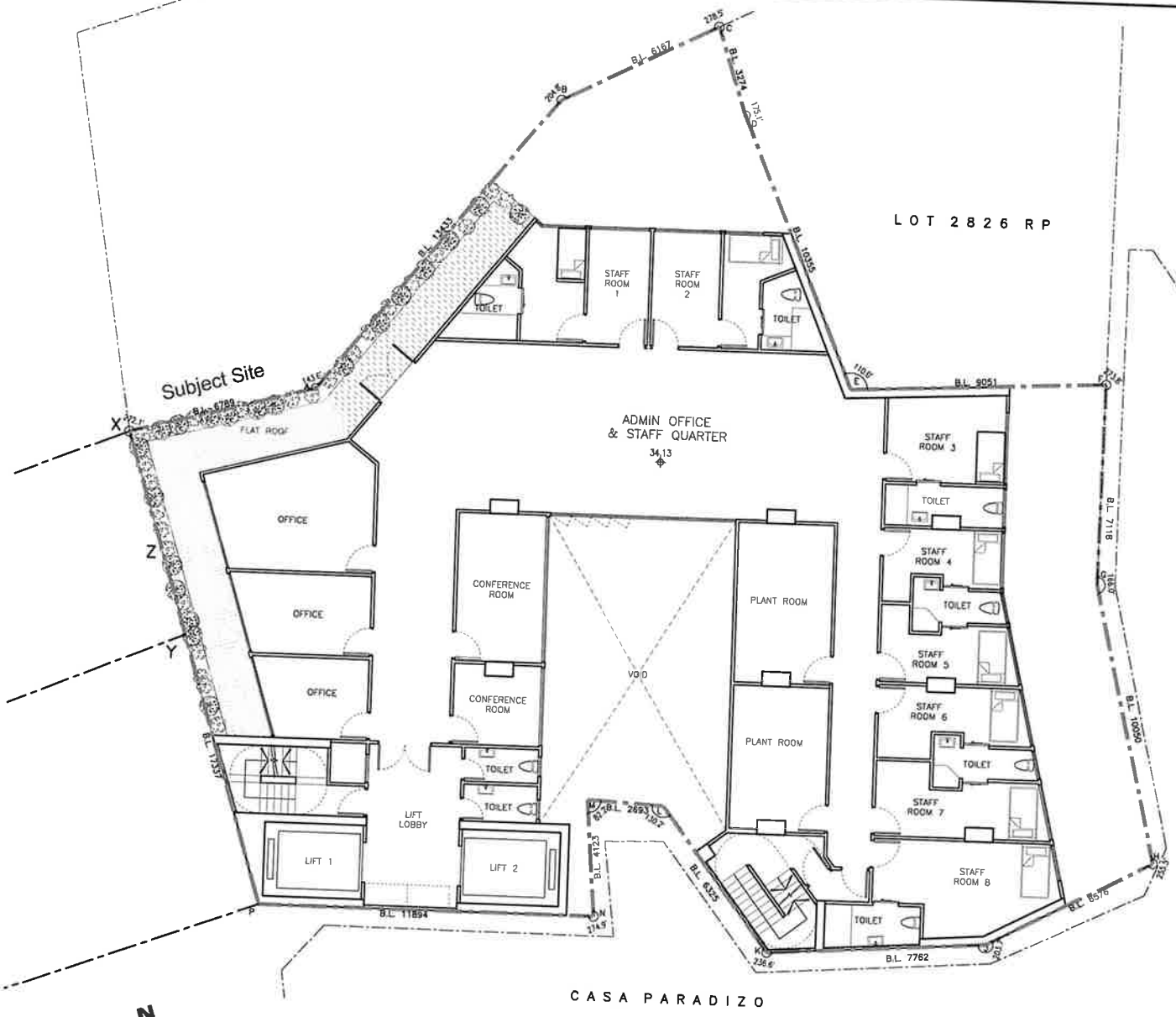


1 TYPICAL FLOOR PLAN PLAN
G-07

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202 PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.	TYPICAL FLOOR PLAN PLAN RCHE	G-07	1:150 (A3) 1:225 (A4)	B A	OCT. 2022 JULY. 2022	Do not scale drawing. Contractors are required to verify exact dimensions on site. The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate. The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified. This drawing is not for construction purposes unless expressedly certified.

RLEE



1 G-08 8/F PLAN

2202

PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

8/F PLAN
ADMIN OFFICE & STAFF QUARTER

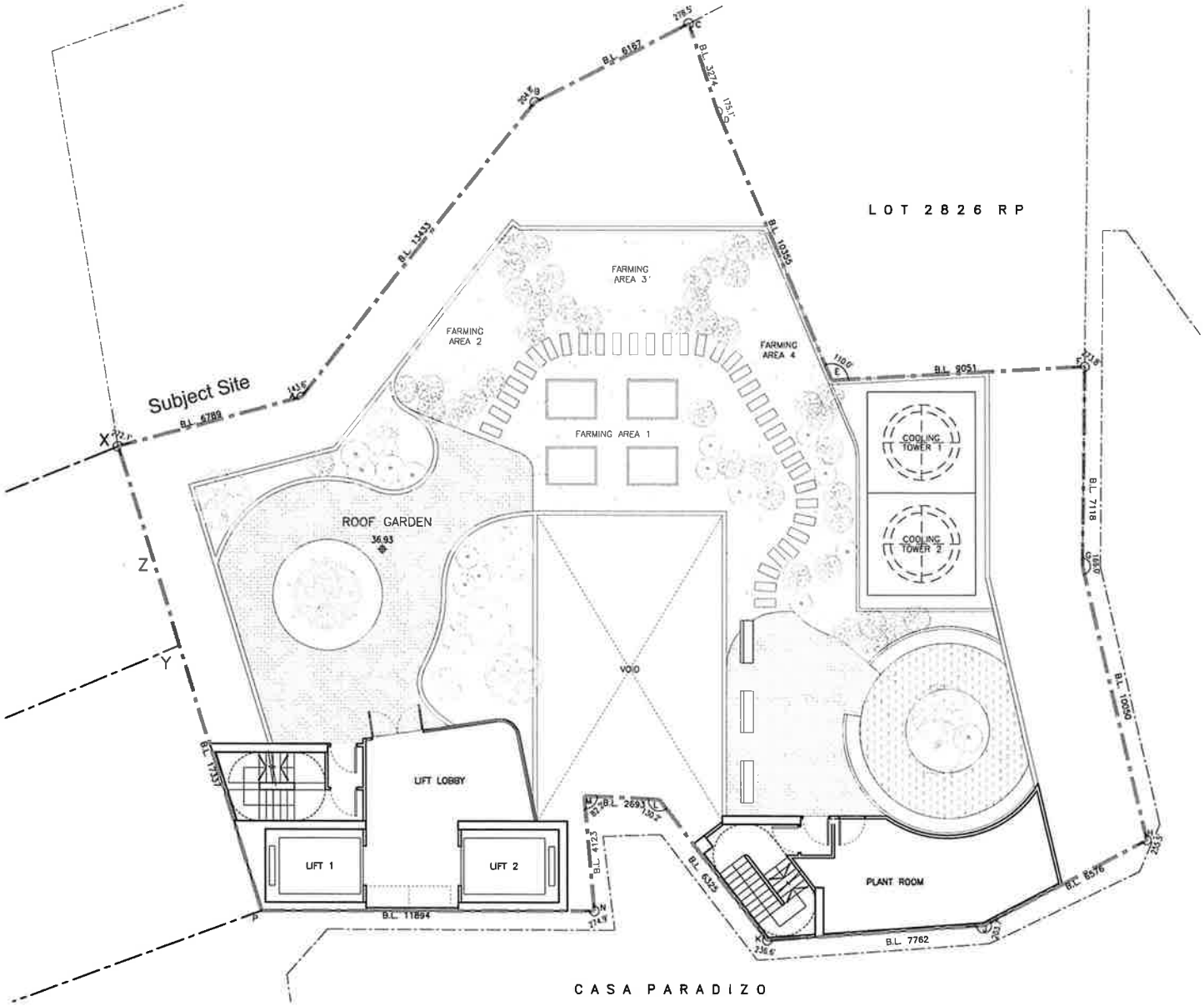
G-08 1:150 (A3) 1:225 (A4)

B	OCT. 2022	
A	JULY. 2022	

Do not scale drawing.
Contractors are required to verify exact dimensions on site.
The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate.
The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified.
This drawing is not for construction purposes unless expressedly certified.

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

RLEE



1 G-09 ROOF GARDEN PLAN

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202 PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.	ROOF GARDEN PLAN	G-09	1:150 (A3) 1:225 (A4)	B OCT. 2022 A JULY. 2022	Do not scale drawing. Contractors are required to verify exact dimensions on site. The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate. The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified. This drawing is not for construction purposes unless expressedly certified.

RLEE

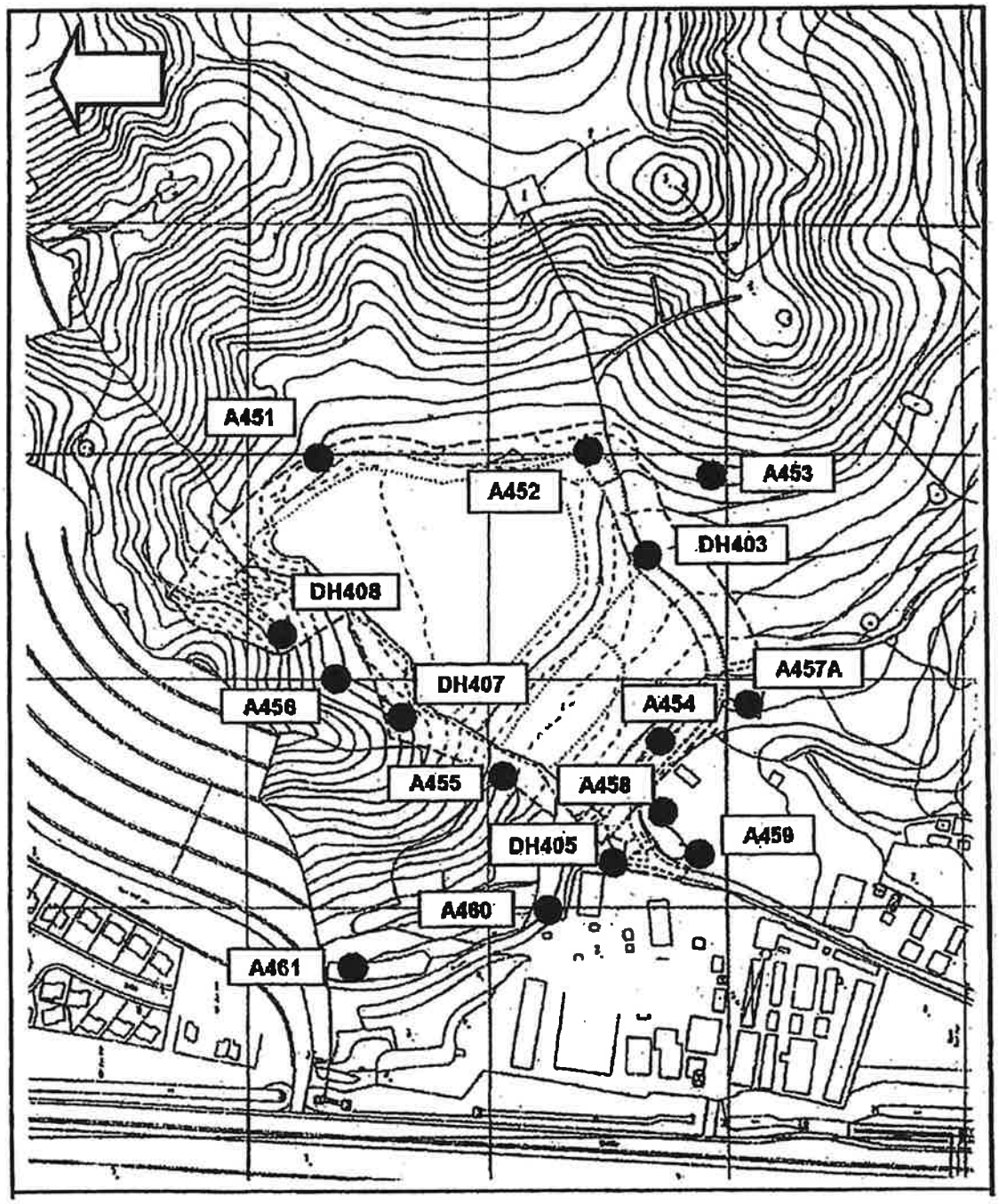
S12A AMENDMENT OF PLAN APPLICATION
APPROVED NGAU TAM MEI
OUTLINE ZONING PLAN NO. S/YL-NTM/12

PROPOSED REZONING FROM "R(C)" TO "G/IC"
FOR A PROPOSED "SOCIAL WELFARE FACILITIES"
(RESIDENTIAL CARE HOMES FOR THE ELDERLY)
(RCHE)

AT LOT 4823 IN D.D.104, 81 SAN TAM ROAD,
SAN TIN, N.T.

APPENDIX B

RECENT GAS MONITORING DATA OF NGAU TAM MEI LANDFILL
(FROM JULY 2020 TO JUNE 2022)



Locations of Landfill Gas Migration Monitoring Wells

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 17-Jul-2020
Weather Condition: Sunny
Equipment Used: Landfill gas monitor GEM-2000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	10:43	<0.1	4.4	15.4	28.1	0	
A452	10:39	<0.1	2.4	17.5	30.9	0	
A453	10:34	<0.1	1.4	18.4	32.1	0	
A454	10:22	<0.1	13.6	0.6	33.2	0	
A455	11:00	<0.1	1.7	18.1	33.8	0	
A456	10:51	<0.1	0.5	19.3	30.0	0	
A457A	9:55	<0.1	<0.1	14.9	31.1	0	
A458	10:02	<0.1	6.7	13.9	30.8	0	
A459	10:08	<0.1	0.3	19.0	34.8	0	
A460	10:14	<0.1	0.4	18.9	32.5	0	
A461	10:17	<0.1	0.8	18.7	31.0	0	
DH403	10:26	<0.1	1.6	18.2	31.5	0	
DH405	10:12	<0.1	5.4	14.8	35.8	0	
DH407	10:48	<0.1	<0.1	19.9	30.4	0	
DH408	10:54	<0.1	0.8	19.0	33.4	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 14-Aug-2020
Weather Condition: Sunny
Equipment Used: Landfill gas monitor GEM-2000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	14:54	<0.1	6.3	12.6	30.6	0	
A452	14:46	<0.1	0.3	19.0	34.7	0	
A453	14:42	<0.1	4.3	15.4	32.5	0	
A454	14:29	<0.1	11.8	0.3	35.0	0	
A455	15:06	0.1	8.1	9.2	32.8	0	
A456	15:00	<0.1	3.0	16.5	30.3	0	
A457A	14:02	<0.1	<0.1	13.8	34.0	0	
A458	14:09	<0.1	4.5	15.3	34.0	0	
A459	14:13	<0.1	0.9	18.3	35.0	0	
A460	14:21	<0.1	0.7	17.9	35.0	0	
A461	14:24	<0.1	4.5	9.9	32.8	0	
DH403	14:38	<0.1	7.1	10.9	31.3	0	
DH405	14:17	<0.1	9.8	10.4	34.4	0	
DH407	14:56	<0.1	5.9	13.1	28.8	0	
DH408	15:03	<0.1	3.5	15.5	35.0	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 25-Sep-2020
Weather Condition: Sunny
Equipment Used: Landfill gas monitor GEM-2000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	11:31	<0.1	7.6	11.0	28.3	0	
A452	11:28	<0.1	1.5	17.8	29.5	0	
A453	11:23	<0.1	4.8	15.2	27.8	0	
A454	11:14	<0.1	8.1	6.5	33.7	0	
A455	11:43	<0.1	5.3	14.2	26.9	0	
A456	11:36	<0.1	3.4	16.1	25.9	0	
A457A	11:08	<0.1	<0.1	10.7	31.2	0	
A458	11:00	<0.1	2.8	17.4	28.3	0	
A459	11:03	<0.1	1.7	17.8	28.7	0	
A460	11:51	<0.1	2.5	16.0	30.3	0	
A461	11:58	<0.1	6.0	10.3	29.2	0	
DH403	11:20	<0.1	7.4	11.3	28.5	0	
DH405	11:48	<0.1	6.5	14.6	35.1	0	
DH407	11:34	<0.1	6.6	12.3	27.1	0	
DH408	11:39	<0.1	4.4	15.2	28.7	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 22-Oct-2020
Weather Condition: Sunny
Equipment Used: Landfill gas monitor GEM-5000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	10:39	<0.1	0.8	20.5	24.6	0	
A452	10:34	<0.1	5.5	15.8	22.5	0	
A453	10:29	<0.1	2.7	18.5	24.1	0	
A454	9:45	<0.1	16.7	0.4	29.8	0	
A455	11:06	<0.1	3.0	18.1	23.8	0	
A456	10:48	<0.1	0.5	21.1	23.2	0	
A457A	10:10	<0.1	<0.1	11.5	24.8	0	
A458	10:01	<0.1	4.2	17.0	26.0	0	
A459	10:05	<0.1	1.8	19.2	27.3	0	
A460	9:52	<0.1	8.0	6.5	24.5	0	
A461	9:56	<0.1	4.3	15.5	24.4	0	
DH403	10:23	<0.1	1.3	20.0	23.3	0	
DH405	9:50	<0.1	5.5	16.6	29.0	0	
DH407	10:45	<0.1	0.3	21.3	22.8	0	
DH408	10:52	<0.1	1.6	19.9	25.2	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 18-Nov-2020
Weather Condition: Cloudy
Equipment Used: **Landfill gas monitor GEM-5000**

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	14:17	<0.1	6.2	13.2	27.0	0	
A452	13:53	<0.1	3.8	18.6	26.9	0	
A453	14:22	<0.1	3.4	18.4	27.7	0	
A454	14:31	<0.1	16.1	5.3	31.1	0	
A455	14:12	<0.1	3.9	17.1	27.5	0	
A456	14:05	<0.1	1.8	19.7	27.5	0	
A457A	14:47	<0.1	<0.1	10.1	31.0	0	
A458	15:00	<0.1	8.5	12.8	29.4	0	
A459	15:05	<0.1	1.2	20.3	29.7	0	
A460	14:38	<0.1	5.3	12.5	28.7	0	
A461	14:41	<0.1	4.1	17.0	27.3	0	
DH403	14:26	<0.1	2.7	18.1	27.0	0	
DH405	14:34	<0.1	4.7	18.0	31.5	0	
DH407	14:01	<0.1	6.4	14.6	26.8	0	
DH408	14:09	<0.1	1.9	19.2	27.6	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 18-Dec-2020
Weather Condition: Sunny
Equipment Used: **Landfill gas monitor GEM-5000**

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	11:16	<0.1	7.0	14.0	16.6	0	
A452	11:13	<0.1	6.9	14.4	15.7	0	
A453	11:10	<0.1	1.6	20.1	16.1	0	
A454	11:03	<0.1	16.4	7.9	21.2	0	
A455	11:28	<0.1	7.0	14.4	16.6	0	
A456	11:22	<0.1	1.2	20.3	16.0	0	
A457A	10:42	<0.1	<0.1	12.1	18.4	0	
A458	10:31	<0.1	2.1	19.3	19.4	0	
A459	10:35	<0.1	2.5	18.9	20.4	0	
A460	10:54	<0.1	7.7	12.7	17.4	0	
A461	10:59	<0.1	5.8	17.2	17.2	0	
DH403	11:06	<0.1	7.7	14.2	15.5	0	
DH405	10:51	<0.1	7.0	15.7	21.3	0	
DH407	11:20	<0.1	4.2	18.0	15.3	0	
DH408	11:24	<0.1	4.0	18.3	25.5	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 15-Jan-2021
Weather Condition: Sunny
Equipment Used: **Landfill gas monitor GEM-5000**

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	13:38	<0.1	5.6	17.8	21.7	0	
A452	13:56	<0.1	9.2	14.6	19.5	0	
A453	14:00	<0.1	1.4	19.9	19.1	0	
A454	14:06	<0.1	16.3	9.2	24.5	0	
A455	13:49	0.1	6.2	16.4	20.5	0	
A456	13:44	<0.1	0.9	19.9	22.5	0	
A457A	14:34	<0.1	<0.1	14.8	25.2	0	
A458	14:42	<0.1	5.8	16.2	24.3	0	
A459	14:45	<0.1	2.0	19.8	25.8	0	
A460	14:12	<0.1	5.8	15.6	21.6	0	
A461	14:24	<0.1	4.3	17.9	20.7	0	
DH403	14:03	<0.1	9.5	11.1	19.8	0	
DH405	14:09	<0.1	8.2	14.5	23.6	0	
DH407	13:46	<0.1	7.7	12.4	19.4	0	
DH408	13:42	<0.1	4.8	18.5	25.6	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 05-Feb-2021
Weather Condition: Sunny
Equipment Used: **Landfill gas monitor GEM-5000**

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	13:46	<0.1	7.7	14.3	24.0	0	
A452	13:35	<0.1	14.7	6.5	23.5	0	
A453	14:15	<0.1	1.8	19.1	25.0	0	
A454	14:28	<0.1	15.6	8.7	29.7	0	
A455	14:05	<0.1	5.1	15.1	24.7	0	
A456	13:57	<0.1	1.3	19.3	26.4	0	
A457A	14:47	<0.1	<0.1	14.3	30.4	0	
A458	14:56	<0.1	4.8	16.3	28.3	0	
A459	15:02	<0.1	0.7	20.1	30.1	0	
A460	14:34	<0.1	5.6	15.9	25.1	0	
A461	14:37	<0.1	2.9	18.5	25.8	0	
DH403	14:19	0.1	3.8	17.2	23.5	0	
DH405	14:30	<0.1	4.9	16.6	27.3	0	
DH407	13:50	<0.1	6.2	12.6	25.2	0	
DH408	14:00	<0.1	1.3	19.3	30.8	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 11-Mar-2021 16-Mar-2021
Weather Condition: Sunny , Sunny
Equipment Used: **Landfill gas monitor GEM-5000**

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	14:00	<0.1	1.9	20.6	26.1	0	
A452	13:56	<0.1	5.7	15.2	25.4	0	
A453	13:53	<0.1	1.5	20.5	27.5	0	
A454	13:46	<0.1	15.3	6.0	28.9	0	
A455	14:10	<0.1	4.7	16.1	25.9	0	
A456	14:04	<0.1	2.5	20.2	26.9	0	
A457A	14:22	<0.1	<0.1	13.4	29.2	0	
A458	9:44	<0.1	10.2	9.8	25.5	0	
A459	14:32	<0.1	0.1	20.6	31.0	0	
A460	13:38	<0.1	5.3	17.4	25.3	0	
A461	13:41	<0.1	2.7	19.4	26.4	0	
DH403	13:49	0.1	4.7	17.0	28.0	0	
DH405	13:35	<0.1	4.6	17.3	27.4	0	
DH407	14:03	<0.1	5.3	16.1	26.2	0	
DH408	14:06	<0.1	2.7	20.1	28.4	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 16-Apr-2021
Weather Condition: Cloudy
Equipment Used: **Landfill gas monitor GEM-5000**

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	13:54	<0.1	5.4	16.2	26.0	0	
A452	11:54	<0.1	3.0	18.3	23.5	0	
A453	11:50	<0.1	2.9	18.9	24.7	0	
A454	11:42	<0.1	15.8	6.6	26.6	0	
A455	14:09	<0.1	2.9	18.0	26.6	0	
A456	14:02	<0.1	0.7	20.4	25.6	0	
A457A	13:29	<0.1	<0.1	13.1	27.1	0	
A458	13:40	<0.1	4.6	16.1	26.7	0	
A459	14:21	<0.1	0.3	20.9	26.4	0	
A460	11:34	<0.1	4.5	18.0	24.5	0	
A461	11:38	<0.1	2.7	19.5	24.7	0	
DH403	11:45	<0.1	1.6	20.0	24.0	0	
DH405	11:27	<0.1	4.3	18.3	25.2	0	
DH407	14:04	<0.1	5.4	15.0	24.9	0	
DH408	13:59	<0.1	0.7	20.3	26.0	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 18-May-2021, 20-May-2021
Weather Condition: Sunny , Sunny
Equipment Used: **Landfill gas monitor GEM-5000**

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	14:07	<0.1	4.8	16.5	33.0	0	
A452	13:58	<0.1	6.1	13.7	35.4	0	
A453	13:55	<0.1	3.9	16.9	33.6	0	
A454	13:46	<0.1	10.9	8.1	34.0	0	
A455	14:20	<0.1	4.4	15.9	37.1	0	
A456	14:02	<0.1	1.3	19.5	33.2	0	
A457A	14:32	<0.1	<0.1	14.1	36.7	0	
A458	14:40	<0.1	9.1	11.6	34.2	0	
A459	14:44	<0.1	0.6	20.7	34.5	0	
A460	13:40	<0.1	3.8	17.7	34.1	0	
A461	13:42	<0.1	3.7	17.7	33.9	0	
DH403	13:51	<0.1	8.2	12.9	35.0	0	
DH405	13:36	<0.1	4.2	17.5	33.2	0	
DH407	14:15	<0.1	5.1	15.3	33.3	0	
DH408	14:11	<0.1	1.3	20.2	36.6	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 18-Jun-2021
Weather Condition: Fine
Equipment Used: **Landfill gas monitor GEM-5000**

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	13:49	<0.1	6.1	14.4	33.9	0	
A452	13:53	<0.1	6.4	12.8	35.2	0	
A453	13:57	<0.1	4.2	15.9	34.5	0	
A454	14:05	<0.1	13.9	2.2	35.6	0	
A455	13:44	<0.1	4.4	15.5	35.2	0	
A456	13:38	<0.1	3.5	17.3	30.9	0	
A457A	14:30	<0.1	<0.1	12.9	37.0	0	
A458	14:39	<0.1	2.5	17.7	35.5	0	
A459	14:41	<0.1	1.1	18.6	38.8	0	
A460	14:10	<0.1	3.5	16.2	35.3	0	
A461	14:12	<0.1	4.2	15.2	35.3	0	
DH403	14:00	<0.1	10.2	9.7	34.2	0	
DH405	14:07	<0.1	4.3	16.1	37.3	0	
DH407	13:36	<0.1	5.9	14.3	32.5	0	
DH408	13:40	<0.1	1.3	19.1	34.6	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 16-Jul-2021
Weather Condition: Cloudy
Equipment Used: Landfill gas monitor GEM-5000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	10:51	<0.1	5.1	15.3	29.7	0	
A452	10:47	<0.1	2.9	17.3	29.3	0	
A453	10:41	<0.1	3.0	17.7	30.0	0	
A454	10:33	<0.1	13.5	0.3	30.7	0	
A455	11:03	<0.1	0.2	20.2	29.1	0	
A456	10:57	<0.1	1.5	19.1	28.0	0	
A457A	10:04	<0.1	<0.1	11.3	29.8	0	
A458	10:15	<0.1	9.1	12.2	30.6	0	
A459	10:19	<0.1	1.8	18.8	31.7	0	
A460	10:26	<0.1	3.6	15.6	29.3	0	
A461	10:29	<0.1	3.2	15.8	28.4	0	
DH403	10:36	<0.1	6.8	13.4	28.9	0	
DH405	10:23	<0.1	1.2	19.3	30.2	0	
DH407	10:59	<0.1	2.1	18.5	27.2	0	
DH408	10:55	<0.1	0.1	20.2	29.6	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 13-Aug-2021
Weather Condition: Cloudy
Equipment Used: Landfill gas monitor GEM-5000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	14:51	<0.1	9.2	10.6	28.2	0	
A452	14:36	<0.1	6.6	11.7	27.6	0	
A453	14:30	<0.1	4.7	15.4	28.5	0	
A454	14:16	<0.1	6.1	8.3	29.9	0	
A455	15:08	<0.1	10.3	9.0	29.2	0	
A456	14:58	<0.1	5.5	13.9	28.3	0	
A457A	15:22	<0.1	<0.1	11.0	31.4	0	
A458	13:51	<0.1	9.8	12.1	31.9	0	
A459	13:56	<0.1	1.6	18.3	30.2	0	
A460	14:08	<0.1	2.4	16.4	30.0	0	
A461	14:11	<0.1	6.5	8.5	29.8	0	
DH403	14:22	<0.1	12.2	8.1	27.9	0	
DH405	14:05	<0.1	6.4	14.4	30.4	0	
DH407	14:54	<0.1	6.5	13.3	27.8	0	
DH408	15:01	<0.1	6.0	13.6	29.8	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 27-Sep-2021
Weather Condition: Fine
Equipment Used: Landfill gas monitor GEM-5000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	14:20	<0.1	7.4	11.4	28.8	0	
A452	14:17	<0.1	4.1	16.1	30.6	0	
A453	14:11	<0.1	4.3	16.1	30.5	0	
A454	14:01	<0.1	12.7	0.7	34.8	0	
A455	14:33	<0.1	8.7	11.2	29.4	0	
A456	14:26	<0.1	5.5	14.8	29.7	0	
A457A	14:48	<0.1	<0.1	9.3	36.0	0	
A458	13:42	<0.1	5.7	15.1	34.4	0	
A459	13:44	<0.1	1.8	18.3	33.3	0	
A460	13:52	<0.1	5.0	10.8	30.1	0	
A461	13:56	<0.1	5.8	11.7	30.3	0	
DH403	14:05	<0.1	9.1	10.6	30.2	0	
DH405	13:50	<0.1	7.2	14.1	33.2	0	
DH407	14:28	<0.1	6.4	13.4	29.1	0	
DH408	14:24	<0.1	3.2	16.9	32.1	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 27-Oct-2021
Weather Condition: Cloudy
Equipment Used: Landfill gas monitor GEM-5000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	13:59	<0.1	3.0	16.6	25.5	0	
A452	13:56	<0.1	4.2	16.1	25.2	0	
A453	13:52	<0.1	2.5	18.6	26.0	0	
A454	13:46	<0.1	8.0	11.8	29.0	0	
A455	14:13	<0.1	6.1	13.3	25.9	0	
A456	14:05	<0.1	2.4	18.6	25.2	0	
A457A	14:46	<0.1	<0.1	13.8	28.8	0	
A458	14:34	<0.1	1.4	19.1	29.4	0	
A459	14:37	<0.1	1.6	18.5	30.0	0	
A460	14:22	<0.1	3.5	13.9	26.9	0	
A461	14:25	<0.1	4.9	10.9	27.0	0	
DH403	13:49	<0.1	8.6	11.9	25.6	0	
DH405	14:20	<0.1	0.3	20.1	27.8	0	
DH407	14:02	<0.1	5.4	13.7	24.2	0	
DH408	14:07	<0.1	6.7	13.5	25.8	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 18-Nov-2021
Weather Condition: Sunny
Equipment Used: Landfill gas monitor GEM-5000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	14:38	<0.1	6.6	11.8	23.5	0	
A452	14:28	<0.1	10.8	9.8	23.9	0	
A453	14:21	<0.1	3.9	16.9	23.5	0	
A454	14:10	<0.1	16.8	0.6	27.6	0	
A455	14:54	0.2	10.2	9.3	24.5	0	
A456	14:46	<0.1	0.6	20.2	23.4	0	
A457A	14:03	<0.1	<0.1	10.6	29.9	0	
A458	13:49	<0.1	10.9	11.1	27.8	0	
A459	13:54	<0.1	2.1	18.1	30.4	0	
A460	13:37	<0.1	4.8	12.2	25.1	0	
A461	13:40	<0.1	7.3	12.1	24.2	0	
DH403	14:15	<0.1	3.5	17.3	24.1	0	
DH405	13:33	<0.1	3.1	18.1	26.3	0	
DH407	14:48	<0.1	7.5	9.7	22.4	0	
DH408	14:42	<0.1	6.9	13.9	27.5	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 16-Dec-2021
Weather Condition: Sunny
Equipment Used: Landfill gas monitor GEM-5000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure	Remark
A451	14:13	<0.1	1.4	18.8	25.0	0	
A452	14:09	<0.1	3.9	16.1	25.3	0	
A453	14:04	<0.1	2.5	18.1	24.9	0	
A454	13:55	<0.1	17.3	2.0	26.9	0	
A455	14:28	<0.1	0.1	20.4	24.6	0	
A456	14:20	<0.1	0.4	19.9	24.8	0	
A457A	14:47	<0.1	<0.1	11.7	29.4	0	
A458	14:35	<0.1	1.4	19.0	26.5	0	
A459	14:38	<0.1	0.8	19.7	29.6	0	
A460	13:48	<0.1	6.5	10.5	26.5	0	
A461	13:50	<0.1	4.9	16.2	26.4	0	
DH403	13:59	<0.1	0.2	20.2	25.7	0	
DH405	13:44	<0.1	2.4	18.8	27.1	0	
DH407	14:18	<0.1	7.2	10.3	24.2	0	
DH408	14:23	<0.1	5.9	15.1	29.1	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 20-Jan-2022
Weather Condition: Sunny
Equipment Used: Landfill gas monitor GEM-5000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	14:27	<0.1	1.1	19.6	19.2	0	
A452	14:23	<0.1	12.5	7.9	18.5	0	
A453	14:20	<0.1	2.1	18.9	20.5	0	
A454	14:12	<0.1	16.6	5.1	24.7	0	
A455	14:42	<0.1	2.8	17.9	20.1	0	
A456	14:34	<0.1	0.7	20.2	21.1	0	
A457A	14:05	<0.1	<0.1	12.4	27.3	0	
A458	13:52	<0.1	4.8	15.7	23.7	0	
A459	13:56	<0.1	1.9	19.0	26.7	0	
A460	13:39	<0.1	6.0	14.0	20.5	0	
A461	13:43	<0.1	5.5	16.3	20.7	0	
DH403	14:16	<0.1	9.3	12.0	21.1	0	
DH405	13:34	<0.1	4.7	16.7	23.2	0	
DH407	14:37	<0.1	7.3	10.3	19.4	0	
DH408	14:31	<0.1	3.7	17.5	24.1	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 18-Feb-2022
Weather Condition: Fine
Equipment Used: Landfill gas monitor GEM-5000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	14:07	<0.1	0.5	20.4	18.3	0	
A452	14:35	<0.1	5.4	15.2	19.0	0	
A453	14:42	<0.1	2.2	19.6	18.0	0	
A454	14:52	<0.1	16.0	7.5	21.7	0	
A455	14:23	<0.1	4.2	16.3	19.1	0	
A456	14:17	<0.1	0.7	20.2	19.2	0	
A457A	15:16	<0.1	<0.1	13.6	23.6	0	
A458	15:29	<0.1	7.1	13.4	20.1	0	
A459	15:24	<0.1	0.7	20.6	22.5	0	
A460	15:02	<0.1	4.6	16.8	18.6	0	
A461	15:06	<0.1	5.2	17.0	17.6	0	
DH403	14:44	<0.1	7.8	13.4	17.7	0	
DH405	14:57	<0.1	4.6	17.1	19.8	0	
DH407	14:19	<0.1	7.0	11.6	18.3	0	
DH408	14:11	<0.1	5.2	16.4	21.8	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 17-Mar-2022
Weather Condition: Cloudy
Equipment Used: Landfill gas monitor GEM-5000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	14:09	<0.1	6.6	14.2	25.9	0	
A452	14:29	<0.1	8.0	11.2	26.1	0	
A453	14:33	<0.1	2.7	18.5	26.4	0	
A454	14:04	<0.1	11.0	4.3	27.4	0	
A455	14:22	<0.1	3.1	17.3	27.8	0	
A456	14:16	<0.1	4.2	16.5	27.5	0	
A457A	13:57	<0.1	<0.1	14.0	29.0	0	
A458	13:41	<0.1	5.8	14.7	29.4	0	
A459	13:45	<0.1	1.2	19.1	30.0	0	
A460	13:32	<0.1	4.4	16.0	26.6	0	
A461	13:35	<0.1	3.1	17.0	26.9	0	
DH403	14:36	<0.1	2.0	19.1	26.0	0	
DH405	13:30	<0.1	4.9	16.2	28.9	0	
DH407	14:18	<0.1	6.2	12.6	25.7	0	
DH408	14:13	<0.1	2.0	18.9	28.2	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 14-Apr-2022
Weather Condition: Sunny
Equipment Used: Landfill gas monitor GEM-5000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	11:48	<0.1	1.8	18.7	26.9	0	
A452	11:46	<0.1	0.6	19.5	26.0	0	
A453	12:06	<0.1	2.5	18.3	28.6	0	
A454	12:13	<0.1	10.6	1.9	30.3	0	
A455	11:59	<0.1	2.3	18.2	27.2	0	
A456	11:54	<0.1	2.6	18.2	29.2	0	
A457A	11:38	<0.1	<0.1	13.1	31.3	0	
A458	11:26	<0.1	2.1	18.5	30.7	0	
A459	11:29	<0.1	1.5	18.7	30.6	0	
A460	12:21	<0.1	3.6	15.7	28.2	0	
A461	12:23	<0.1	3.3	16.0	28.3	0	
DH403	12:10	<0.1	2.0	18.6	28.7	0	
DH405	12:18	<0.1	4.1	16.8	30.5	0	
DH407	11:57	<0.1	0.8	19.6	26.4	0	
DH408	11:52	<0.1	3.3	17.2	30.2	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 20-May-2022
Weather Condition: Sunny
Equipment Used: Landfill gas monitor GEM-5000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	14:31	<0.1	8.2	10.6	30.1	0	
A452	14:20	<0.1	4.0	13.2	30.7	0	
A453	14:14	<0.1	4.3	15.7	31.0	0	
A454	11:55	<0.1	5.2	9.2	29.7	0	
A455	14:46	<0.1	0.4	19.6	31.8	0	
A456	14:36	<0.1	4.8	14.7	29.4	0	
A457A	15:11	<0.1	<0.1	13.1	35.7	0	
A458	14:59	<0.1	0.9	19.1	35.3	0	
A459	14:55	<0.1	1.3	18.2	36.2	0	
A460	14:10	<0.1	2.7	16.2	31.1	0	
A461	11:51	<0.1	4.9	11.2	28.8	0	
DH403	11:59	<0.1	9.5	9.3	29.8	0	
DH405	11:46	<0.1	3.8	17.1	28.9	0	
DH407	14:38	<0.1	6.4	11.8	27.2	0	
DH408	14:33	<0.1	3.8	16.1	31.4	0	

LANDFILL GAS MONITORING - FIELD MEASUREMENT

Name of Site : Ngau Tam Mei
Date of Monitoring: 10-Jun-2022
Weather Condition: Cloudy
Equipment Used: Landfill gas monitor GEM-5000

Well No.	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Temperature (°C)	Relative Pressure (mbar)	Remark
A451	15:06	<0.1	6.0	13.4	26.1	0	
A452	15:03	<0.1	4.8	8.0	27.8	0	
A453	14:59	<0.1	4.9	14.6	28.3	0	
A454	14:48	<0.1	6.5	2.5	29.6	0	
A455	15:19	<0.1	4.7	13.7	28.3	0	
A456	15:12	<0.1	3.7	16.5	26.4	0	
A457A	14:32	<0.1	<0.1	12.9	29.2	0	
A458	14:39	<0.1	1.3	19.2	30.4	0	
A459	14:44	<0.1	0.7	19.7	30.9	0	
A460	15:33	<0.1	1.5	18.0	27.6	0	
A461	15:35	<0.1	4.6	9.2	27.3	0	
DH403	14:54	<0.1	12.4	6.6	29.8	0	
DH405	15:26	<0.1	8.0	12.8	29.2	0	
DH407	15:10	<0.1	5.9	12.9	26.3	0	
DH408	15:15	<0.1	5.8	13.4	27.0	0	

S12A AMENDMENT OF PLAN APPLICATION
APPROVED NGAU TAM MEI
OUTLINE ZONING PLAN NO. S/YL-NTM/12

PROPOSED REZONING FROM "R(C)" TO "G/IC"
FOR A PROPOSED "SOCIAL WELFARE FACILITIES"
(RESIDENTIAL CARE HOMES FOR THE ELDERLY)
(RCHE)

AT LOT 4823 IN D.D.104, 81 SAN TAM ROAD,
SAN TIN, N.T.

APPENDIX C

"HAZARDS ARISING DURING CONSTRUCTION"
EXTRACTED FROM EDP'S LANFILL GAS HAZARD
ASSESSMENT GUIDANCE NOTE

8 *HAZARDS ARISING DURING CONSTRUCTION*

Introduction

8.1 During the construction phase, hazards may arise which are related either to the flammability of landfill gas or to it's potentially asphyxiating properties. In particular cases, it is possible that toxicity effects may be significant. The following sub-sections of the Guidance Note may be used to form the basis of Specification Clauses for incorporation in Contract Documentation for developments within the Consultation Zone.

General Hazards Which May Be Encountered

8.2 The developer should be aware of, and should inform construction contractors accordingly, that methane and carbon dioxide are always likely to be present in the soil voids. In addition the developer should be aware of the potential hazards and other properties of landfill gas as described in Section 1.

Outline of Safety Requirements

8.3 In all construction work adjacent to landfill sites, safety procedures should be implemented to minimise the risks of:

- fires and explosions;
- asphyxiation of workers; and
- toxicity effects.

8.4 Precautions should be clearly laid down and rigidly adhered to with respect to:

- trenching and excavation; and

- creation of confined spaces at, near to or below ground level.

8.5 In addition to normal site safety procedures, gas detection equipment and appropriate breathing apparatus should be available and used when entering confined spaces or trenches deeper than 1 metre.

Additional General Requirements

8.6 During the construction phase, the following additional precautions should be followed.

Appointment of Safety Officer

8.7 For large developments, a Safety Officer, trained in the use of gas detection equipment and landfill gas-related hazards, should be present on site throughout the groundworks phase. The Safety Officer should be provided with an intrinsically safe portable instrument (or instruments), appropriately calibrated and capable of measuring the following gases in the ranges indicated:

methane	0-100% LEL and 0-100 % v/v
carbon dioxide	0-100%; and
oxygen	0-21%

8.8 For smaller developments, if a Safety Officer is not appointed, then expert opinion and advice should be sought on a regular basis.

Safety Measures

8.9 All personnel who work on site and all visitors to the site should be made aware of the possibility of ignition of gas in the vicinity of excavations. Safety notices should be posted warning of the potential hazards.

8.10 Those staff who work in, or have responsibility for 'at risk' areas, including all excavation workers, supervisors and engineers working within the Consultation Zone, should receive appropriate training on working in areas susceptible to landfill gas, fire and explosion hazards.

8.11 An excavation procedure or code of practice to minimise landfill gas related risk should be devised and carried out by the project proponent.

8.12 No worker should be allowed to work alone at any time in or near to any excavation. At least one other worker should be available to assist with a rescue if needed.

8.13 Smoking, naked flames and all other sources of ignition should be prohibited within 15m of any excavation or ground-level confined space. 'No smoking' and 'No naked flame' notices should be posted prominently on the construction site and, if necessary, special areas designated for smoking.

8.14 Welding, flame-cutting or other hot works should be confined to open areas at least 15m from any trench or excavation.

8.15 Welding, flame-cutting or other hot works may only be carried out in trenches or confined spaces when controlled by a 'permit to work' procedure, properly authorised by the Safety Officer (or, in the case of small developments, other appropriately qualified person).

8.16 The permit to work procedure should set down clearly the requirements for continuous monitoring for methane, carbon dioxide and oxygen throughout the period during which the hot works are in progress. The procedure should also require the presence of an appropriately qualified person, in attendance outside the 'confined area', who shall be responsible for reviewing the gas measurements as they are made, and who shall have executive responsibility for suspending the work in the event of unacceptable or hazardous conditions. Only those workers who are appropriately trained and fully aware of the potentially hazardous conditions which may arise should be permitted to carry out hot works in confined areas.

8.17 Ground level construction plant should be fitted with vertical exhausts at least 0.6m above ground level and with spark arrestors.

8.18 Any electrical equipment, such as motors and extension cords, should be intrinsically safe.

8.19 During piping assembly or conduiting construction, all valves/seals should be closed immediately after installation. As construction progresses, all valves/seals should be closed as installed to prevent the migration of gases through the pipeline/conduit. All

piping/conduiting should be capped at the end of each working day.

8.20 Mobile offices, equipment stores, mess rooms etc. should be located on an area which has been proven to be gas free (by survey with portable gas detectors) and ongoing monitoring should be carried out to ensure that these areas remain gas free. The use of permanent gas detectors may be appropriate in some circumstances where there is a relatively high risk but for many developments it will be sufficient to have regular monitoring undertaken manually by the safety officer. The particular arrangements to be adopted at a specific site will need to be determined during the risk assessment/design of protection measures.

8.21 Alternatively, such buildings should be raised clear of the ground. If buildings are raised clear of the ground, a minimum, clear separation distance (as measured from the highest point on the ground surface to the underside of the lowest floor joist) should be 500mm.

8.22 During construction, adequate fire extinguishing equipment, fire-resistant clothing and breathing apparatus (BA) sets should be made available on site.

- At larger developments, fire drills should be organised at not less than six monthly intervals.

- The developer should formulate a health and safety policy, standards and instructions for site personnel to follow.

Monitoring

8.23 Periodically during ground-works construction, the works area should be monitored for methane, carbon dioxide and oxygen using appropriately calibrated portable gas detection equipment.

8.24 The monitoring frequency and areas to be monitored should be set down prior to commencement of ground-works either by the Safety Officer or by an appropriately qualified person.

8.25 Routine monitoring should be carried out in all excavations, manholes and chambers and any other confined spaces that may have been created by, for example, the temporary storage of building materials on the site surface.

8.26 All measurements in excavations should be made with the monitoring tube located not more than 10mm from the exposed ground surface.

8.27 Monitoring of excavations should be undertaken as follows:

For excavations deeper than 1m, measurements should be made:

- at the ground surface before excavation commences;
- immediately before any worker enters the excavation;
- at the beginning of each working day for the entire period the excavation remains open; and
- periodically through the working day whilst workers are in the excavation.

For excavations between 300mm and 1m deep, measurements should be made:

- directly after the excavation has been completed; and
- periodically whilst the excavation remains open.

For excavations less than 300mm deep, monitoring may be omitted, at the discretion of the Safety Officer or other appropriately qualified person.

Actions in the Event of Gas Being Detected

8.28 Depending on the results of the measurements, actions required will vary and should be set down by the Safety Officer or other appropriately qualified person. As a minimum these should encompass those actions specified in *Table 8.1*.

Table 8.1 Actions in the Event of Gas Being Detected in Excavations

Parameter	Measurement	Action
O_2	< 19%	Ventilate trench/void to restore O_2 to >19%

Parameter	Measurement	Action
	< 18%	Stop works evacuate personnel/prohibit entry increase ventilation to restore O_2 to >19%
CH_4	> 10% LEL	Post 'No Smoking' signs prohibit hot works ventilate to restore CH_4 to <10% LEL
	>20% LEL	Stop works evacuate personnel/prohibit entry increase ventilation to restore CH_4 to <10% LEL
CO_2	>0.5%	ventilate to restore CO_2 to <0.5%
	> 1.5%	Stop works evacuate personnel/prohibit entry increase ventilation to restore CO_2 to <0.5%

Specific Advice Relating to the Drilling of Boreholes

8.29 As part of the site investigation and subsequent ground works for a development within a Consultation Zone, it will often be necessary to drill exploratory boreholes. Such work should be undertaken following the general advice given above. Specific recommendations relating to the drilling of boreholes within the Consultation Zone are presented below.

Supervision and Safety Management of Drilling Operations

8.30 Drilling should only proceed with adequate care and precautions against the potential hazards which may be encountered.

8.31 Before site works begin, the drilling contractor should devise a 'method-of-working' statement covering all normal and emergency procedures and the site supervisor and all operatives must be familiar with this statement.

8.32 The method-of-working statement should cover, *inter alia*:

- number of operatives;
- experience and special skills of operatives;

- normal method of operations;
- emergency procedures, including fire fighting;
- supervisors responsibilities;
- storage and use of safety equipment;
- safety procedures; and
- signs, barriers and guarding.

Safety Equipment and Clothing

8.33 An intrinsically safe, portable methane meter should be available at all times.

Other safety equipment should include:

- no smoking signs, to be placed prominently adjacent to the drilling area;
- portable fire extinguisher;
- high visibility clothing to be worn by all drilling operatives; and
- additional protective clothing should include stout industrial boots (with steel toe cap and insole), plastic hard hats, heavy duty waterproof industrial groves.

Working Procedures

8.34 On arrival at site the drilling rig should be set-up up-wind of the borehole location, 'No smoking' signs set out and the working area should be roped or coned-off.

8.35 When drilling on landfill sites, all spoil obtained from the borehole should be stockpiled alongside the borehole and disposed of (to an appropriately licensed disposal site) at the end of the working day. At the end of the working day all vehicles, the drilling rig and any hand tools should be hosed-down with clean water to remove deposits of excavated spoil. Suitable guards or barriers should be placed around the excavation or borehole to prevent access by unauthorised persons.

Safety Procedures

8.36 One person should be present at all times during drilling operations, with the sole responsibility of assuring the observance of all safety procedures. This person should be trained in the use of all recommended safety equipment.

8.37 Smoking should be prohibited anywhere on a landfill site and within 15 metres of a

boring or excavation at any locations within the Consultation Zone.

8.38 For large diameter boreholes, a working platform should be placed over the hole which will prevent accidental entry into the hole by operatives.

8.39 No worker should be allowed to work alone at any time near the edge of the well under construction. Another worker should always be present, beyond the area considered to be subject to the possible effects of landfill gas or cave-in.

8.40 Periodically during the well construction, the work areas should be monitored for levels of methane.

8.41 If the well construction is not completed by the end of the working day, the hole should be covered with a plate of sufficient overlap to prevent access to the hole and sufficient structural strength to support expected loads. The plate should be weighted down to discourage removal and, on landfill sites, the edges of the plate should be covered with sufficient depth of wet soil to prevent escape of gas.

8.42 All pipes or casings should be capped at the end of each working day.

8.43 Engine-driven rigs should have vertical exhaust stacks discharging not less than 1.5m above ground level and should have overspeed limits to prevent engine run away on ingested gas.

8.44 Diesel engine air-intakes should also be located not less than 1.5m above ground level.

8.45 Any electrical equipment should be intrinsically safe.

8.46 Additional safety advice and guidance may be found in 'Investigation into Establishing an Effective Practical Safe Working Practice When Drilling in Landfill Sites and Adjacent Areas and Contaminated Ground and Adjacent Areas' compiled by the British Drilling Association (1993).

Installation of Vertical Wells

8.47 To prevent uncontrolled gas release and to protect personnel from the risk of falling into the borehole, the open borehole should be covered with a sheet or plate strong enough to support personnel and having an overlap all round the borehole.

8.48 The drilling rig, boring machine or excavator should remain in place over the borehole and could be used as a support to assist placement of the casing.

8.49 The upper end of the well casing should be sealed, preferably with a fused or screwed end cap or alternatively with an inflatable bag type flow stopper, until the permanent headworks/monitoring tap is fitted. Landfill gas must not be allowed to vent freely at the site surface.

7 CONCLUSION

This Environmental Assessment presents the findings from assessing the potential impacts associated with the operation of the proposed RCHE development to confirm its environmental suitability. Key environmental concerns have been addressed and potential impacts assessed covering the following:

- Air Quality
- Noise
- Water Quality
- Waste Management
- Landfill Gas

Overall, it would be environmentally acceptable with no adverse impacts on the identified sensitive uses. Suitable noise mitigation measures are recommended to minimize noise impacts to meet the specified noise standard.

Air Quality

The development may be subject to vehicular emission impact from roads nearby during the operation of the project. However, no adverse vehicular emission impact is anticipated upon incorporation of the relevant buffer distance stipulated under the HKPSG into the layout design.

There is no chimney within 200m from site boundary, i.e., complying the buffer distance for chimney emissions under the HKPSG. Thus, no adverse air quality impact to the proposed residential development due to industrial chimney emissions is anticipated.

Noise

Road traffic would be the major source of noise nuisance during the Project operation. After implementation of recommended architectural fins, the predicted noise levels at all residential units comply with HKPSG $L_{10(1\ hour)}$ 70dB(A) noise criterion.

A catalogue of low noise type cooling towers as shown in Appendix 3.2 for reference. The Intake Silencers will be provided for the cooling towers located on open rooftop. The sound power level and noise mitigation requirements will be stipulated in the project contractor specification governing the equipment selection by the design and build contractor. Provided the fixed plant noise generation at the cooling tower does not exceed the allowable SWL, fixed plant noise impact towards the affected NSRs will not exceed the noise criteria stipulated in the HKPSG.

Water Quality

With a properly designed sewerage and drainage system, no insurmountable water quality impacts would be generated from the construction and operation phases of the Project.

Waste Management

The quantity of waste to be generated from the Project is anticipated not significant, considering the small project scale. Through proper project planning and execution, waste could be further avoided while useful materials could be reused or recycled. With implementation of the statutory procedures and recommended mitigation measures for offsite disposal of surplus excavated material, non-inert wastes, general refuse, chemical and clinical wastes, there should not be any insurmountable waste impact.

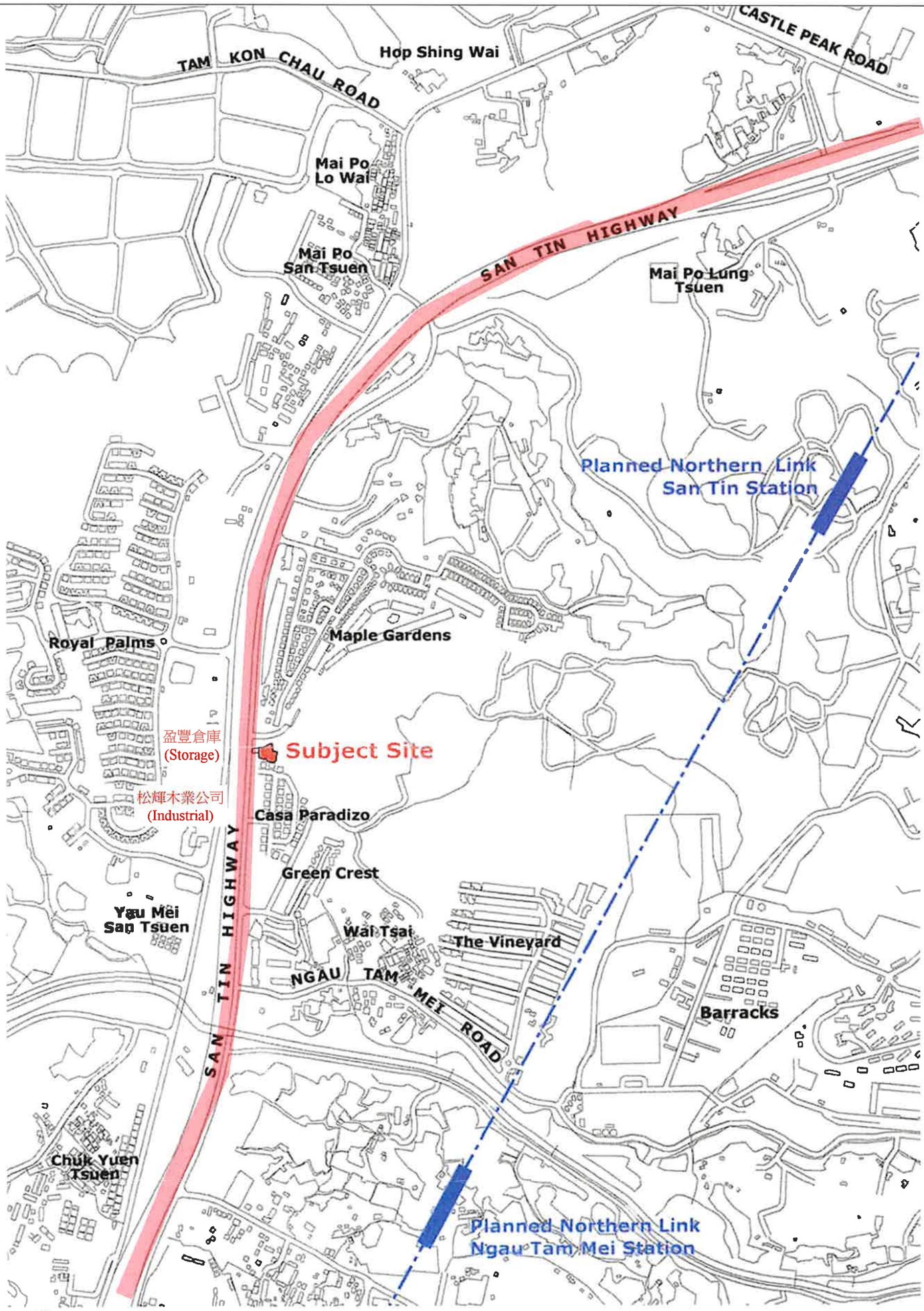
Landfill Gas

Since the proposed development will be located within the consultation zone of the Ngau Tam Mei Landfill, this Landfill Gas Hazard Assessment was undertaken to access the likelihood of LFG migration.

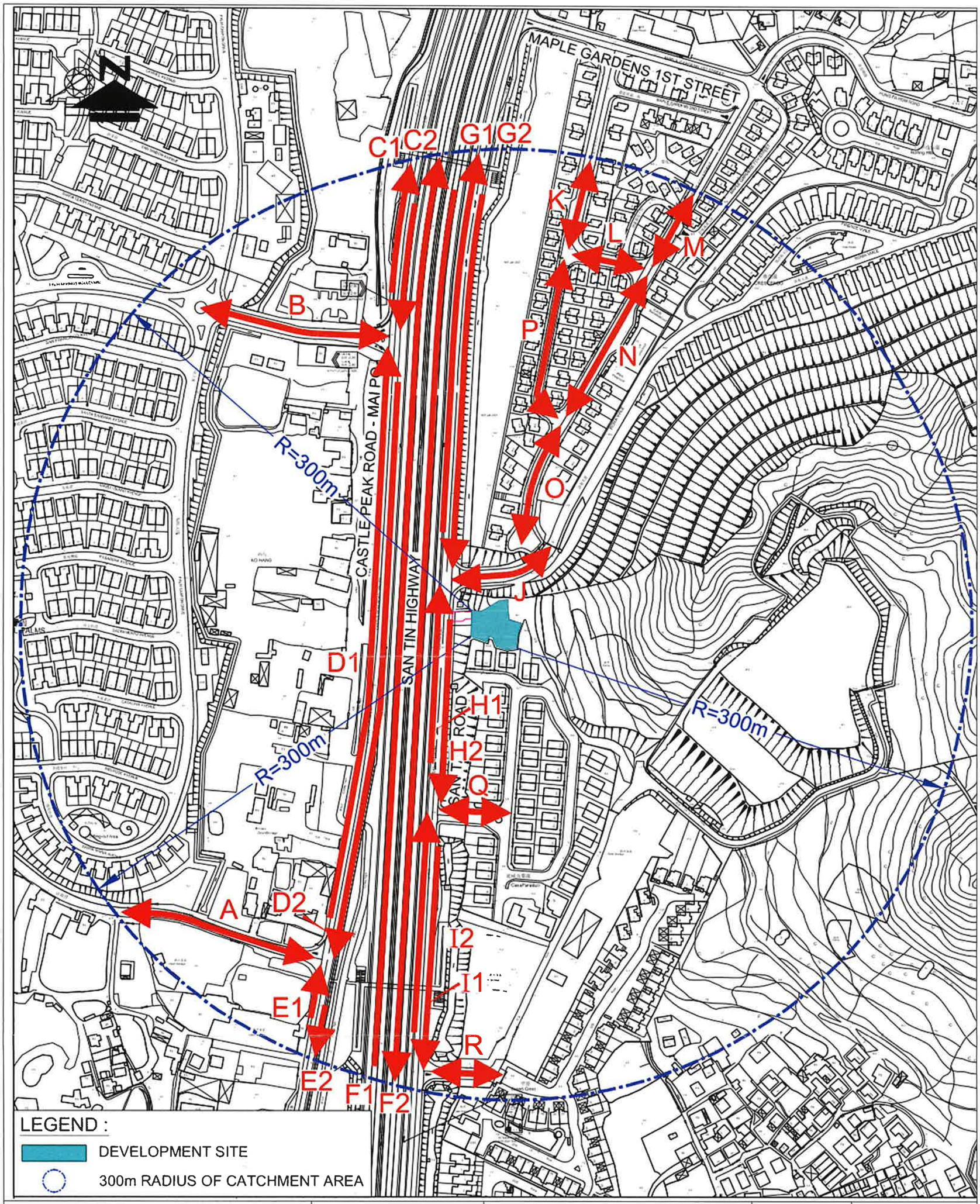
The results of landfill gas hazard assessment shows the overall level of landfill gas risk posed by the Ngau Tam Mei Landfill to the proposed development is "Low:.

Appropriate protection and precautionary measures including regular landfill gas monitoring during both the construction and operation of the project have been recommended. Provided that all the recommended protection measures with in monitoring are implemented properly, the safety of the site workers and all personnel presence in the proposed development would be safeguarded and there would be no adverse impact anticipated on the feasibility of the proposed development.

Appendix 1.1.
SITE LAYOUT PLAN & SURROUNDING ENVIRONMENT

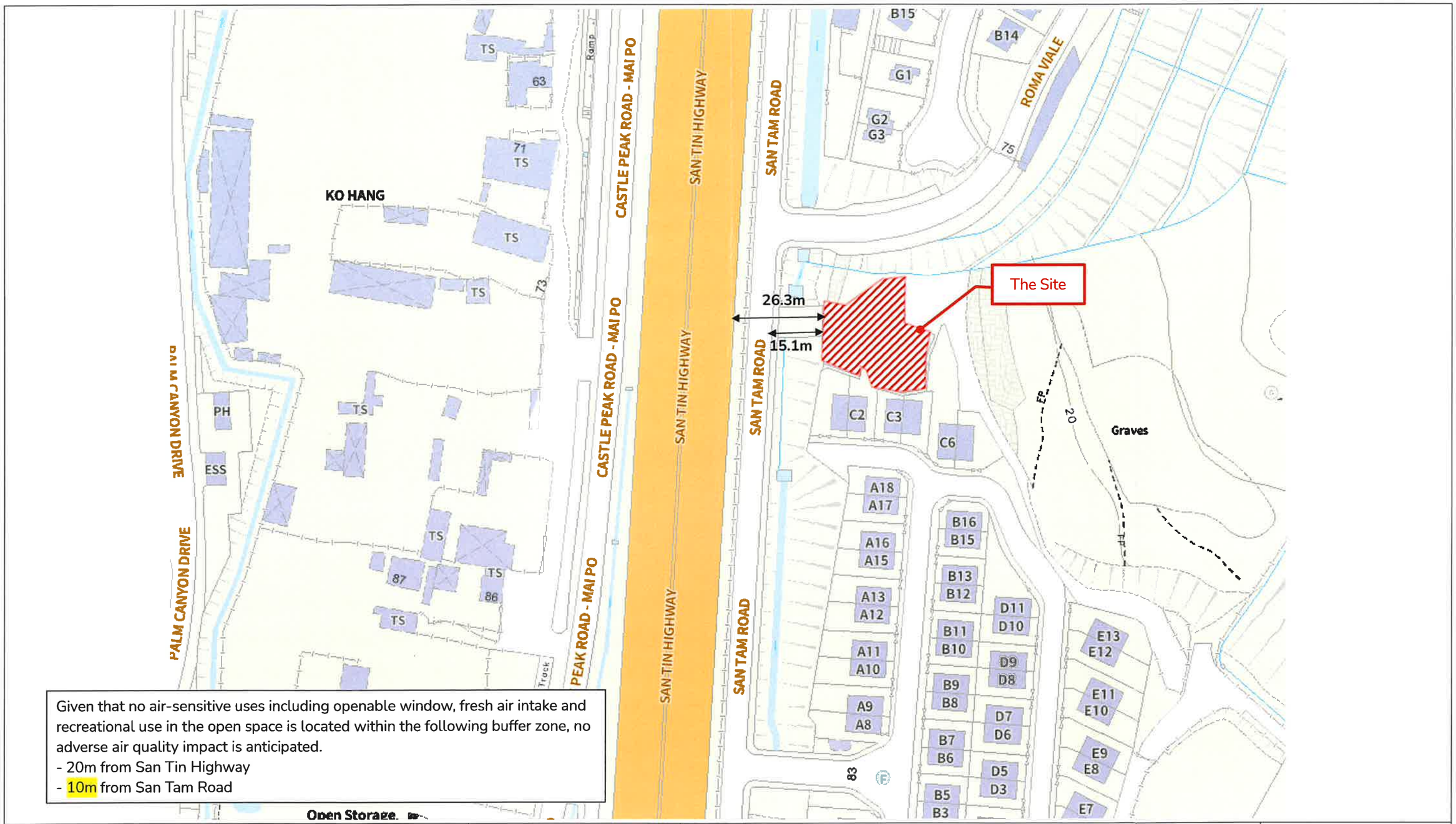


PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 1.1.1		LEAD ARCHITECT: R Lee Architects (HK) Ltd	PREPARED BY	Phoenix Lee
DRAWING TITLE: SITE LAYOUT PLAN AND SURROUNDING ENVIRONMENT	SCALE: N.T.S.	REV: A	ENVIRONMENTAL CONSULTANT: NOVOX	CHECKED BY	Eddy Ng
				APPROVED BY	Banting Wong



PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 1.1.2		LEAD ARCHITECT: R Lee Architects (HK) Ltd	PREPARED BY	Phoenix Lee
DRAWING TITLE: LOCATION OF ADJACENT ROADS	SCALE: N.T.S.	REV: A	ENVIRONMENTAL CONSULTANT: NOVOX	CHECKED BY	Eddy Ng
				APPROVED BY	Banting Wong

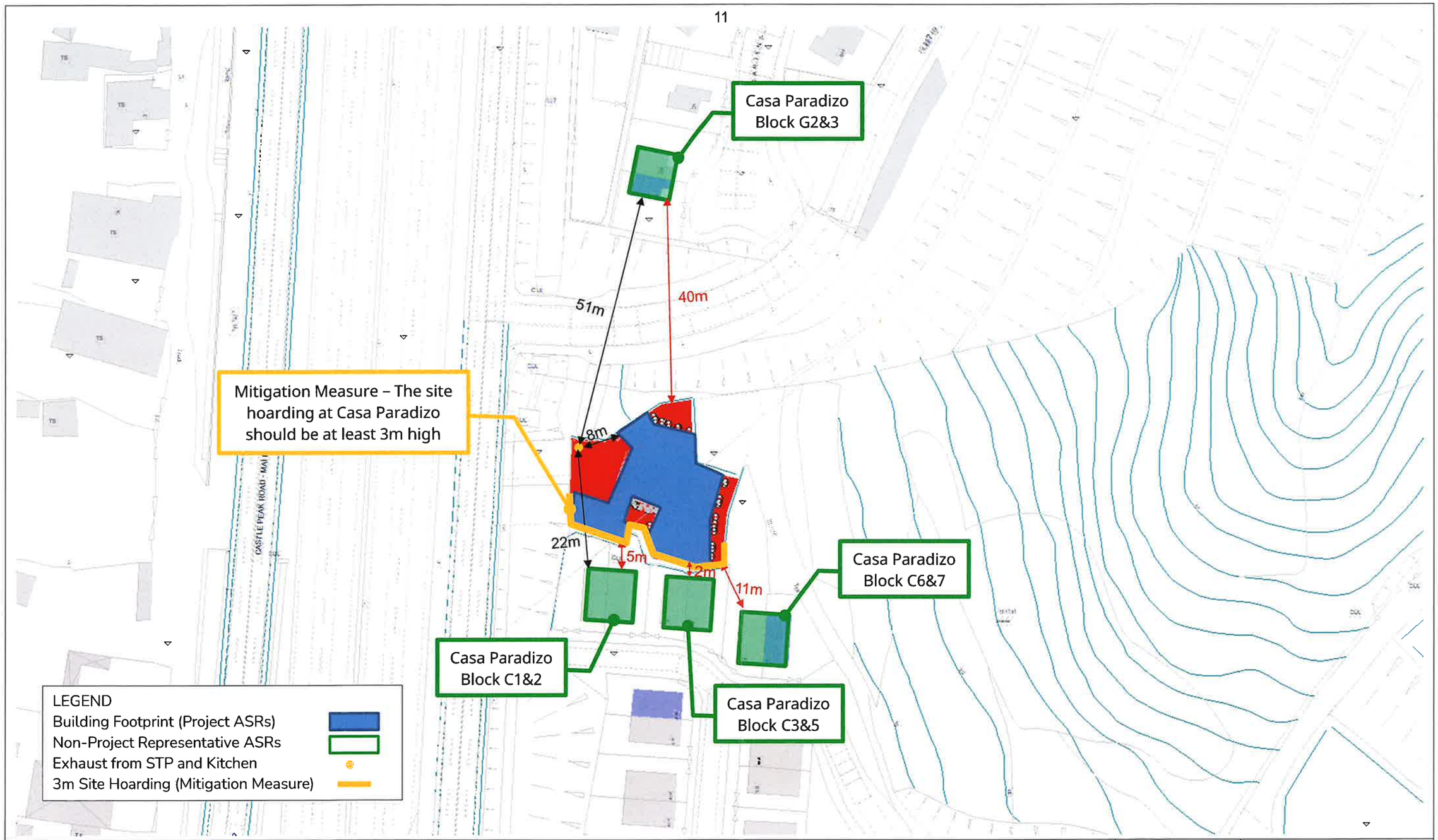
APPENDIX 2.1. AIR QUALITY SENSITIVE RECEIVERS & EMISSION SOURCES



Given that no air-sensitive uses including openable window, fresh air intake and recreational use in the open space is located within the following buffer zone, no adverse air quality impact is anticipated.
- 20m from San Tin Highway
- 10m from San Tam Road

PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 2.1.1		LEAD ARCHITECT:	ENVIRONMENTAL CONSULTANT:	PREPARED BY	Phoenix Lee
DRAWING TITLE: REPRESENTATIVE ASRS & BUFFER DISTANCE FROM VEHICLE SOURCES	SCALE: N.T.S.	REV: A			CHECKED BY	Eddy Ng
					APPROVED BY	Banting Wong

11



PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 2.1.2	LEAD ARCHITECT: R Lee Architects (HK) Ltd	PREPARED BY: Phoenix Lee
DRAWING TITLE: INDICATIVE LOCATION OF THE EXHAUST OF STP AND KITCHEN	SCALE: N.T.S. / REV: A	ENVIRONMENTAL CONSULTANT: Novox	CHECKED BY: Eddy Ng
			APPROVED BY: Banting Wong

APPENDIX 2.2. BROCHURE OF THE DEODRIZATION SYSTEM

Project : **Lot 4823, D.D. 104, 81 San Tam Road, San Tin, N. T.---**

STP For RCHE

Schedule of Equipment

Activated Carbon Filter

Description	Activated Carbon Filter
Branch	Rage
Country of origin	China
Material	Filter - Activity Carbon Filter Housing – Fiberglass Piping – uPVC
Capacity	180 m3/hr
Flange Diameter	150 mm
Pipe Diameter	150 mm
Accessories	Dehumidifier Hydrogen Sulphide Transmitter and Detector Humidity Transmitter Pressure Indicator Local Control panel Extraction Fan w/ Motor

Project : **Lot 4823, D.D. 104, 81 San Tam Road, San Tin, N. T.---**

STP For RCHE

The design air flow is according to Technical Schedule of tender specification to specify air flow rate (min. 180m3/hr). The flow rate of provided air fan and accessories, please refer to Attachment – catalogue 12 in item of HF-121B (for Fan) and catalogue 6 in item of Process Air (for Dehumidifier).

a) Calculation for Air Volume.

Tank area : 3.5 x 4.1m = 14.35 m2

Tank Depth : 3.05m

Water Depth of Pump Stop : 0.6m

Times of Air change : 5 times /hr

Tank max. air volume in sewage pump sump : (3.05 – 0.6)m x 14.35m2 = 35.15m3

Total Air Flow : 35.15 x 5 = 175.8m3/hr (take 180m3/hr)

b) Activated Carbon Filter contact time.

Design contact time : ≥ 2 sec.

Provided volume of activated carbon : 0.17 m3 (Refer to Attachment – Applicable Specification 1)

Air flow : 180 m3/hr (0.05 m3/sec)

Contact time : $\frac{0.17m3}{0.05m3/sec}$

= 3.4 sec. > 2 sec. (OK)

c) Calculation for Vent Duct Size.

Air duct area : Total air flow (m3/s) ÷ Velocity(m/s)

Take Velocity : 6m/s

Min. requirement Area for Vent Duct : 180m3/hr ÷ 6m/s = 0.0081m2

Adopted 0.15m x 0.15m duct = 0.0225m2 > 0.0081m2 , OK

Check air velocity passing through vent duct : $\frac{180\ m3/hr \div 3600s/hr}{0.0225m2}$ = 2.22m/s > 2 sec.(OK)

Therefore, the deodorizing adsorption system will have minimum odour removal efficiency of 99.5% at 5ppm H_2S concentration.

Above calculation is base on 1-year operation. A Storage of activated Carbon is standby to replace. The activated Carbon in the filter will be replaced if the gas detector find the odour release is beyond the calculation.

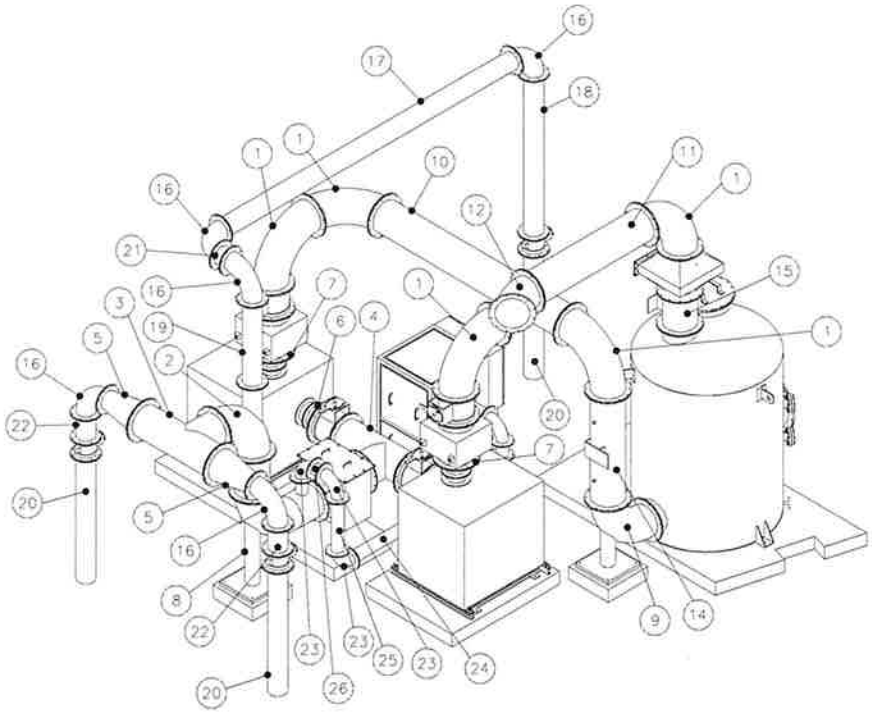
Hydrogen sulphide by volume. With reference to the EPD website, the 1 odour unit is 0.00047 ppm by volume. 5 OU is equivalent to 0.00235 ppm.

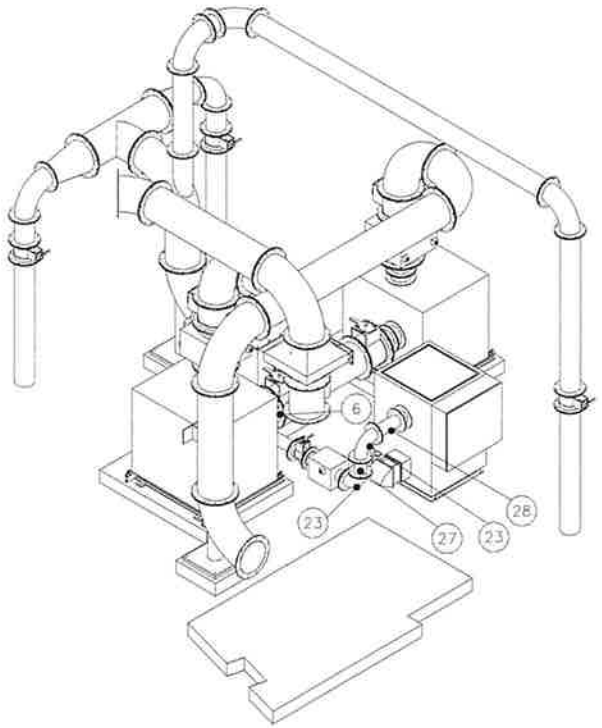
As such, 5ppm is equal to 5/0.00047 = 10638 OU. It is reasonable to assume that the small size on-site STP would not generate the odour unit higher than 5ppm.

The Applicant will ensure that the performance of the deodorizer can achieve the target odour removal efficiency of 99.5% at all time.

Equipment/ Material List of Deodorization Activated Carbon Adsorption Filter

Item	Description	Quantity
A	GRP air ductwork	
B	Flexible joint	
C	Flow switch for air duct	2 nos.
D	Diff pressure gage for pre-filter, after filter and carbon media	3 nos.
E	Electrochemical cell type H_2S detector in IP 65 enclosure	2 nos.
F	RH sensor	1 no
G	SS mist eliminator in SS house	1 no
H	Pre-filter in SS house	1 no
I	After filter in SS house	1 no
J	GRP Non-return damper	1 no
K	GRP Volume control damper	1 no
L	Extraction fan c/w acoustic enclosure	2 nos
M	Dehumidifier	1 no
N	Activated carbon filter Including GRP carbon vessel and activated carbon for initial fill up Local control panel with component	1 lot





註释：
1. 配件：管件数量如图示
2. 树脂：4183加阻燃
3. 表面：防UV树脂涂层，颜色RAL7032
4. 配件：除特别指明外，纤维管件厚度为
   直径 100 至 500 = 4毫米
5. 所有金属部份：S.S.316
6. 除特别指明外，所有尺寸均为毫米
7. 請與图號：MWPP2-PP-02
   MWPP2-PP-03
   MWPP2-PP-04 同時查看

图號：MWPP2-PP-01

REFERENCE PROJECT

Project : Proposed Development at Ma Wan Park Phase II, Ma Wan
(To be known as Ma Wan Lot No. 739, Ma Wan Village)

Equipment Schedule

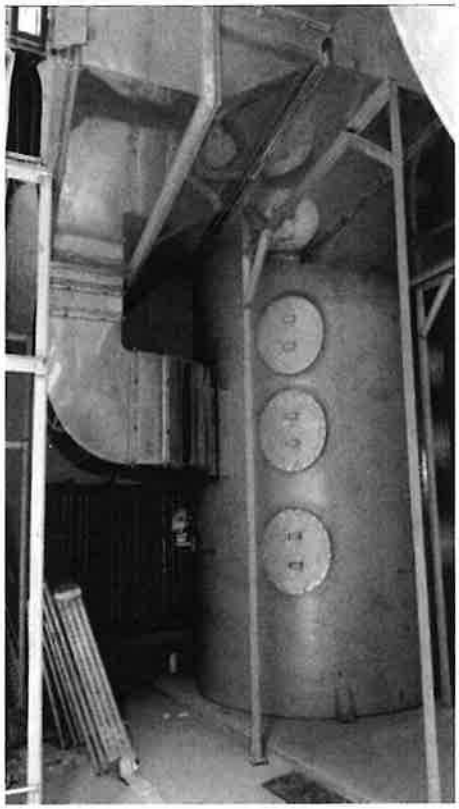
12. Deodorization System

Description	Deodorization System
Manufacturer	ECOLO
Supplier	ECOLO HK
Model	Rage
Country of origin	China
Catalog Reference	Attached
Job Reference	Attached
Certificate	-
Material	Filter - Activity Carbon Filter Housing - Fiberglass
Capacity	1,500 m3 /hr
H2S concentration	5 ppm
H2S removal efficiency	≧99.5% efficiency at 5ppm conc.
Pipe Diameter	350 mm
Accessories	Dehumidifier Mist Eliminator Hydrogen Sulphide Transmitter and Detector Humidity Sensor and Transmitter Stainless Steel Local Control panel Extraction Fan w/ Motor Pre-filter and After-filter Differential Pressure Gauge Air Flow Switch Non-return damper and Volume control damper

Rage Activated carbon adsorption tower is designed for industrial and municipal odour control. Activated carbon is the most widely used media for pollutant adsorption in gas phase. The carbon pellet has a very porous structure with a high surface-to-volume ratio, and enables the odorous compounds being captured when the foul gases passing through the carbon bed through the duty extraction fan.

The adsorption tower can be a single bed or dual bed design depends on the air volume and made from Fiberglass Reinforced Plastic (FRP), steel or stainless steel as per the specification.

A single bed construction activated carbon filter system with cat ladder and working platform



A dual bed construction system with air duct connection

Two dual bed construction filter houses on a 12m length trailer delivered to site

A wide range of activated carbon manufactured from both bituminous coal and coconut shell and impregnated specific chemicals available for various odorous compound removal. Sometimes, beds of carbon with different chemical impregnated are packed in the single house for capture and chemically destroy different type of odourous composition. Typically, KOH or $KMNO_4$ for breaking down Hydrogen Sulphide. The disadvantage of the addition of caustics lowers the ignition temperature and shall be considered as hazardous, and higher production cost.

Recently, regenerate type activated carbon is available, which is unimpregnated carbon that regain some absorption capacity after washing. However, cost will be higher.

Benefits

- Simple in construction & maintenance
- Capable to handle a number of odourous gases.

Rage Engineered solutions for effective odor control.

Rage had been engaged for odor control solution since 70s, providing solution for a wide variety of processes. All system have been developed by our experienced engineering team specifically to meet the needs of our **environmental and industrial customers**.

Our extensive global experience and lessons learned are applied to our capabilities in:

- Design, equipment / accessories selection, planning
- Engineering
- Fabrication
- Existing installation upgrades
- After sales services

Rage ordering code shall be revised in the following ways as from October, 2014.

Activated carbon filter

TYPE	Materials	Capacity in m^3/h	Geometrical shape	No of bed	Type of carbon
ACF	**FRP** - Standard FRP		**C**- circular	**SB** – Single	**1** – One type
	XXX - To specify		**R**- rectangular or square	**DB** -Dual	**2** – Mixed type

Example of code : ACF-FRP-18000-R-DB-1 ; ACF-FRP-2500-C-SB-2

Biofilter

TYPE	Materials	Capacity in m^3/h	Geometrical shape	No of stage	No of pump	Type of pump
BIOF	**FRP** - Standard FRP		**C**- circular	**1-** One	**1-** One pump	**SUB** – Submersible
	XXX - To specify		**R**- rectangular or square		**2-** Two pumps	**NSU**- Non submersible

Example of code : BIOF-FRP-18000-R-1-2SUB ; BIOF-FRP-2500-C-1-2NSU

Biotrickling filter

TYPE	Materials	Capacity in m^3/h	Geometrical shape	No of stage	No of pump	Type of pump
BTF	**FRP** - Standard FRP		**C**- circular	**1-** One	**1-** One pump	**SUB** – Submersible
	XXX - To specify		**R**- rectangular or square	**2-** Two	**2-** Two pumps	**NSU**- Non submersible
					3- Three pumps	
					4- Four pumps	

Example of code : BTF-FRP-18000-R-1-2-SUB ; BTF-FRP-12500-C-2-4-NSU

Chemical scrubber

TYPE	Materials	Capacity in m^3/h	Geometrical shape	No of stage	No of pump	Type of pump
CSR	**FRP** - Standard FRP		**C**- circular	**1-** One	**1-** One pump	**SUB** – Submersible
	XXX - To specify		**R**- rectangular or square	**2-** Two	**2-** Two pumps	**NSU**- Non submersible
				3- Three	**3** Three pumps	
					4 Four pumps	
					5 Five pumps	
					6 Six pumps	

Example of code : CSR-FRP-18000-R-1-2-SUB ; CSR-FRP-12500-C-2-4-NSU

Sizing for the DO system at Ma Wan Park Phase 2

Date : 2021-12-13

Type of DO system : Activated Carbon Filter

1) **Carbon requirement**

Air volume : 0.417m^3/s (1,500m^3/h)

Air from dehumidifier 0.042m^3/s (150m^3/h)

Total air volume = 0.459m^3/s (1,650m^3/h)

Inlet H_2S concentration : 5ppm

Retention time : 3 seconds

Breakthrough period : 365 days

1.0ppm of H_2S eqv. to 1.3708mg/m^3

For 5ppm H_2S in 0.459m^3/s air stream, H_2S weight = 0.459 x 5 x 1.3708 = 3.146mg/s

Daily H_2S in weight in air stream = 0.272Kg/ day

H_2S in weight in air stream in 365 days = 99.28Kg or 99Kg

Absorption of H_2S by carbon = 150kg/ m^3

Carbon volume required for 365 days working period

= 99 / 150 = **0.66 m^3**

When based on 3 seconds retention time requirement

Carbon volume required : 0.459 x 3 = 1.377m^3

Carbon density : 530Kg/m3

Weight of carbon in the DO system : 1.377 x 530 = 730Kgs round up to **750Kgs (1.415m^3)**

2) **Carbon Tank**

Single bed Carbon tank shall be made. The tank is capable to carry 1.415m^3 carbon.

Carbon tank foot print size : (Ø1.5) = 1.767m^2 < available site area

Thickness of carbon bed (t): 0.8m

Overall size of carbon tank : **Ø1.5 x 2.2H m**

3) **Pressure drop across filter bed** (Air volume : 0.459m^3/s (1,650m^3/h))

Cross sectional area of filter bed : 1.767m^2

Air velocity per carbon bed (v) = 0.459 / 1.767 = **0.259 m/s** < 3m/s

Pressure Drop across filter bed = 10 x **t** x 923.2 $\mathbf{v}^{1.501}$ = 10 x **0.8** x 923.2 $(\mathbf{0.259})^{1.501}$

≈976Pa

A summary of Activated carbon filter system design

		Requirement	Design
1	**Activated carbon filter**		
	Air volume	1,500 m^3/h	0.416m^3/s
	Air volume from dehumidifier		150 m^3/h (0.042m^3/s)
	Total air volume in carbon filter		1,650 m^3/h (0.459m^3/s)
	Contact time	≧3 seconds	3 seconds
	Media - catalytic activated carbon		1.415 m^3
	Tank size		Ø1.5 x 2.2H m
	Net Weight of filter house		370Kg
	Operating weight		1,120Kg
	Configuration		Single bed / Circular
	Air volume per carbon bed		1,650 m^3/h (0.459m^3/s)
	Air velocity across carbon bed	<0.3m/s	0.259m/s
	DP across media		**976Pa**
2	**Pre Filter size**		600x600x50mm
	Air volume		0.459m^3/s
	Face velocity		1.275m/s
	DP across **Pre filter**		**50Pa**
2A	**Demister size**		600x 600x50mm
	DP across **Pre filter**		**70Pa**
3	**After Filter size**		600x600x50mm
	Air volume		0.459m^3/s
	Face velocity		1.275m/s
	DP across After filter		**60Pa**
	CARBON FILTER SYSTEM DP		**1, 156Pa**

Project：Proposed Development at Ma Wan Park Phase II, Ma Wan
(To be known as Ma Wan Lot No. 739, Ma Wan Village)

Equipment Schedule

12a. Activated carbon Filter

Manufacturer	Rage
Country of Origin	USA / China
Type	Activated carbon Filter
Code	ACF-FRP-1500-C-SB-1
Inlet air	1500m^3/h
Size (m)	1.5 x 2.2H
Housing Material	FRP
Geometrical shape of filter house	Circular
Media Volume	1.42 m^3
Media Load	750 Kg
Color	Signal Grey (RAL7004)
Media	Catalytic activated carbon

RAGE INC.
PLUMSTEADVILLE, PA 18949

Datasheet Carbon Media HCAT 4060_15

Description:

Catalytic activated carbons for H_2S treatment

Rage HCAT 4060 series of activated carbon is non-impregnated, activated carbons derived from coal or hardwood which is specially developed for the removal of Hydrogen Sulfide and Sulfur compounds from vapor streams. This series of products are well suited for use in sewage treatment plants and pumping stations where these compounds are typically found. Rage HCAT 4060 provides high H_2S absorption capacity but without the thermal risks associated with some chemically treated carbons.

Application

- **Hydrogen Sulfide removal**
- **VOCs absorption**
- **Odor Control**

TECHNICAL CHARACTERISTICS

Particulars	Test Standard	Value
Diameter	N/A	4.0 mm
CTC	ASTM D 3467- 2009	≧60%
Moisture	ASTM D 2867- 09	≦15%
Ash content	ASTM D 2866 11	≦16%
Iodine	ASTM D 4607- 2014	≧1000mg/g
Bulk density	ASTM D 2854- 09	530 ± 30g/l
Hardness	ASTM D 3802- 10	≧95%
H_2S absorption capacity	ASTM D6646 -2014	0.15 g/cc

Project：Proposed Development at Ma Wan Park Phase II, Ma Wan
(To be known as Ma Wan Lot No. 739, Ma Wan Village)

Equipment Schedule

12b. Activated Carbon

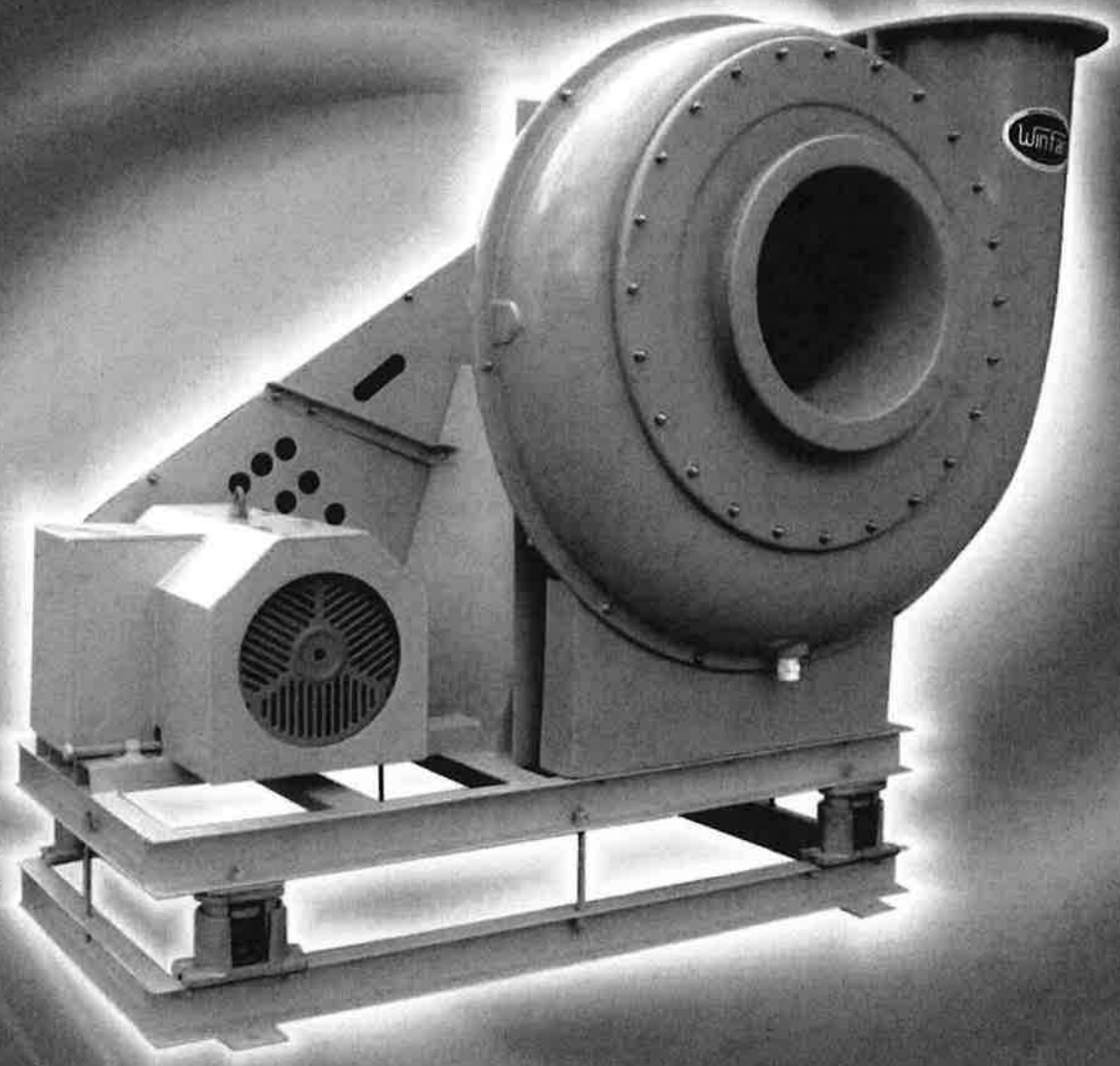
Manufacturer	Rage
Country of Origin	USA / China
Type	Catalytic activated carbon
Code	HCAT 4060_15
Nominal pellet diameter	4mm
CTC	≧60%
Moisture content	≦15%
Hardness	≧95%
Ash Content	≦16%
Iodine number	≧1000 mg/g
Bulk density	530 +/- 30 g/l
H2S adsorption capacity	≧0.15g/cc
Carbon weight for the system (Kgs)	750

BULLTIN:WF003
JANUARY,2007

頂裕工業專用送風機

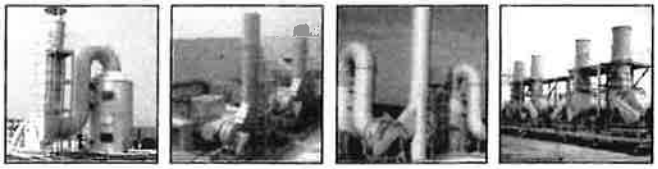
FRP 高壓系列

高性能・高效率・低震動・低噪音



蘇州頂裕風機科技有限公司

風機性能選用說明

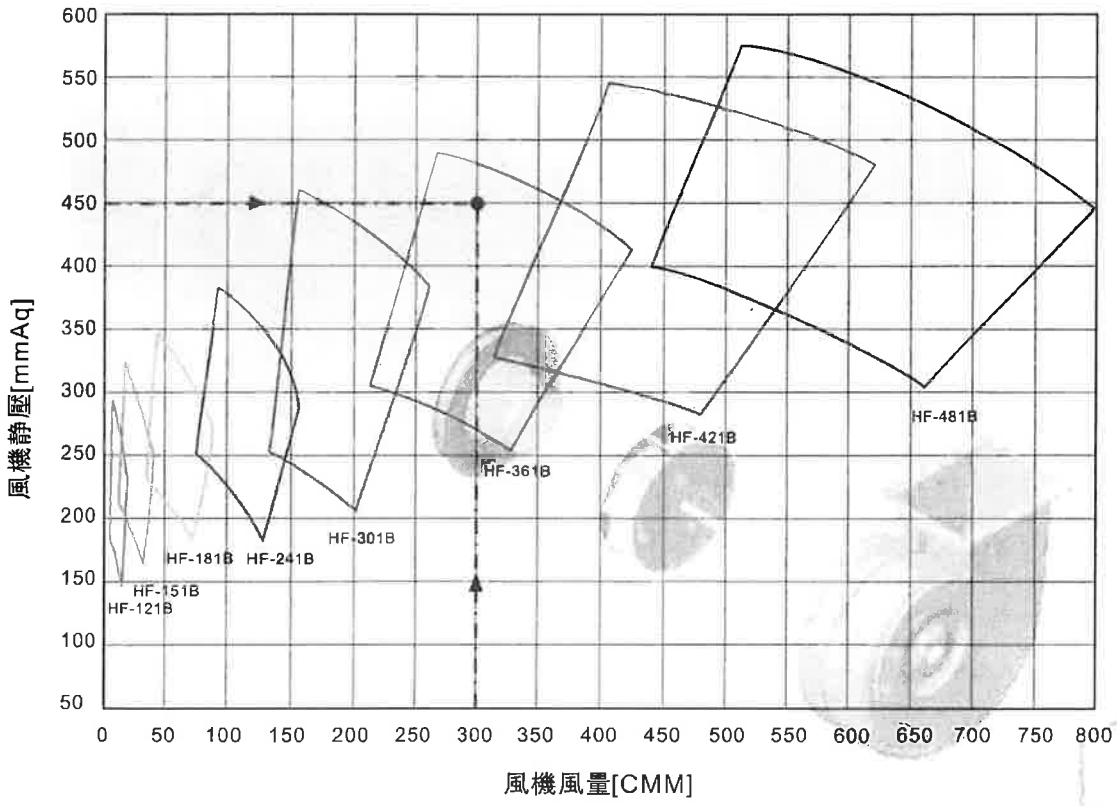


範　例：

若以需求風量300CMM, 靜壓450mmAq為例, 則根據下列性能曲線總表所表示，選出適用的HF-361B機型。

注：1CMM=60CMH　　1Pa=0.1mmAq

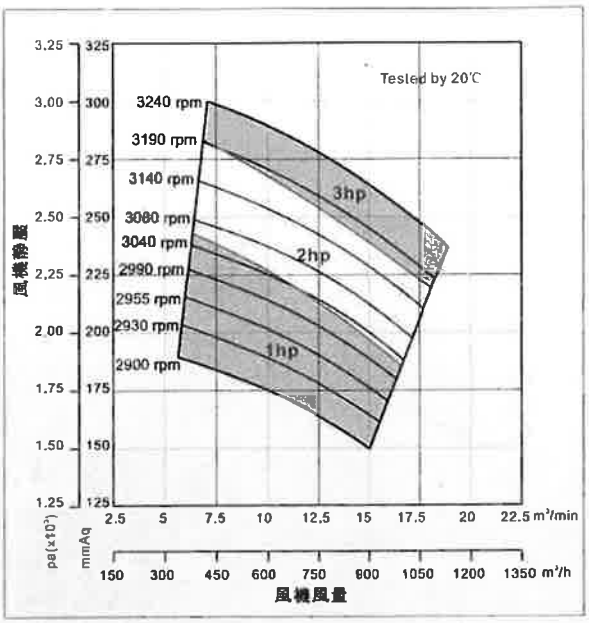
性能曲線總表



風機性能資料

HF-121B 151B 181B 241B

HF-121B



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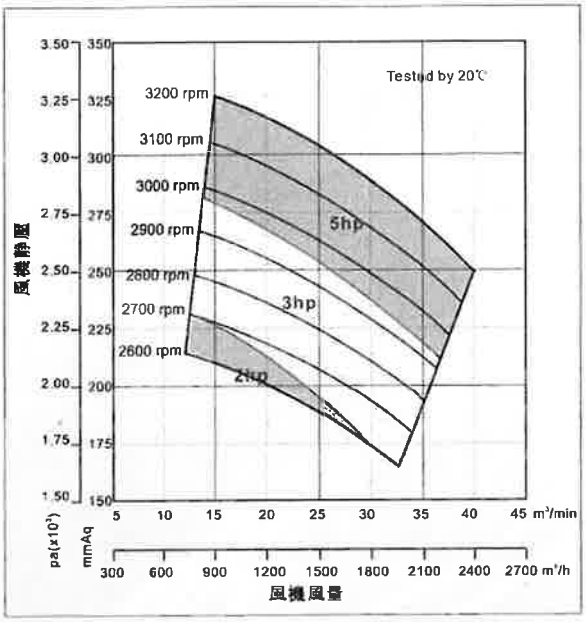
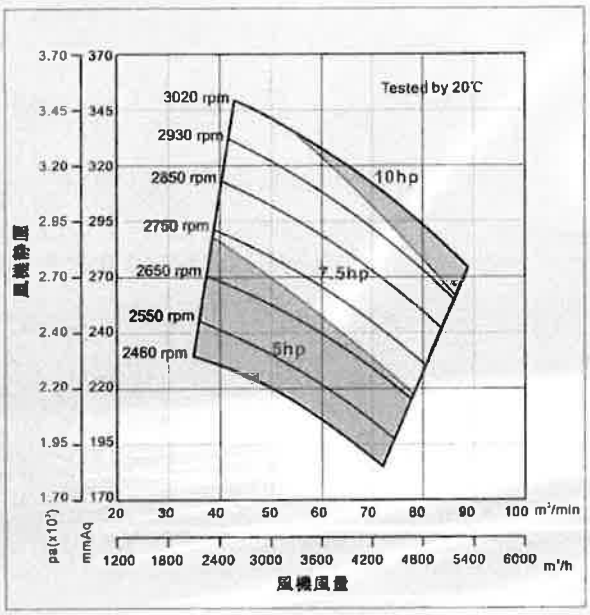
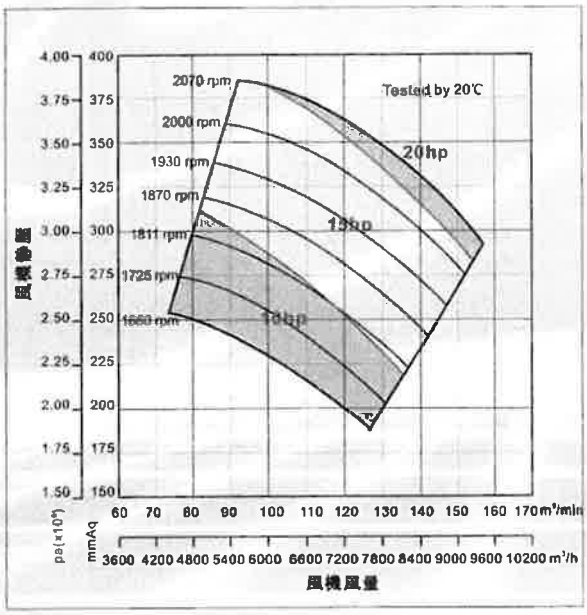


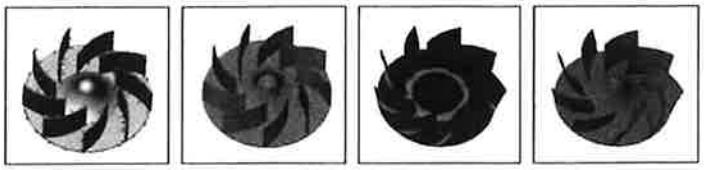
HF-181B



HF-241B

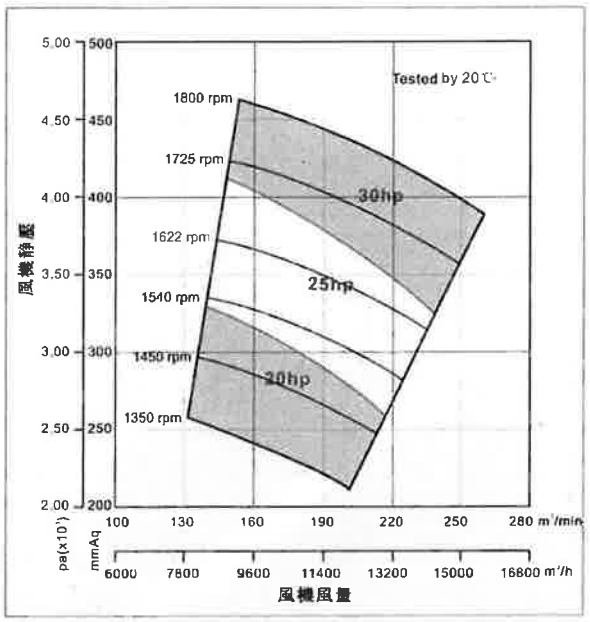


軸馬力不含皮帶傳動損失
量測空氣為標準狀態氣體

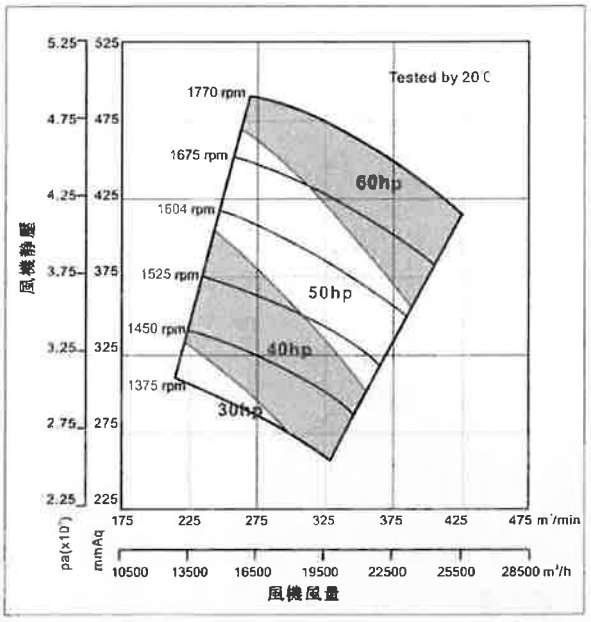


HF-301B 361B 421B 481B

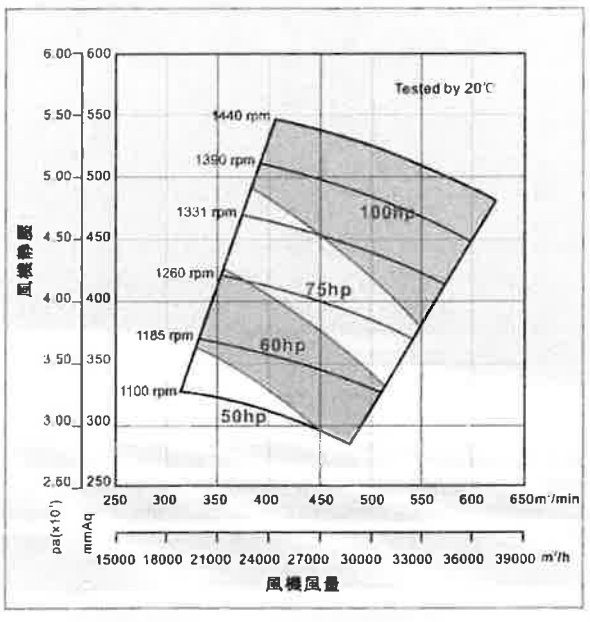
HF-301B



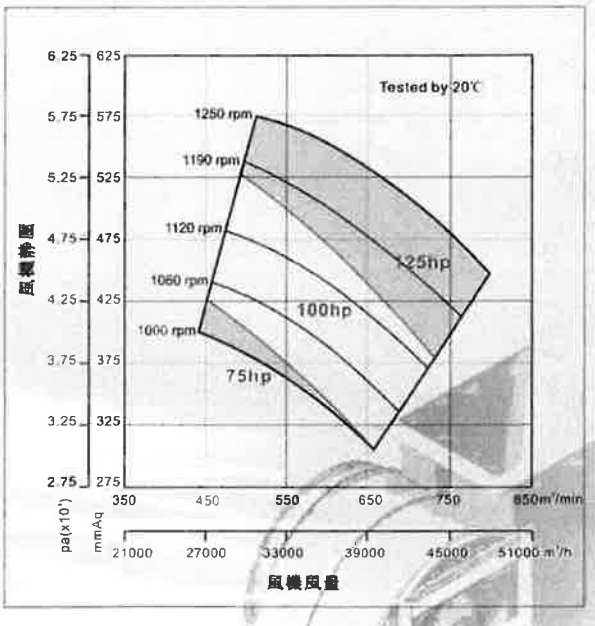
HF-361B



HF-421B



HF-481B



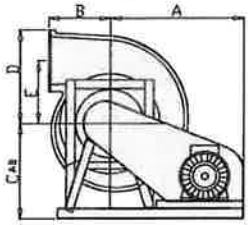
軸馬力不含皮帶傳動損失

量測空氣為標準狀態氣體

風機尺寸

HF-121B 151B 181B 241B 301B

A



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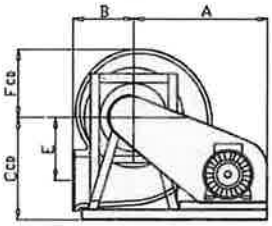

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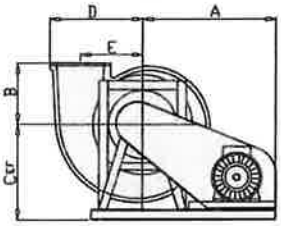

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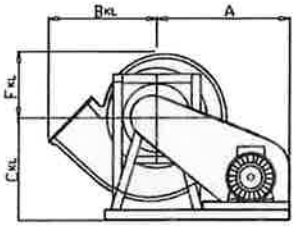
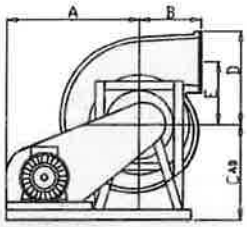


B



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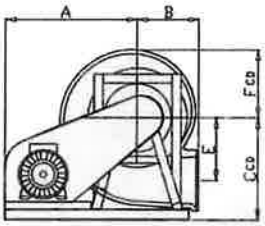

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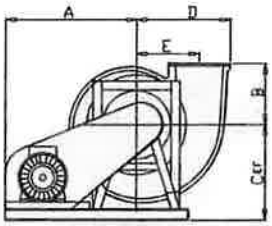

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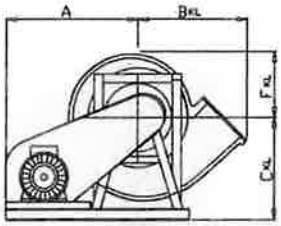
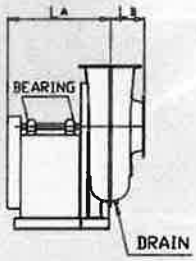


BODY



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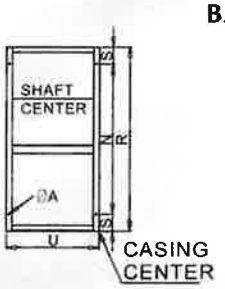
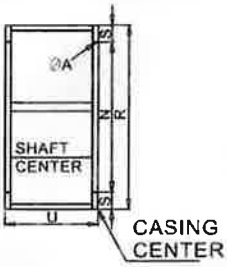




OUTLET&INLET

MODEL	BODY												
	A	B	BKL	CAB	CCD	CEF	CKL	D	E	FCD	FKL	LA	LB
HF-121B	285	260	420	360	400	360	360	335	210	260	250	120	460
HF-151B	356	325	420	500	500	500	500	419	263	325	313	150	550
HF-181B	821	360	658	500	650	600	600	570	250	386	345	265	705
HF-241B	970	447	801	700	750	700	750	685	460	498	485	249	751
HF-301B	1120	600	1058	800	1100	950	950	896	586	632	584	343	910

MODEL	BASE					INLET	
	R	U	N	S	ØA	ØC1	ØC2
HF-121B	700	433	500	100	14	150	250
HF-151B	675	565	425	125	14	185	300
HF-181B	1147	646	897	125	14	400	500
HF-241B	1350	685	1100	125	14	350	450
HF-301B	1600	830	1350	125	14	500	600

★ For specific size ,please do not hesitate to contact with us.
★ It is correspond to class III

E-Mail: winfanblower@gmail.com

WINFAN TECHNOLOGY CO., LTD.

Description

2021/11/15

Job Description:	香港康丰	WINFAN Technology Co. Ltd.
Reference:	1650CMH2000PA	tel：0512-63296761
Fan Type:	HF-151B	fax：0512-63296760
Fan Model:	3KW-4P	Http://www.frpfan.com.tw

Shaft Power Calculation

Values are in accordance with AMCA Standard 210-99

Volume Flow Rate (CMH)	1650	Total Efficiency (η_T)%	68
Inlet Static Pressure (Pa)	-2000	Driver Efficiency (η_d)%	93
Outlet Static Pressure (Pa)	0	Safe factor (S_F)	1.2
Air Density (Kg/M^3)	1.2	Fan Inlet Area (m^2)	0.03
Brake Horsepower (BHP)	2.78	Fan Outlet Area (m^2)	0.03
Atmospheric Pressure (Pa)	101325		

1. Fan Inlet Total Pressure P_{T1} :

$$P_{T1} = P_{S1} + P_{V1}$$

-2000.00 Pa

2. Fan Outlet Total Pressure P_{T2} :

$$P_{T2} = P_{V2} + P_{S2}$$

127.71 Pa

3. Total Pressure Air horsepower L_{PT}:

$$L_{PT} = \frac{K}{K-1} \times \frac{(10336 + P_{T1}) \times Q}{6120} \times \left[\left(\frac{10336 + P_{T2}}{10336 + P_{T1}} \right)^{\left(\frac{K-1}{K}\right)} - 1 \right]$$

1.41 kw

4. Brake Horsepower L_{BHP}:

$$L_{BHP} = \frac{L_{PT}}{\eta_T}$$

2.08 kw
2.78 hp

5. Motor Output M_{output}:

$$M_{output} = \frac{L_{BHP}}{\eta_d}$$

2.23 kw
2.99 hp

6. Rated Motor Power M_{rated}:

$$M_{rated} = M_{output} \times S_f$$

2.68 kw
3.59 hp

Note : P_{S1} = Inlet Static Pressure P_{S2} = Outlet Static Pressure

P_{V1} = Inlet Velocity Pressure P_{V2} = Outlet Velocity Pressure

P_V = (V^2 × r) ÷ 19.6 V = Air Velocity

It is suggested to select motor power below:

4 HP* 4P

SuZhou DingYu Energy-efficient Equipment Co.,Ltd

WINFAN TECHNOLOGY CO., LTD.

E-Mail: winfanblower@gmail.com

Description

2021/11/15

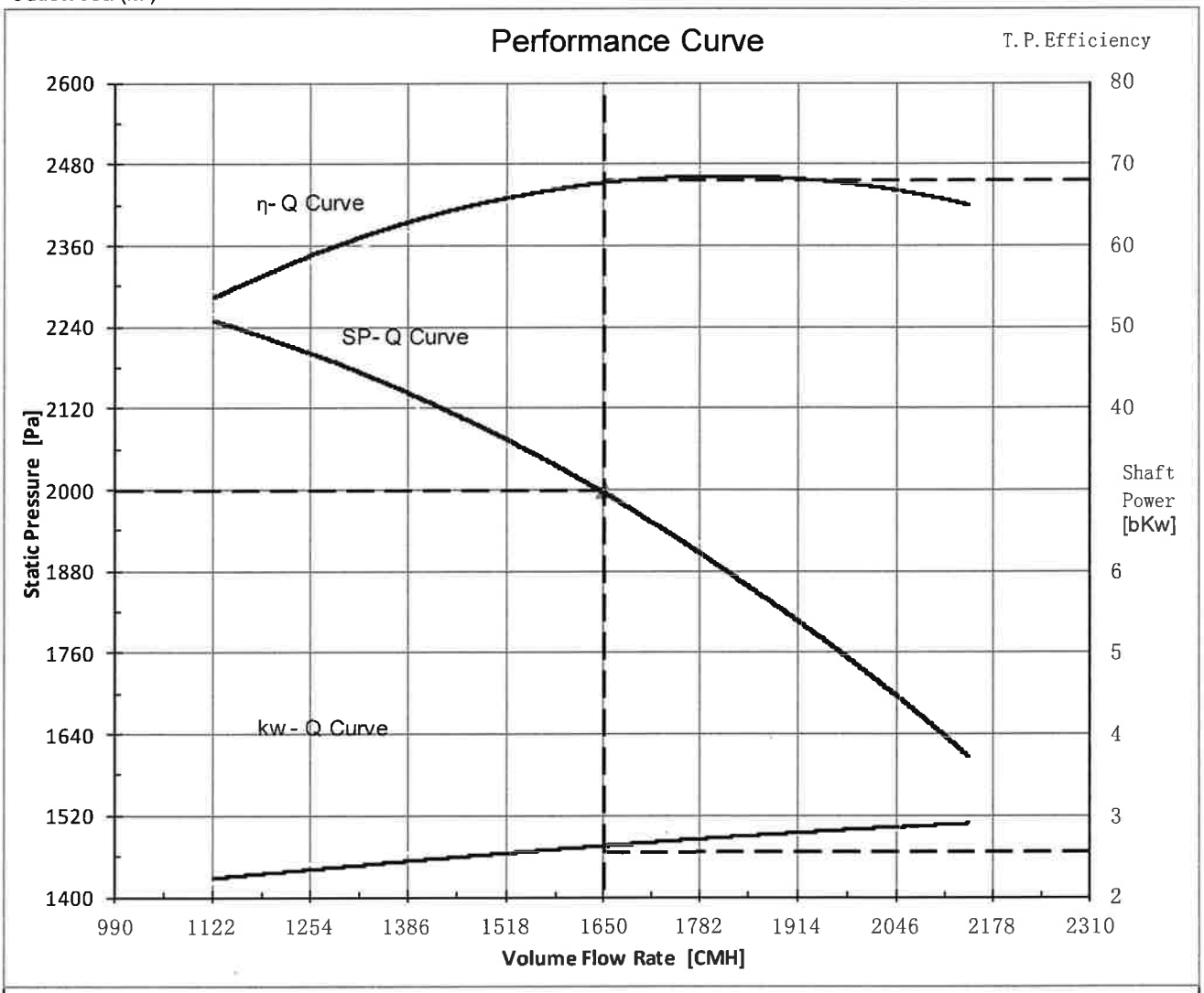
Job Description:	香港康丰
Reference:	**1650CMH2000PA**
Fan Type:	**HF-151B**
Fan Model:	**3KW-4P**

Winfan Technology Co., Ltd.
tel：0512-63296761
fax：0512-63296760
Http://www.frpfan.com.tw

Performance Curve

Values are in accordance with AMCA Standard 210-99

Volume Flow Rate (CMH)	1650
Static Pressure (Pa)20℃	2000
AIR Density (Kg/M^3)	1.200
FAN Speed (RPM)	3050
Total Efficiency (%)	68
Outlet Velocity (M/Sec)	14.59
Outlet Area (M^2)	0.031416



上海东元德高电机有限公司
地址：上海市长宁区中山西路1279弄6号321室
电话：021-51168255
Web：http://www.tecochina.net

TECO

三相异步电动机
SERIES THREE PHASE INDUCTION MOTORS

东元N系列标准电机
TecoNSeries Standard Motor
IEC-60034-30-1 2014/IE3
GB18613-2020/GB3

东元N系列高效率电机
TecoNSeries High Efficiency Motor
IEC-60034-30-1 2014/IE4
GB18613-2020/GB2

南昌 电话: 0791-88195999
东莞 电话: 0769-28826526
厦门 电话: 0592-5703299
天津 电话: 022-23859635
022-23859637
成都 电话: 13708017348
无锡 电话: 05 10-85342005

http://www.tecochina.net

东元集团简介

东元电机创立于1956年，以制造马达起家，至今东元集团已跨入重电、家电、信息、通讯、电子关键零组件、基础工程建设、金融投资及餐饮等多面向的发展领域，更积极参与国家重大工程建设，目前事业版图横跨全球5大洲、近50国。未来，东元将持续深耕核心事业，朝向智能化产品、提供系统解决方案等高附加价值方向积极发展，并致力于高科技事业之拓展，以「节能、减排、智能、自动」为目标，建构一个宏观、高质量的国际级品牌。

上海东元电机有限公司
地址：上海市长宁区中山西路1279弄6号321室
电话：021-51168255
Web：http://www.tecochina.net

所列产品内容仅供参考，如有变更将不另行通知。
All date presented is for reference only and subject to change without notice.

东元历史

1956年　东元电机股份有限公司成立于台湾三重市。
1965年　新生厂设置为当时第一座自动化电机生产工厂。
1966年　工具工厂成立（现为台产基地）。
1973年　冰水厂启用生产冷气机、电扇机。电冰箱等家电产品。
1979年　中坜一厂建厂完成导入全面自动化设备生产电机。
1983年　桃园厂启用生产电扇机、家电电子产品及电脑变动电源。
1987年　中坜二厂建厂完成与西屋合作生产超入型电机。
1991年　桃园冷气厂建厂完成，导入全面自动化生产家电产品。
1991年　马来西亚厂建厂完成，1994年分成压缩机厂建厂完成。
1995年　并购新加坡(WESTINGHOUSE)电机厂。
2002年　无锡东元电机建厂。
2003年　无锡东元正式投产。
2004年　无锡东元金一厂建厂。
2004年　江西东元电机建厂。
2012年　成立上海东元德盛电机有限公司作为东元集团在中国上海的销售服务中心。
2016年　无锡东元精密机械建厂


CERTIFICATE

WUXI TECO Electric & Machinery CO. LTD.

ISO 9001：2015

ANAB

IAF


CQC

职业健康安全管理体系认证证书

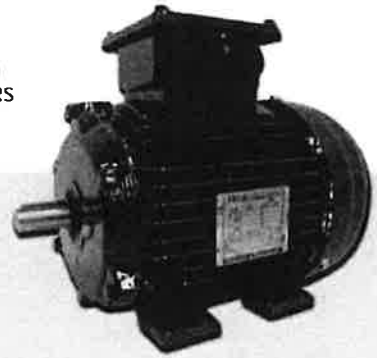
中国质量认证中心


CQC

环境管理体系认证证书

中国质量认证中心

三相异步电动机
SERIES THREE PHASE INDUCTION MOTORS



目 录
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东元N系列三相异步电动机
Teco N Series Three Phase Induction Motors

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铭板信息Nameplate.....9
轴承温升Bearing temperature rise.....10
产品编号Product Code.....11-12
包装Package.....13

特性表Datasheet
Teco N Series Three Phase Induction Motors

标准电机Standard Motor 380V 50HZ.....14-17
Model:TEV3
高效率电机High Efficiency Motor 380V/50HZ.....18-20
Model:TEV4

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技术数据

产品：三相异步电动机
设计依据：国际电工委员会IEC60034,中国国家标准GB755
额定电压：380V或其它电压
额定频率：50HZ或60HZ
输出功率：0.18～400kW
工作制：连续工作制
机座号：80-355
防护等级：IP55
冷却方式：IC411
绝缘等级：F级绝缘
温升：S1,1.0(50Hz)时采用电阻法考核定子绕组温升不超过80℃

安装方式：IMB3(卧式底座安装)，IMB5(卧式法兰安装)，IMB35(卧式底座带法兰)，IMV1(立式法兰安装)，IMV3(立式轴伸向下)及其它电动机安装型式请参阅外形尺寸表。

● 能效等级符合中国国家标准 GB18613-2020 能效，频率50HZ以外不在国家能效认证范围，特性值IE3特性有所差异，不表以GB特性为准

TECHNICAL DATA

Class: three phase induction motors
Design standard: IEC 60034 GB 755
Rated voltage: 380V or other voltage
Rated frequency: 50Hz or 60Hz
Output range: 0.18～400kW
Time duty: Continuous S1(S.F.: 1)
Frame Nos: 80-355
Protection enclosure: Totally enclosed(IP55)
Cooling method: Self-circulation Surface cooling(C411)
Stator insulation: Class F insulation system
Temperature rise: Not to Exceed 80 °C Rise by Resistance Method; S.F.1.0(50Hz)

Mounting: IMB3,IMB35,IMB5,IMV1 or others For typical performance and dimensions of series motor refer to table hereunder.

● GB18613-2020 Frame frequency beyond 50Hz is not the part of GB. If GB Justified does not correspond to IE3 GB shall prevail.

适用条件

电源条件： 电压波动率在10%以内，频率波动率在±5%以内，电压及频率综合波动率10%以内。但频率波动率不超过±5%。

使用场所： 室内、无腐蚀气体环境
环境温度： -15~40℃
环境湿度： 相对湿度90%以下(但不能凝结)
海拔高度： 海拔1000m以下
传动方式： 皮带轮传动。但是2P 45kW及以上，6极4P 37kW及以上使用联轴器。
旋转方向： 可双向旋转，当电源电线与电动机出线端子采用一致的，面向轴伸端看为顺时针方向旋转。
起动方式： 全压直接起动或Y-△起动
涂装： GB3(IE3: 蓝色 Munsell 5PB 3/8
GB2(IE4) 浅灰色 NO.700 Munsell N5
要求： 安装联轴器或皮带轮，应利用轴伸设牙拉通过人，禁止以外力敲击轴伸安装，如有特殊需要请另行洽谈。

APPLICATION

Power source conditions: Voltage ± 10%, Frequency ±5%, and 10% Max of Combined Voltage and Frequency. But Frequency Variation Does Not Exceed ±5%.
Place: Indoor Non-hazardous
Ambient temperature: -15~40 ;
Relative humidity: Less than 90% RH(Non-condensation)
Altitude: Less than 1,000 meters
Drive method: Belt Service,However 2 Pole 45 kW and Up 4, 6&8Pole F# 250 and Above Coupling Service is the Way.
Direction of rotation: CW According to IEC Definition, Suitable For Bi-Directional Operation.
Method of starting: Full voltage direct on-line or Y-Δ starting
Painting: GB3(IE3: Purple Munsell 5PB 3/8
GB2(IE4: Light Gray NO.700 Munsell N5
Requirement: Pulley, coupling and belt should be heated and pushed onto the shaft extension with slight axial force. Do not hammer to prevent bearing damage if need special requirement, further discussion will be demanded.
Drive method: Belt direct coupling gear and so on

电机特点

IP55防护结构,防尘,防水花及回流,铸铁框架,结构强壮,符合国际标准,安全更具保障性

采用东元F级绝缘,耐热强度高,抗电冲击强,绝缘寿命长,在恶劣环境下也能胜任

使用著名品牌之轴承,著名硅厂之硅钢片,性能更具保障

规范化的设计、优质的材料、先进的加工设备和完善的质量保证体系,这些表现在效率高振动小、噪声低、安全可靠

选用:依据客户需要可搭配热保护器, PTC,空间加热器。RTD,PT100及其它

注:

自2021年3月起东元电机中小型电机,某些机种已经开始加装 VB-100 自带屏智慧型振摇仪,提供即时振动运转数值、振动健康指数预知马达检修时程,让您的工厂设备智慧升级,不停工、不怠慢,随时处于最佳产能状态。

CHARACTER

The protection enclosure is IP55,protect dust,drip and oil,Cast iron Frame strong configuration,which is accord to international standards and safety safeguarded further.

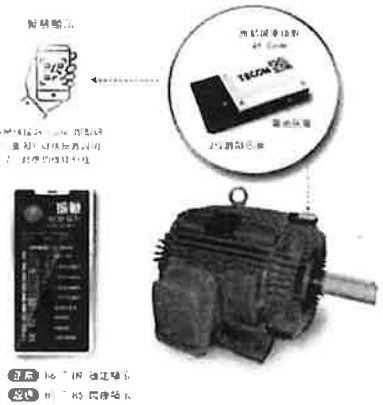
The stator insulation is class F of TECO insulation system with good heatproof quality,

strong resistance to electrical sparks,long insulation life and can be competent in the bad environment.

These ranges use bearing famous brand company and the silicon steel sheet are come from famous national steel company.

Standardized design, high quality material, advanced processing equipment and consummation quality guarantee system,it is embody in the high efficency,low vibrate and reliable safety.

the thermistor,PTC,Heater,RTD,PT100 or others can be providedaccord ing to the needs of purchaser.



振动 Vidration

所有电动机转子都使用平衡旋转级（标准）振动等级进行动态平衡。电动机在空载运行时振动速度有效值不超过下表中的规定值。

Motors are dynamically balanced to severity grade A rating, a half key. Table below contains the effective vibration values for unloaded motors.

振动等级 Vibration grade	轴高 Shaft height mm	80≤H≤132	132<H≤280	H>280
A	安装方式 Mounting	速度 毫米/秒 Velocity mm/s	速度 毫米/秒 Velocity mm/s	速度 毫米/秒 Velocity mm/s
	自由悬置 Free suspension	1.6	2.2	2.8
	刚性安装 Rigid mounting	1.0	1.4	2.3

最高转速 Max.rpm

鼠笼型感应电动机的安全运行转速

除非铭牌上另行标明，各测电压为1000V及以下、机座号355及以下的所有单速三相笼型感应电动机应能在表列出的转速之内安全连续运行

电压1000V及以下三相笼型感应电动机最大安全运行转速

Safe running speed for the squirrel-cage induction motors

Unless otherwise the name plate specifies, all the squirrel cage, 3 phase, induction motors lower than 1000V and smaller than 355 Frame Size can safely run continuously at the speed in the table below

The safe Max. rpm for the squirrel-cage, 3 phase induction motors of 1000V or lower.

单位为转/每分钟rpm/min

机座号 Frame Size	2极 2Pole	4极 4Pole	6极 6Pole	8极 8Pole
80	3200	3600	2400	1800
90	**3200**	**3600**	**2400**	**1800**
100	3200	3600	2400	1800
112	**3200**	**3600**	**2400**	**1800**
132	3600	3600	2400	1800
160	**4500**	**3700**	**2400**	**1800**
180	4500	3700	2400	1800
200	**4500**	**2300**	**1800**	**1350**
225	3600	2300	1800	1350
250	**3600**	**2300**	**1800**	**1350**
280	3600	2300	1800	1350
315	**3600**	**2300**	**1800**	**1350**
355	3600	2300	1800	1350

注:当电动机在额定转速以上运行时，例如，当应用调速控制时,其噪声和振动强度将会增大。要求电动机调整轴的极平以满足在额定转速以上的加速能力。此外,轴承寿命可能会受影响。应关注加油的时间和时间补充油脂量及其寿命。

——仅供参考

Note: When the motors run above the rated speed, for example, using in speed controller, the noise and vibration will increase. In this situation, the motors are required to be corrected to satisfy the acceleration ability above the rated speed. Besides, the bearing lifetime will decrease. Pay attention to the time for adding the oil and grease to insure its lifetime.

油脂寿命 Grease life (Horizontal installation)

机座号 Frame Size	极数 Poles	润滑脂寿命 Grease Lifetime up to CT 40°C
免加油润滑型轴承的润滑脂 Grease for permanent lubrication bearing		
80~225	2, 4, 6, 8	20000 小时 (h) (B3 安装)
可再润滑型轴承的润滑脂 Grease for regreasable bearing		
250~280	2	3000 小时 (h)
250~280	4, 6, 8	8000 小时 (h)
315~355	2	2000 小时 (h)
315~355	4, 6, 8	4000 小时 (h)

注

1. 当环境温度每升高10℃，或滚动轴承启动及停止频率增加一倍，润滑脂寿命减半。
2. 适合B3安装,垂直安装或振动较大场合请与我公司联系。

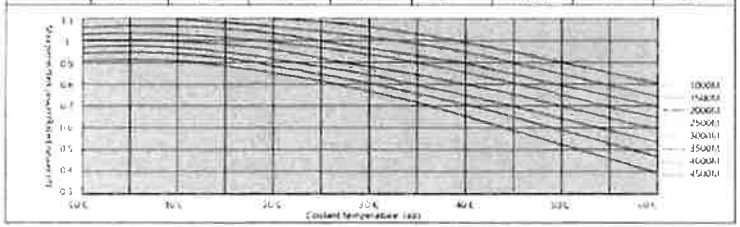
Note:

1. If the coolant temperature is increased by 10K the grease lifetime is halved. If the starting rate is doubled, the grease lifetime is halved.
2. 2000h is applicable for vertically installed motors with bearing arrangement B3.

海拔 Site altitude above sea level

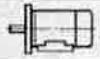
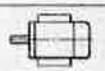
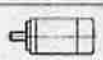
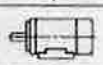
1. 电机由于环境温度及海拔高度的功率输出变化The changes of the output of the motors for the environmental temperature and elevation.
2. 可使用功率=额定功率×系数% Available power = rated power X coefficient

Ambient temperature (air)	Max. permitted power in relation to ambient temperature and altitude above sea level Max. permitted power/Rated power PN							
	1000m	1500m	2000m	2500m	3000m	3500m	4000m	4500m
0°C			1.07	1.04	1.01	0.98	0.95	0.92
10°C		1.10	1.07	1.04	1.01	0.98	0.95	0.92
20°C	1.10	1.07	1.04	1.00	0.96	0.92	0.89	0.86
30°C	1.06	1.02	0.97	0.93	0.89	0.85	0.81	0.77
40°C	1.00	0.96	0.91	0.85	0.81	0.76	0.71	0.66
50°C	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.53
60°C	0.80	0.75	0.70	0.65	0.60	0.54	0.47	0.40

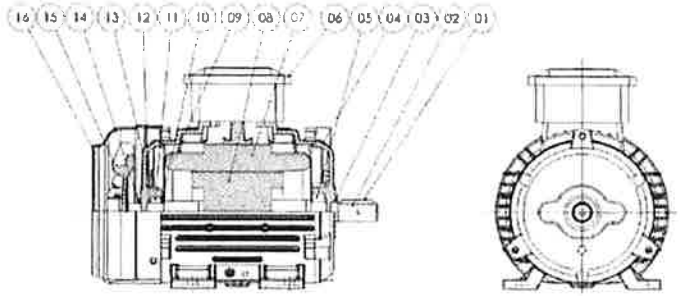


备注：海拔较高时，因空气稀薄，冷却效果差，为防止电机过热烧毁，需降低电机温升。此曲线供参照。
Note: In high altitude areas, due to the thin air, the effect of cooling is bad,the temperature rise must be decreased to prevent the motors from destroyed over temp. to ensure the meters to run safely.

安装方式（IM）

基型脚安装		基型凸缘安装		轴伸向前安装	
IM 1001 (IM B3)		IM 3001 (IM B5)		IM 2001 (IM B35)	
水平轴 脚贴地		水平轴 B Flange		水平轴 脚贴地 B Flange	
IM 1051 (IM B6)		IM 3011 (IM V1)		IM 2011 (IM V15)	
水平轴 轴看脚贴左侧地面		垂直轴 轴端向下 B Flange		垂直轴 轴端向下脚贴地面 B Flange	
IM 1061 (IM B7)		IM 3031 (IM V3)		IM 2031 (IM V36)	
水平轴 轴看脚贴右侧地面		垂直轴 轴端向上 B Flange		垂直轴 轴端向上脚贴地面 B Flange	
IM 1071 (IM B8)		IM 3601 (IM B14)		IM 2101 (IM B34)	
水平轴 脚贴天花板		水平轴 C Flange		水平轴 脚贴地 C Flange	
IM 1011 (IM V5)		IM 3611 (IM V18)		IM 2111 (IM V17)	
垂直轴 轴端向下脚贴地面		垂直轴 轴端向下 C Flange		垂直轴 轴端向下脚贴地面 C Flange	
IM 1031 (IM V6)		IM 3631 (IM V19)		IM 2131 (IM V37)	
垂直轴 轴端向上脚贴地面		垂直轴 轴端向上 C Flange		垂直轴 轴端向上脚贴地面 C Flange	

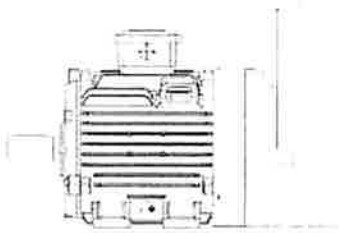
剖面图 Profile



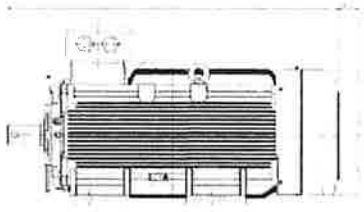
项目 ITEM	名称 NAME	项目 ITEM	名称 NAME
1	KEY（键）	9	FRAME（框架）
2	**SHAFT（轴）**	10	**STOP RING-BEARING**
3	V-Ring	11	BEARING（轴承）
4	**BRACKET（盖）**	12	**PRE-LOAD SPRING**
5	BEARING（轴承）	13	END BRACKET（端盖）
6	**TERMINAL BOX（接线盒）**	14	**V-RING**
7	STATOR（定子）	15	EXTERNAL FAN（风扇）
8	**ROTOR（转子）**	16	**FAN COVER（风罩）**

强冷风机资料
Force fan motors data

TECO



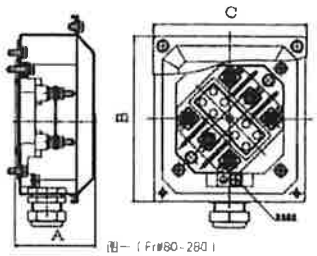
Fr#80~280



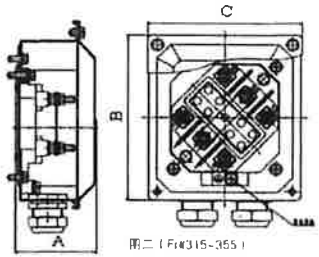
Fr#315~355

机座号 Frame Size	极数 Pole	电压 Voltage	频率 Frequency (Hz)	功率 Rated output (kW)	电流 Current Value(A)	转速 Speed (r/min)	风量 Fan Power (m³/s)	风压 Fan Pressure (Pa)	L (mm)
80	2-8P	380V	50	35	0.1	2800	58	60	105.5
90	2-8P	380V	50	35	0.1	2800	91	80	108
100	2-8P	380V	50	40	0.1	2800	142	80	100
112	2-8P	380V	50	45	0.1	2800	229	80	82.5
132	2-8P	380V	50	45	0.25	1400	337	35	121
160	2-8P	380V	50	50	0.25	1400	609	40	105
180	2-8P	380V	50	75	0.25	1400	686	55	119
200	2-8P	380V	50	100	0.3	1400	1679	85	110
225	2-8P	380V	50	120	0.35	1400	1788	70	171.5
250	2-8P	380V	50	230	0.7	1400	1813	80	167.5
280	2-8P	380V	50	250	0.75	1400	2415	85	104.5
315	2-8P	380V	50	450	1.3	1390	6200	180	120(315S) 104(315M,L)
355	2-8P	380V	50	650	1.9	1390	6500	180	101(355M,L) 85(355C)

接线盒资料(钢板材质) Terminal box data
加热器参数 Space Heater



图一（Fr#80-280）



图二（Fr#315-355）

机座号 Frame Size	极数 Pole	接线柱数 Numberof terminals	接线柱规格 Contact Screw (mm)	引线外径 Outer Cable Diameter (mm)	出线孔径 Cableentry size	进线孔数量	外形尺寸 Outline(mm) A	B	C	加热器规格型号 Spaces heater type
80	2P 4P-8P	6	M4	6~12	Φ21	1	60	110	110	1Φ.220V，20W
90	2P 4P-8P									
100	2P 4P-8P	6	M5	7~14	Φ26	1	68.5	127	120	1Φ.220V，30W
112	2P 4P-8P									
132	2P 4P-8P									1Φ.220V，40W
160	2P 4P-8P	6	M6	10~18	Φ35	1	81.5	166	160	
180	2P 4P-8P									1Φ.220V，50W
200	2P 4P-8P	6	M8	22~34	Φ52	1	89.5	212	196	
225	2P 4P-8P									
250	2P 4P-8P	6	M10	37~42	Φ65	1	115.5	245	224	1Φ.220V，60W
280	2P 4P-8P									
315	2P 4P-8P	6	M12	37~42	Φ65+Φ65	2	152	318	288	1Φ.220V，150W
355	2P 4P-8P	6	M16	45~52	Φ75+Φ75	2	188	408	372	1Φ.220V，200W

噪声 Noise levels

功率 kW	同步转速 r/min 3000 (2 极)	1500 (4 极)	1000 (6 极)	750 (8 极)
		dB(A) L_{wA}/L_{pA}		
0.55	/	66/56	63/53	63/53
0.75	**78/68**	**66/56**	**63/53**	**64/54**
1.1	78/68	66/56	63/53	64/54
1.5	**78/68**	**66/56**	**64/54**	**70/60**
2.2	78/68	70/60	70/60	71/61
3	**82/72**	**70/60**	**73/63**	**71/61**
4	83/73	72/62	73/63	72/61
5.5	**85/75**	**75/65**	**73/63**	**72/61**
7.5	85/75	76/65	73/62	72/61
11	**87/76**	**77/66**	**73/62**	**76/65**
15	87/76	77/66	77/66	79/68
18.5	**87/76**	**80/69**	**80/69**	**79/68**
22	88/77	80/69	80/69	79/68
30	**90/79**	**83/72**	**80/69**	**80/68**
37	90/79	84/73	82/70	82/70
45	**92/81**	**84/73**	**85/73**	**82/70**
55	92/80	85/73	85/73	88/83
75	**94/76**	**88/76**	**89/84**	**88/82**
90	94/82	88/76	89/83	88/81
110	**98/93**	**94/89**	**89/82**	**88/81**
132	98/92	94/88	89/82	92/84
160	**98/92**	**94/87**	**94/86**	**92/84**
200	98/91	94/87	94/86	92/84
250	**100/92**	**95/87**	**94/86**	**92/84**
315	100/92	95/87	94/86	/

备注：
L_{pA}声压级
L_{wA}声功率级
对试距离为1M
在50HZ电源供电下，容差为±3dB

L_{pA}-sound pressure level
L_{wA}-sound power level
1M away from the motor
Standard rated output at 50Hz,and the tolerance is ±3dB

铭板信息 Nameplate

3C铭板

中英文铭板

全英文铭板（仅限外销使用）

轴承温升 Bearing temperature rise

注意!

轴承温升的高低比轴承本身实际温度更能反映出问题的状况。

如果轴承温升过甲太快或是有非常明显的振动或异音，电动机必须立刻停止运转，详细检查何题发生的原因，否则不得重新运转。

如果轴承温升及运转情况都正常的话，电动机必须继续运转直到轴承温度稳定为止，许可的温度值如下:

滚动轴承插入式温度检出器	警告值	跳脱值
轴承测试的温度	95℃	100℃

ATTENTION!

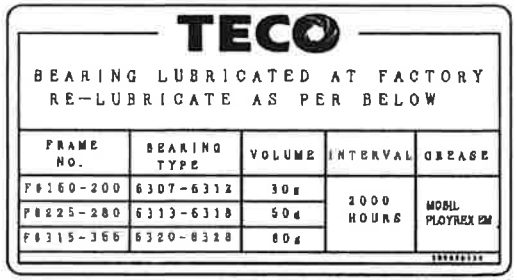
If the rate of rise in temperature is excessive or if the mo tor exhibits excessive vibration or noise,it should be shut down immediately and a thorough investigation made as to the cause before it is operated again.

Following the initial start-up, the bearing temperatures should be closely monitored.The rate of rise in bearing temperature is more indicative of impending trouble than is the actual temperature.

If the bearing temperature rise and motor operation appear to be normal, operation should continue until the bearing temperatures stabilize

Recommended limits on bearing temperatures are as follows:

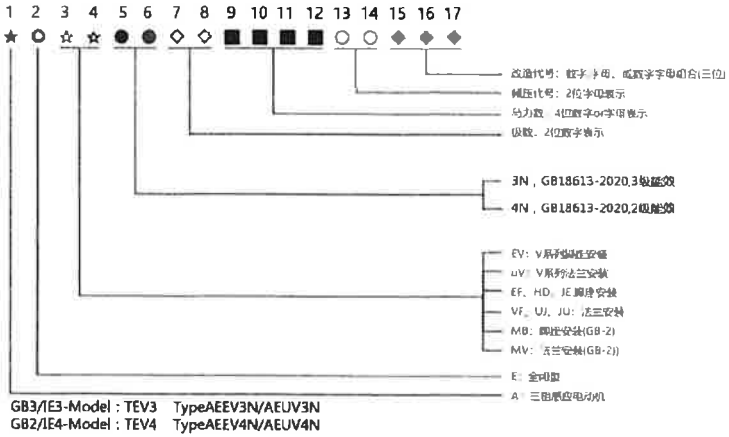
Anti-Friction Bearings.	**Alarm temperature**	**Trip temperature**
By permanently installed detector	**95℃**	**100℃**



标准:F#250开始给油　　润滑油铭板

*F#225及以下给油为特殊指定

产品编号 Product Code



GB3/IE3-Model : TEV3　TypeAEEV3N/AEUV3N

GB2/IE4-Model : TEV4　TypeAEEV4N/AEUV4N

TECO

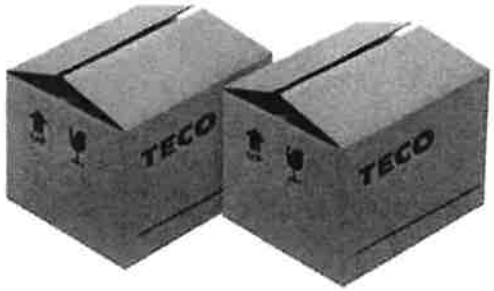
東元產品改造代碼對照表	
15~17碼代號	描述
—	標準
B04	鋁製外蓋，不銹鋼拉不取力出線接380v
B02	出線口朝風扇
B03	V系列出線在頂，電出線孔朝左（軸向）
BN-	使用非鐵質接線盒
BN5	鋁殼T箱（兩個出線孔，一個位不設，一個賽頭），鋁製散熱筒，不銹鋼拉不取
CF-	C-Face Flange（小法蘭）
D01	出線接低部
FAN	強冷外扇
G01	出線接高部
-H-	出線接座
-L1	長引線1000mm，T箱另附，壓接端子
-L2	長引線1500mm，T箱另附，壓接端子
-L3	長引線3000mm，T箱另附，壓接端子
-L4	長引線2000mm，T箱另附，壓接端子
LC-	座腳兩用（D Flange）—IMB35
LG-	底上出線
NP-	全英文銘牌
NP1	金屬板不銹，全英文銘牌
NP2	全英文銘牌，出廠檢驗單
NPF	SKF軸承，全英文銘牌
PA-	IP56
PA5	IP65
PAR	主電機IP56，接線盒防護IP66，銘板FIP56
Q--	標準（適合製品EV13）
R0-	V系列側出線（與風軸T箱在右）
R1-	V系列側出線（面向風扇T箱在左）
S1-	NSK軸承
S1A	大之軸承
S1F	SKF軸承
SA-	雙出軸
SN2	軸材質鉻鉬鋼
SN3	軸材質鉻鉬鋼，副軸表面
TH-	附電熱器（單相，220V）
TH6	鑄鋁金屬盒，加防凝結熱帶
TL-	附熱保護（PTC160）-3PCS/SET
TP-	附熱保護器（145℃）
VS-	自冷變頻規格（二次風立水+熱保護器-145℃）
VS6	防護等級，出線口朝風扇，自冷變頻規格（二次風立水+熱保護器-145℃）
W01	戶內型，附防雨罩
Y02	低噪音步，不加油步
YB9	SKF軸承，中耐壓（B12）
YE	自動給脂型（無風扇風罩）
YFB	SKF軸承，引線長IM.T箱另附，無罩無罩

包装
Package

TECO

1.纸箱包装

机座号 Fr#80 到 Fr#112 的包装为纸箱，如下图：



2.木条箱包装

机座号 Fr#132到Fr#355的包装为木单箱，如下图：

东元电机的包装也在不断的改进和更新中，如有更改，恕不另行通知。

特性表 Data Sheet

N系列标准电机（Nstandard Motors）

Model: TEV3

380V 50HZ

GB18613-2020GB3(IE3)

2极

OUTPUT				EFFICIENCY			POWER FACTOR			CURRENT		TORQUE							
		FULL LOAD	TRANS NO.	FULL LOAD	3/4 LOAD	1/2 LOAD	FULL LOAD	3/4 LOAD	1/2 LOAD	FULL LOAD	LOCKED ROTOR	FULL LOAD	LOCKED ROTOR	BREAK UP	BREAK DOWN	SD	NOISE POWER	SPEED WEIGHT	
KW	HP	rpm		(%)	(%)	(%)	(%)	(%)	(%)	(A)	%FLC	kg-m	%FLT	%FLT	%FLT	kg-m²	dB(A)		kg
0.75	1	2875	80M	80.7	78.3	75.1	83.5	77.0	65.5	1.69	780	0.254	260	275	335	0.006	78	17.0	
1.1	1.5	2870	80M	82.7	83.0	81.3	85.0	78.5	68.5	2.50	800	0.373	300	295	350	0.007	78	18.5	
1.5	2	2850	90S	84.2	85.4	85.8	90.5	87.0	78.0	2.99	800	0.512	220	210	280	0.012	78	25.0	
2.2	3	2860	90L	85.9	86.7	86.8	89.5	85.0	75.5	4.38	850	0.748	245	235	315	0.014	78	27.5	
3	4	2855	100L	87.1	88.3	88.4	90.0	86.5	78.5	5.81	880	1.022	255	240	355	0.025	82	38.0	
4	5.5	2875	112M	88.1	89.0	88.9	91.0	87.5	80.0	7.58	950	1.354	270	250	380	0.046	83	48.0	
5.5	7.5	2930	132S	89.2	89.6	89.5	88.0	84.0	77.5	10.9	800	1.826	205	205	340	0.075	85	63.0	
7.5	10	2920	132S	90.1	90.9	90.8	87.0	84.5	77.5	14.5	725	2.499	185	195	315	0.081	85	66.0	
11	15	2935	160M	91.2	92.0	92.0	90.0	89.0	83.5	20.1	775	3.647	230	165	285	0.183	87	105	
15	20	2935	160M	91.9	92.0	92.0	89.0	85.5	77.5	27.9	885	4.973	275	230	330	0.209	87	112	
18.5	25	2935	160L	92.4	93.0	93.0	90.0	89.5	84.0	33.8	810	6.144	245	200	295	0.237	87	126	
22	30	2940	180M	92.7	92.7	92.5	87.0	85.0	77.0	41.4	780	7.281	225	160	275	0.263	88	156	
30	40	2950	200L	93.3	93.5	92.5	90.0	90.0	86.5	54.3	775	9.895	200	145	270	0.602	90	236	
37	50	2955	200L	93.7	94.5	94.0	91.0	90.5	87.0	65.9	815	12.18	195	145	280	0.733	90	273	
45	60	2960	225M	94.0	94.0	93.5	91.0	91.0	85.0	78.8	810	14.78	150	140	290	1.187	92	295	
55	75	2970	250M	94.3	94.5	94.0	91.5	90.0	86.5	96.8	800	18.02	150	130	315	1.544	92	416	
75	100	2970	280S	94.7	94.0	93.6	92.0	89.0	87.0	134	800	24.61	155	135	300	1.935	94	505	
90	125	2970	280M	95.0	95.0	94.0	90.5	90.0	82.5	159	830	29.53	150	135	285	2.483	94	571	
110	150	2970	315S	95.2	95.0	94.3	91.0	89.5	85.0	193	834	36.09	230	200	280	3.200	98	786	
132	175	2975	315M	95.4	95.1	94.4	91.0	90.5	87.0	231	755	43.24	150	130	280	4.800	98	835	
160	215	2975	315L	95.6	95.5	94.5	91.0	90.5	87.0	278	764	52.41	160	140	270	5.200	98	910	
200	270	2975	315L	95.8	95.8	94.8	91.0	90.5	86.0	346	735	65.51	150	140	260	6.000	98	1,175	
250	335	2975	355M	95.8	95.5	94.6	90.5	89.0	84.0	438	740	81.89	140	115	260	8.800	100	1,414	
315	420	2975	355L	95.8	95.5	94.6	91.0	89.0	84.0	548	740	103.2	140	115	260	10.40	100	1,564	
355	475	2975	355C	95.8	95.5	94.6	92.0	90.5	85.5	612	840	116.3	120	120	260	16.00	100	2,200	
400	540	2975	355C	96.0	96.0	94.8	92.0	91.0	87.5	690	850	131.0	120	120	260	20.00	100	2,550	

NOTE: 1. The above are typical values based on test according to GB/T 1032 method B, IEC 60034-2-1:2014.
2. Tolerance according to GB 755, IEC 60034-1
3. Breakdown & Locked rotor torques are show as average expected volteges.
4. Noise : sound power level at no-load, dB(A), Tolerance + 3 dB(A)
5. Data subject to change without notice

特性表 Data Sheet

TECO

N系列标准电机（Nstandard Motors）

Model: TEV3

380V 50HZ

GB18613-2020GB3(IE3)

4极

OUTPUT				EFFICIENCY			POWER FACTOR			CURRENT		TORQUE							
		FULL LOAD	TRANS NO.	FULL LOAD	3/4 LOAD	1/2 LOAD	FULL LOAD	3/4 LOAD	1/2 LOAD	FULL LOAD	LOCKED ROTOR	FULL LOAD	LOCKED ROTOR	BREAK UP	BREAK DOWN	SD	NOISE POWER	SPEED WEIGHT	
KW	HP	rpm		(%)	(%)	(%)	(%)	(%)	(%)	(A)	%FLC	kg-m	%FLT	%FLT	%FLT	kg-m²	dB(A)		kg
0.55	0.75	1420	80M	80.8	81.5	79.5	75.0	65	51.0	1.38	640	0.37	300	270	320	0.010	66	18.5	
0.75	1	1410	80M	82.5	81.8	79.7	73.5	64.0	50.0	1.88	640	0.518	315	280	335	0.013	66	17.0	
1.1	1.5	1430	90S	84.1	84.4	83.2	79.5	71.5	57.5	2.50	720	0.748	255	205	280	0.019	66	25.0	
1.5	2	1435	90L	85.3	84.1	82.2	75.0	65.5	51.5	3.56	760	1.017	300	235	335	0.023	66	28.5	
2.2	3	1450	100L	86.7	87.3	86.9	81.0	73.5	60.5	4.76	735	1.476	200	160	270	0.045	70	38.0	
3	4	1455	100L	87.7	87.7	86.2	78.0	70.5	57.5	6.86	780	2.006	250	240	335	0.052	70	42.0	
4	5.5	1445	112M	88.6	88.4	87.9	82.0	76.5	69.5	8.37	715	2.693	245	205	280	0.083	72	47.0	
5.5	7.5	1455	132S	89.0	89.4	90.3	85.0	80.5	70.0	11.0	735	3.678	245	205	300	0.132	75	65.0	
7.5	10	1450	132M	90.4	90.8	90.4	85.0	80.0	69.5	14.6	780	5.033	270	225	330	0.172	75	79.5	
11	15	1460	160M	91.4	92.0	91.5	85.0	81.0	71.0	21.5	775	7.331	230	185	270	0.368	77	113	
15	20	1460	160L	92.1	92.5	92.5	85.0	81.5	71.4	28.1	810	9.987	250	195	285	0.480	77	130	
18.5	25	1475	180M	92.8	94.0	93.8	86.0	82.4	75.0	36.7	790	12.20	215	160	255	0.704	80	165	
22	30	1475	180L	93.0	93.5	93.0	85.0	81.8	74.1	42.3	785	14.51	190	145	245	0.789	80	176	
30	40	1470	200L	93.6	94.5	94.5	86.0	84.5	77.0	56.6	830	19.85	250	205	280	1.451	83	256	
37	50	1480	225S	93.9	94.5	94.0	85.5	82.0	73.0	70.0	760	24.33	210	175	300	1.896	84	290	
45	60	1480	225M	94.2	94.5	94.6	85.0	80.0	70.4	85.4	735	28.98	210	175	290	1.979	84	319	
55	75	1485	250M	94.6	94.6	94.0	87.5	84.5	77.0	101	780	36.04	210	185	265	3.911	85	426	
75	100	1480	280S	95.0	95.0	94.6	86.0	82.0	73.0	141	770	48.38	160	150	300	5.033	88	545	
90	125	1480	280M	95.2	95.2	94.7	85.0	81.0	71.3	169	780	59.28	175	165	300	6.112	86	615	
110	150	1480	315S	95.4	95.2	94.8	88.0	86.5	80.5	198	725	72.43	210	180	270	7.600	94	916	
132	175	1485	315M	95.6	95.5	94.8	88.0	87.5	83.0	238	700	86.62	180	170	230	10.40	94	895	
160	215	1482	315L	95.8	95.8	94.8	88.0	87.0	83.5	289	700	105.2	180	170	230	11.60	94	1,055	
200	270	1485	315L	96.0	95.6	95.2	88.0	87.0	84.5	360	700	131.2	180	170	230	14.00	94	1,215	
250	335	1485	355M	96.0	95.8	96.3	87.0	84.5	77.5	455	740	164.1	150	170	230	27.80	95	1,564	
315	420	1487	355L	96.0	95.8	95.3	87.0	84.5	77.5	573	740	206.4	180	170	260	31.20	95	1,764	
355	475	1485	355C	96.0	95.8	95.3	89.0	87.5	81.0	631	780	233.8	200	180	280	35.80	95	2,350	
400	540	1487	355C	96.0	95.8	95.3	89.5	88.0	83.0	707	780	262.1	200	180	260	42.80	95	2,630	

NOTE: 1. The above are typical values based on test according to GB/T 1032 method B, IEC 60034-2-1:2014.
2. Tolerance according to GB 755, IEC 60034-1.
3. Breakdown & Locked rotor torques are show as average expected voltages.
4. Noise : sound power level at no-load, dB(A), Tolerance + 3 dB(A)
5. Data subject to change without notice

Project : Proposed Development at Ma Wan Park Phase II, Ma Wan
(To be known as Ma Wan Lot No. 739, Ma Wan Village)

Equipment Schedule

12c. Extraction Fan

Manufacturer	WINFAN
Country of Origin	China
Model	HF151B-3KW
Flow rate	0.46m^3/sec vs 2000Pa
Power transmission	Belt driven
Casing / Impeller	FRP
Shaft materials	SS316L
Motor mounting frame	SS316L
Fan base frame	SS41 with Epoxy painting
Bolt and nuts	SS316
Motor	TECO
Model	TEV3/100L-3KW-4P-B3
Frame size	100L
Operating Voltage	380VAC / 3 ph / 50Hz
Motor rating	3 kW
No of pole	4
Speed	1455RPM
IP rating	55
Insulation Class	F
Efficiency Class (IEC)	IE3
Fan and Motor weight (kg)	200 kg

Chapter One Main parameter

Main Parameters/Model		ZLMD-1
Process Air	Rated Airflow（m^3/h）	150
	Process ESP（Pa)	/
	Process Motor Power (kW)	0.12
Reactivation Air	Rated Airflow（m^3/h）	50
	Process ESP（Pa)	/
	React. Motor Power (kW)	0.037
Drive Motor	Motor Power (kW)	0.015
Reactivation Mode	Electric, Max Power(kW)	1.0
	Steam Pressure(Mpa)	/
	Steam, Steam Consumption（kg/h)	/
Installed Power	Electric Heating Mode (kW)	1.172
	Steam Heating Mode (kW)	/
Moisture Removal (kg/h)		0.6
Power source		220V/50Hz, 1phase
Approx. Size (L*W*H) mm		572×420×420
Approx. Weight(kg)		30
Latent heat temperature rise (kW/h)		**0.9~1.1**
Note	1. The desiccant dehumidifier will carry latent heat temperature rise to the dry room, please add the cooling capacity of the A/C to overcome the heat. 2. We provide the whole dehumidifier, users should provide the electricity for the reactivation of the dehumidifier, and also purchase and install the air pipe system themselves.	

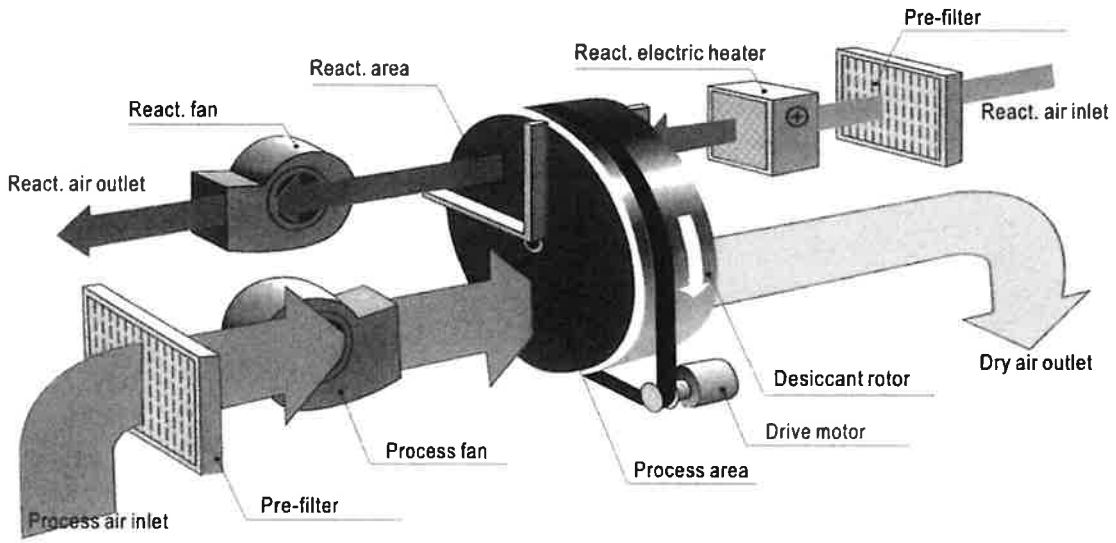
Chapter Two Structure and Work Principle

The core component of rotary dehumidifier is the 8-16 hour spin in turn densely cellular Conde desiccant wheel. The desiccant wheel on both sides by high-performance silicon fluorine rubber seals along the entire surface of the radial will be divided into 270 ° of the treatment area and 90 ° of the regeneration zone, when the moist air comes into the processing area, the air moisture in the desiccant wheel was adsorbed into dry air, dry air meet the need of dry place or gas production process.

With the increases of absorptive water in the absorption process, desiccant wheel gradually loss of moisture absorption capacity. In order to maintain constant moisture absorption capacity, rotary should be regenerated. So, tending to saturation the drive wheel driven by the motor slowly turns into the regeneration area, regeneration restored.

Heated to 100-140℃, the regeneration air and deal with the wind in the opposite direction enters into the regeneration zone, the moisture desorption in the wheel takes exhausted to outside by renewable wind. Desiccant wheel restore moisture absorption capacity and under the drive of low-level driver enters into the handling area to process and absorb the wind again.

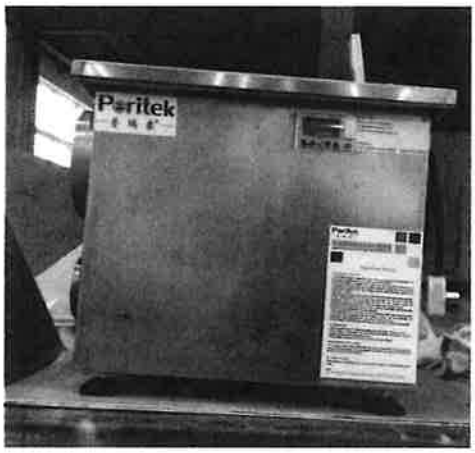
When wheel rotate constantly, dehumidify and regeneration continues. Thus, exporting the constant humidity and dry air won't stop.

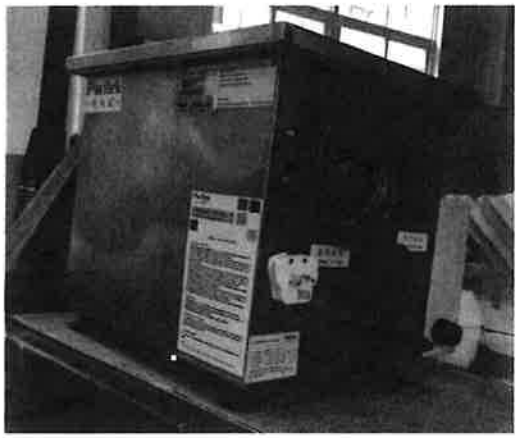


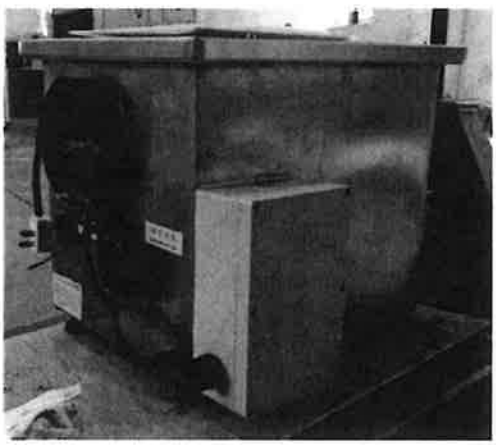
Chapter Three Main Components

Name	Manufacturer
Desiccant rotor	PURESCI, USA
Process fan	Hangzhou Dunli or equal
Reactivation fan	Hangzhou Dunli or equal
Reducer	JIAXUE GROUP or equal
Cabinet	Stainless Steel 316
Temperature and humidity probe	EYC

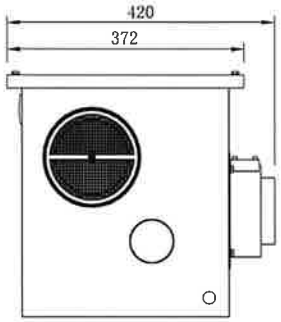
Pictures:

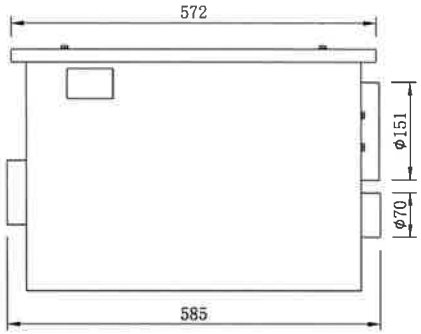


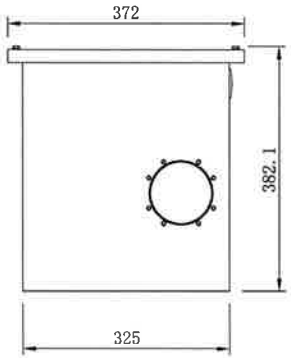


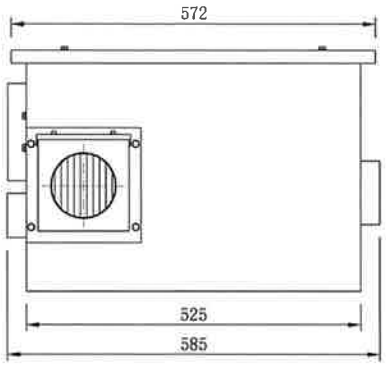


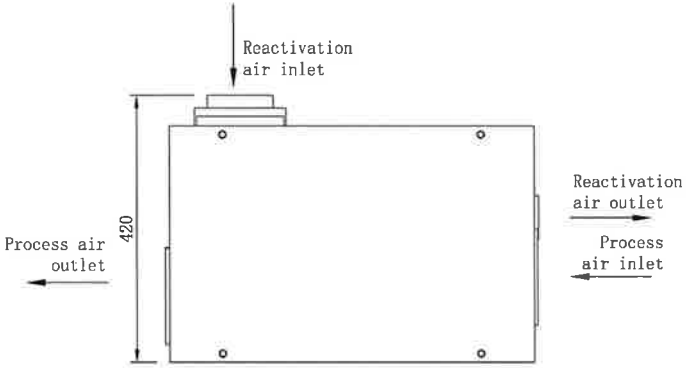
尺寸分段	0.5-6	>6-30	>30-120	>120-400	>400-1000	>1000-2000
未注公差值	±0.1	±0.2	±0.3	±0.5	±0.6	±1.2

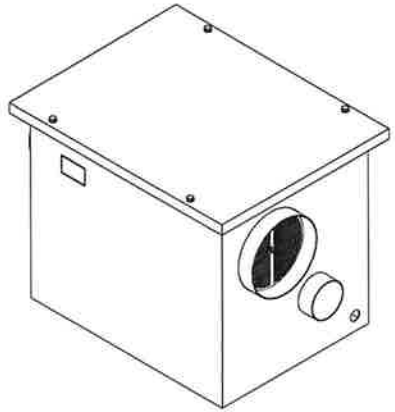












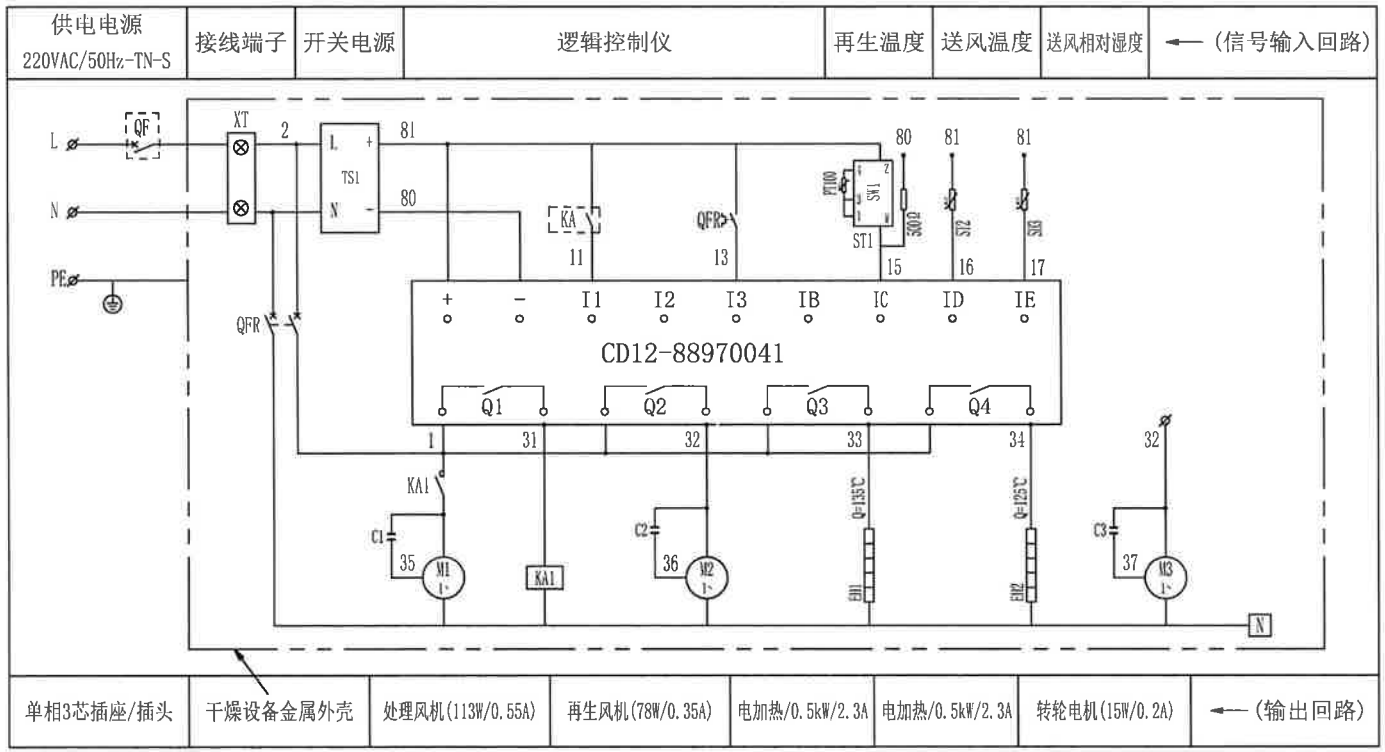
Rated process airflow, m³/h	150
Rated react. airflow, m³/h	50
React. heating power, kW	1.0
Process fan power, kW	0.12
React. fan power, kW	0.037
Rated dehumidify capacity, kg	0.6
Overall dimensions, mm	585×420×382

01	Agu30	2ed issue	Liao	Dong	Zhou	SUS316
00	Agu24	1st issue	Liao	Dong	Zhou	
REV.	Date	Revision	Drawn	Checked	Released	
设计			标准化			阶段标志 / 重量 / 比例 1:5
审核						共 页 第 页
工艺			批准			

HZ PERITECH

Outside drawing

ZLMD-1



XT1：电控柜接线端子

1	2	3	4	5	6	7	8
QFR		KA1		KA			
60	61	62	63	81	11		
报警信号		运行信号		开关机信号			

报警信号

注：“QFR”为无源开关报警信号（断开--报警，闭合--复位）

备注：“QFR”用户实际接收信号（断开--复位，闭合--报警）

远程开/关机信号

注：“KA” 为远程开关机信号，由用户提供无源接点（闭合--开机，断开--停机）

运行信号

说明：1、供电电源为TNS或TNCS系统，电源侧装空气断路器；

2、用户必须选用单相三极电源插座，要求电源插座的接地保护线必须与合格的接地装置作永久的可靠电气连接，插座的永久保护接地线的截面应≥2.5mm² 铜芯线；

注意：严禁在设备运行时拔插头，若要使设备停止运行，则应按下按钮，等设备停机后，方可拔下插头。

普瑞泰® Peritek

设计			标准化		
审核					
工艺			批准		

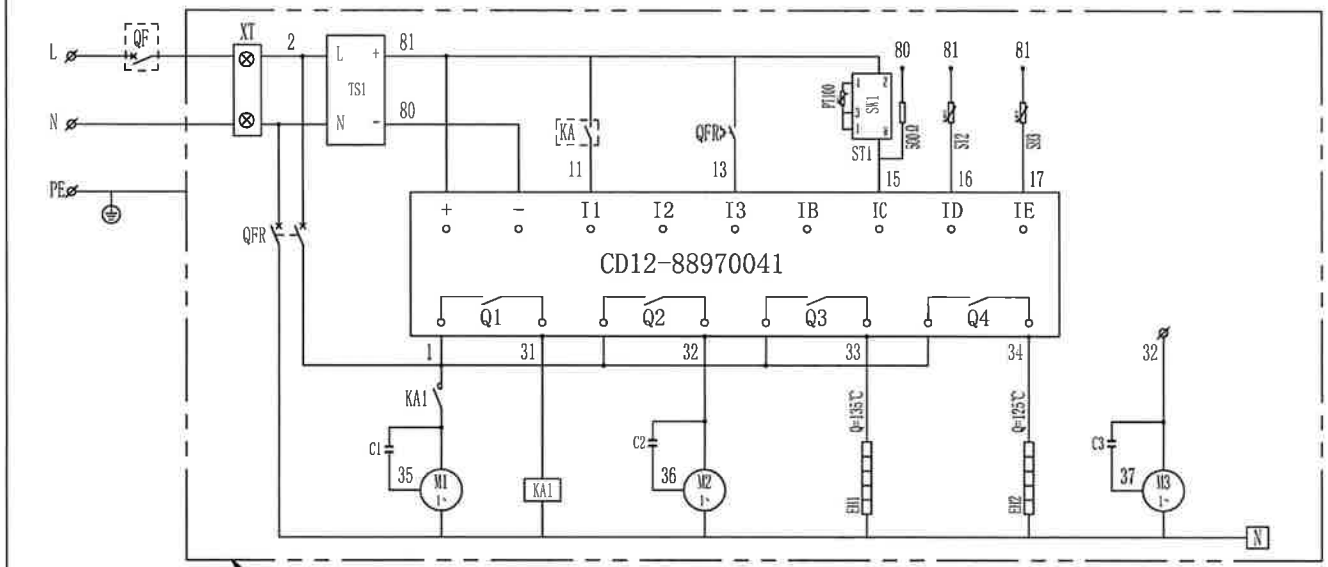
阶段标志	重量	比例
共 页 第 页		

杭州普瑞除湿设备有限公司

电气原理图

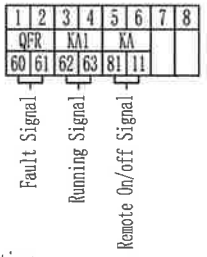
ZLMD-1

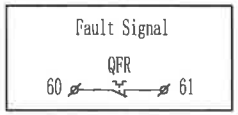
Power Supply 220VAC/50Hz-TN-S	Terminal Blocks	Switching Power Supply	Logic Controller	Reactivation Temperature	Supply Air Temperature	Supply Air Relative Humidity	← (Signal Input Circuit)



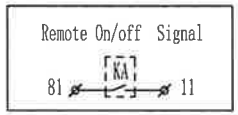
Single phase 3 core socket/ plug	Metal shell of the dehumidifier	Process Fan 113W/0.55A	Reactivation Fan 78W/0.35A	1#Electrical Heat 0.5kW/2.3A	2#Electrical Heat 0.5kW/2.3A	Rotor Motor 15W/0.2A	← (Output circuit)

XT: Electric Control Cabinet Terminal Blocks





Note: "QFR" is passive fault alarm signal(on--alarm, off--reset)



Note: "KA" is remote on/off signal, users provide the passive contact. (on--start, off—stop)

Description:

1. The power supply is TNS or TNCS system, power supply should be installed with air circuit breaker.
2. The user must use single-phase three-pole socket, grounding protection wire of the power socket must be connected to the qualified grounding device constantly and reliably. The section of grounding protection wire electrical connections, socket of permanent protection grounding line cross should should ⩾2.5mm copper wire;

Note: it is strictly prohibited to pull the plug at run time, to stop running equipment you should press the button.

普瑞泰® Peritek

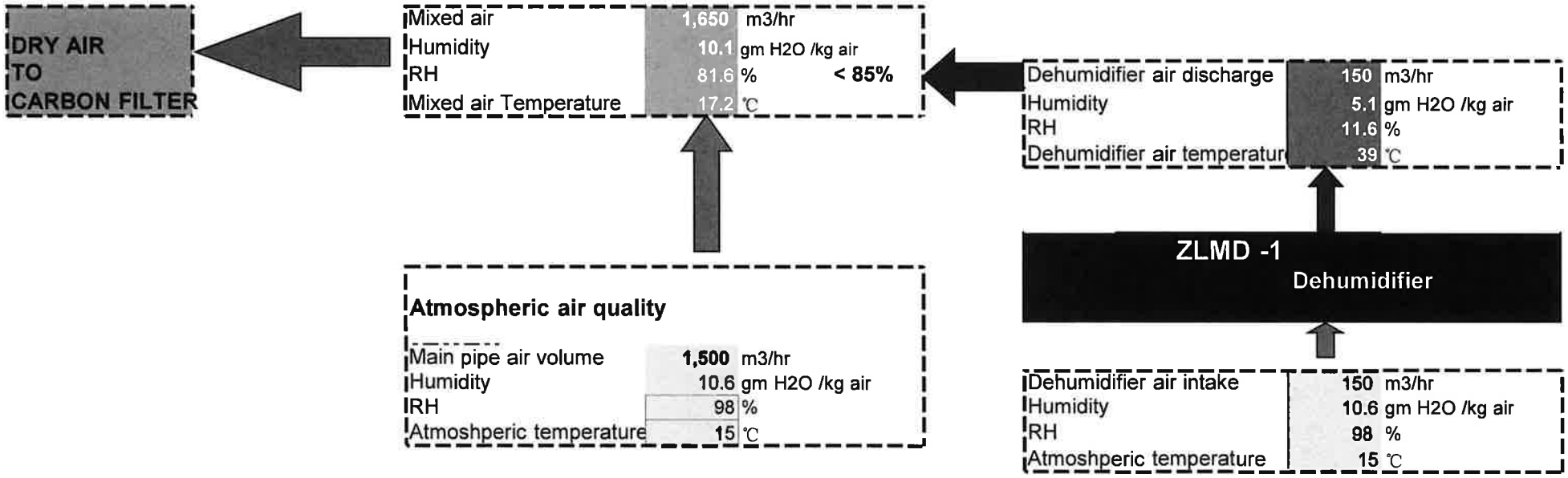
设计			标准化			阶段标志	重量	比例
审核						共 页 第 页		
工艺			批准					

HZ Peritech Dehumidifying Equipment Co., Ltd

Electronic Schematic Diagram

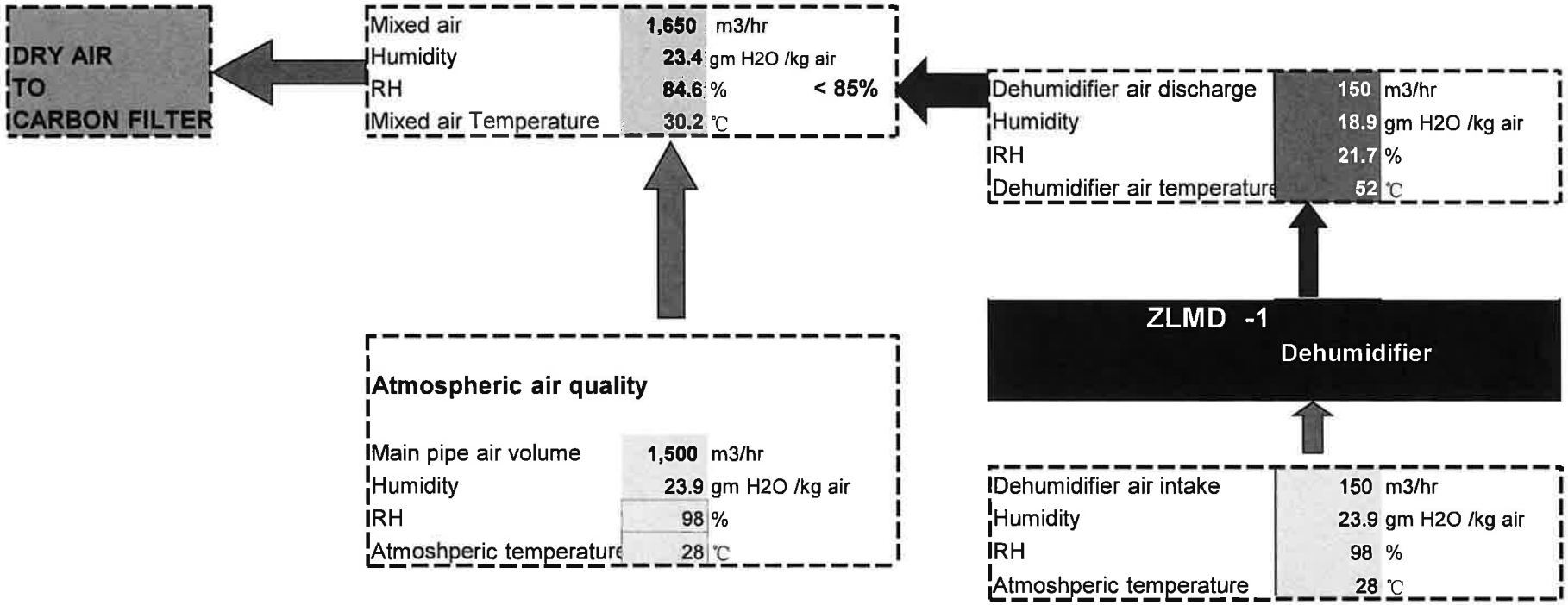
ZLMD-1

Calculation on the process air temperature and moisture content upstream the carbon filter (MWP2)



Lower Temperature

Calculation on the process air temperature and moisture content upstream the carbon filter (WMP2)



Higher Temperature

Project : Proposed Development at Ma Wan Park Phase II, Ma Wan
(To be known as Ma Wan Lot No. 739, Ma Wan Village)

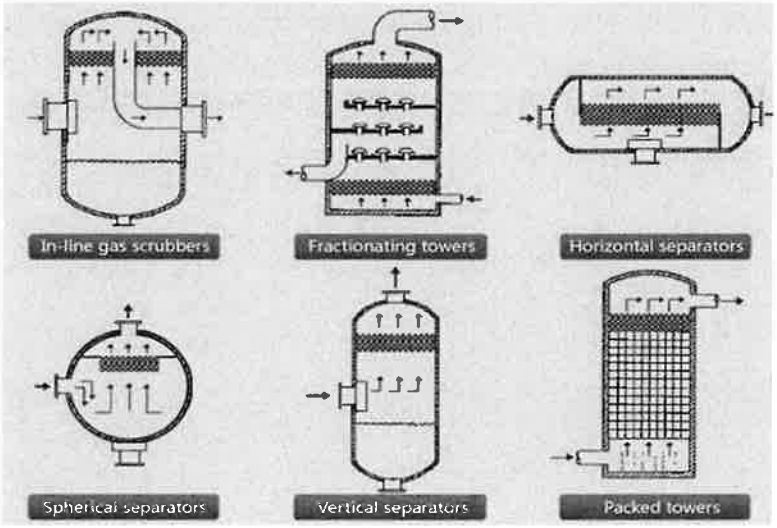
Equipment Schedule

12d. Dehumidifier

Manufacturer	Peritech
Country of Origin	China
Model	ZLMD-1
Type	Desiccant wheel
Material of construction	316 Stainless steel
Location	Indoor
Rated process air (m^3/h)	150 max
Electric power rating (kW)	1.5
Dehumidify capacity (kg/h)	1.5
Power input	220V/ 50Hz/ 1phase
Overall dimension (mm)	572L x 420W x 420H
Weight (Kg)	30

Mesh Mist Eliminator or Demister is a kind of vapor liquid separating device. It is widely used in the chemical, petroleum, medical, light, metallurgy and environmental protection industries. Rage sourced Mesh mist eliminator for a chemical scrubber or biofilter for odor control purpose shall be capable to separate 98- 99% liquid drop with diameter 5-10 microns at velocity of 1-5m/s.

Typical installation of demister



Forms available : Disc, Cube

Standard materials :

Metallic :- 321SS, 304SS, 316SS, Titanium

Non-metallic : - PTFE, Nylon yarn, PVC, Poly proplene

Other materials : Consult factory

Size : To order, made to fit the tower or vessel

P.P Mesh Demister (Poly propylene)

P.P Mesh Demister (Poly propylene)

P.P Mesh Demister (Poly propylene)

SUS Mesh Demister (SUS316L)

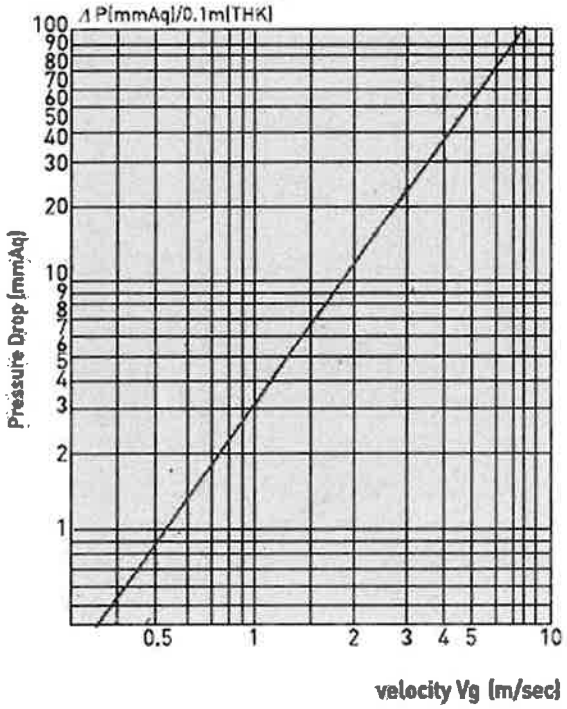
SUS Mesh Demister (SUS304)

SUS Mesh Demister (SUS316)

Technical data of Mesh mist eliminator

Density (Kg/m^3)		Free area (%)		Surface area (m^2/m^3)		Equivalent Style		
SS	PP	SS	PP	SS	PP	Dae Shin	York	GOTO Shoji
193	42	97.6	95.4	378	690	DSM193	421	S370

The mist eliminator has high collection efficiency and low pressure drop. The following is chart for pressure Drop vs Air velocity.



Project : Proposed Development at Ma Wan Park Phase II, Ma Wan
(To be known as Ma Wan Lot No. 739, Ma Wan Village)

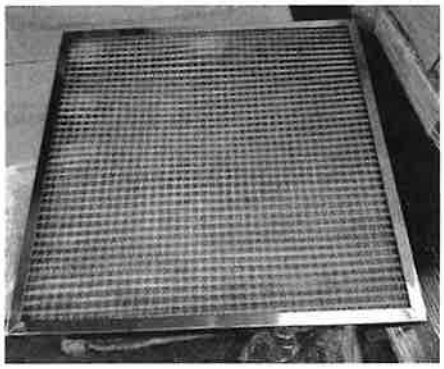
Equipment Schedule

12e. Mist Eliminator

Manufacturer	RAGE
Type	Mesh
Materials	316 stainless steel
Size (mm)	600 x 600
Mesh thickness (mm)	100
With grid thickness (mm)	150
Face velocity (m/s)	1.27
Removal efficiency	98-99% on 10 microns droplet
Housing for mist eliminator	Combined with pre-filter (see details in Pre-filter schedule)

ATF
AIRTENGGROUP

Introduction of 'ATF' air filter:



Product : Multi-layers air filter

Nominal size : 600 * 600 * 50mm (standard)
Measurement : 595 * 595*44mm
other size available on request.

Material :-
Frame : Aluminum (standard)
316SS (available on request)
Filter material : 316SS mesh washable
Efficiency : 40%
Static pressure : 60pa-80pa
Nominal air flow : 3,500m^3/h

Design features
Design for capture of bigger size dust and ash
Low head loss
Light and compact
Washable for reuse
Comply to ASHRAE 52-76, removal efficiency 40%

Applications :-
Pre-filter of air conditioning system
Pre-filter of a multi filtration system
Filter for air containing organic solvent

Project：Proposed Development at Ma Wan Park Phase II, Ma Wan
(To be known as Ma Wan Lot No. 739, Ma Wan Village)

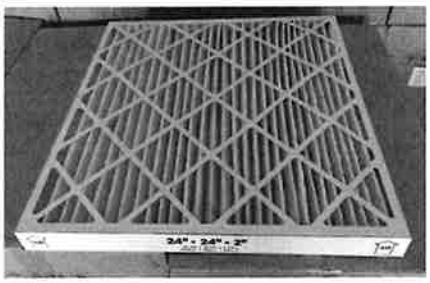
Equipment Schedule

12f. Pre-filter

Manufacturer	ATF
Type	Pre-filter
Frame material	316SS
Filter material	316SS mesh
Size (mm)	600 x 600
Filter thickness (mm)	50
Face velocity (m/s)	1.27
Max. working temperature (℃)	100
Standard	ASHRAE 52-76
Removal Efficiency (%)	40
Material	316 stainless steel
Overall size (mm)	671 x 608 x 660L
End connections	Flange

ATF
AIRTENGGROUP

Introduction of 'ATF' air filter:



Product : Surface Pleated Panel Filter
Nominal size : 600 * 600 * 50mm (stock item)
Measurement : 595 * 595*44mm
other size available on request.

Material :-
Frame : Board frame (standard)
Aluminium /316SS (available on request)
Filter material : Synthetic, electrostatically charged media
Efficiency : 90 %
Initial static pressure : 50pa-80pa depends on velocity

Characteristics

- High initial efficiency and lower initial resistance
- Expanded metal pleat support grid laminated to the media pack to increase rigidity and help maintain proper spacing between pleats.
- Easy for handling

Applications

Capture for 0.5 μm and up fine particulate
Air conditioning system

Project : Proposed Development at Ma Wan Park Phase II, Ma Wan
(To be known as Ma Wan Lot No. 739, Ma Wan Village)

Equipment Schedule

12g. After-filter

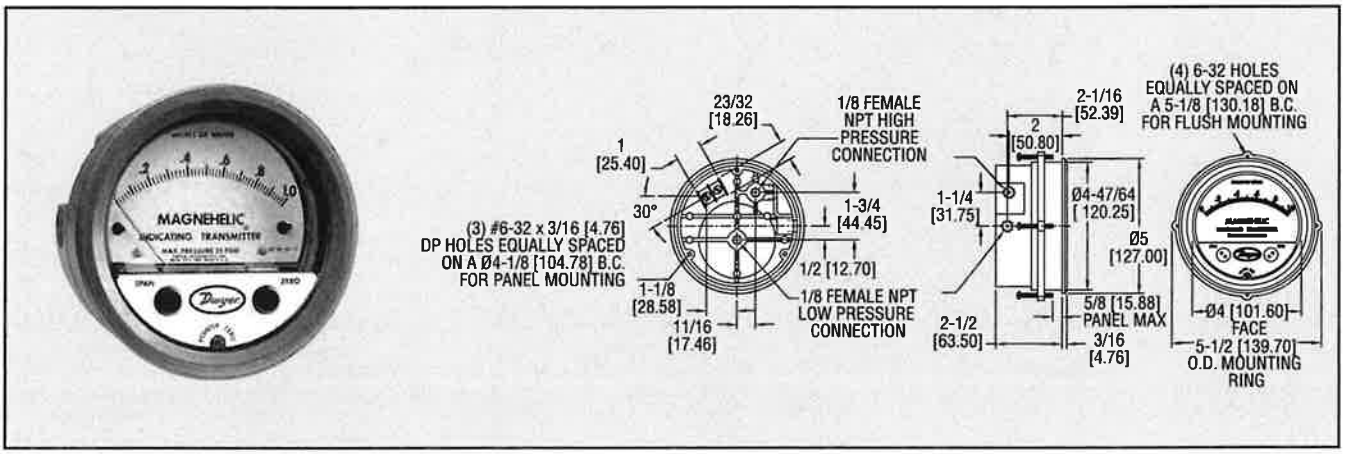
Manufacturer	ATF
Type	After-filter
Frame material	Paper
Filter material	Synthetic
Size (mm)	600 x 600
Filter thickness (mm)	50
Face velocity (m/s)	1.27
Max. working temperature (℃)	80
Standard	EN779 - G4
Removal Efficiency (% of particulate)	90
Material	316 stainless steel
Overall size (mm)	671 x 608 x 500L
End connections	Flange

Series 605

Magnehelic® Differential Pressure

Indicating Transmitter

CE



The Series 605 Magnehelic® Indicating Transmitter provides for both visual monitoring and electronic control of very low differential pressure. The Series 605 is ideal for control applications in building HVAC systems where local indication is desired during routine maintenance checks or necessary when trouble shooting the system. The easily read dial gage is complimented by the two-wire, 4-20 mA control signal utilizing the time-proven Dwyer® Magnehelic® gage mechanical design and Series 600 transmitter technology. The 2-wire design with terminal strip on the rear simplifies connection in any 4-20 mA control loop powered by a 10-35 VDC supply.

Model	Range in w.c.	Maximum Pressure	Electrical Accuracy +/-%	Mechanical Accuracy +/-%
605-00N	.05-0-.20	25 psi (1.7 bar)	2	4
605-11	.25-0-.25	25 psi (1.7 bar)	2	3
605-0	0-.50	25 psi (1.7 bar)	2	3
605-1	0-1.0	25 psi (1.7 bar)	2	2
605-2	0-2.0	2 psi (13.79 kPa)	0.5	2
605-3	0-3.0	2 psi (13.79 kPa)	0.5	2
605-6	0-6.0	2 psi (13.79 kPa)	0.5	2
605-10	0-10	2 psi (13.79 kPa)	0.5	2
605-20	0-20.0	11 psi (75.8 kPa)	0.5	2
605-30	0-30	11 psi (75.8 kPa)	0.5	2
605-50	0-50	11 psi (75.8 kPa)	0.5	2
	Range in Pa			
605-60PA	0-60	25 psi (1.7 bar)	2	4
605-125PA	0-125	25 psi (1.7 bar)	2	3
605-250PA	0-250	25 psi (1.7 bar)	2	2
605-500PA	0-500	2 psi (13.79 kPa)	0.5	2

ACCESSORIES

A-298, Flat Aluminum Bracket - for flush mounting
A-370, Mounting Bracket - flush mount Series 605 Transmitter in bracket. Bracket is then surface mounted. Steel with gray hammertone epoxy finish

OPTION

For NIST traceable calibration certificate, add suffix -NIST to model numbers. Example: 605-3-NIST.

See page 567 for process tubing options.
See page 568 for static fitting options.

SPECIFICATIONS

GAGE SPECIFICATIONS

Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Accuracy: See chart.
Stability: ±1% FS/yr.
Pressure Limits: See chart.
Temperature Limits: 20 to 120°F (-6.67 to 48.9°C).
Process Connections: 1/8" female NPT.
Size: 4" (101.6 mm) dial face, 5" (127 mm) OD x 2-11/16" (68.3 mm).
Weight: 1 lb, 12.6 oz (811 g).
Agency Approvals: CE.

TRANSMITTER SPECIFICATIONS

Accuracy: See chart (includes linearity, hysteresis, repeatability).
Temperature Limits: 20 to 120°F (-6.67 to 48.9°C).
Compensated Temperature Range: 32 to 120°F (0 to 48.9°C).
Thermal Effect: ±0.025% FS/°F (0.045% FS/°C).
Power Requirements: 10-35 VDC (2-wire).
Output Signal: 4 to 20 mA.
Zero and Span Adjustments: Protected potentiometers.
Loop Resistance: DC; 0-1250 Ω max.
Current Consumption: DC; 38 mA max.
Electrical Connections: Screw terminal block.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.

Project : Proposed Development at Ma Wan Park Phase II, Ma Wan
(To be known as Ma Wan Lot No. 739, Ma Wan Village)

Equipment Schedule

12h. Differential Pressure Gauge

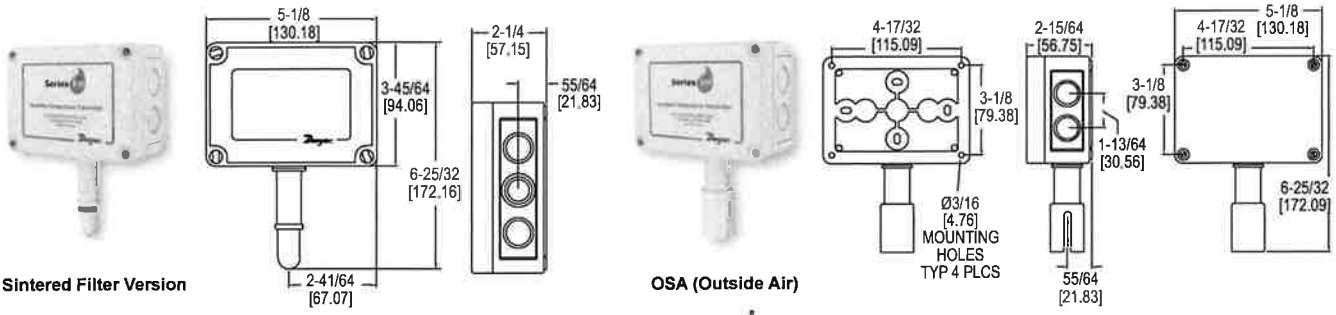
Manufacturer	DWYER
Country of Origin	USA
Type	Magnehelic DP Indicating Transmitter
Model	605-1.5KPa – 1 no 605-250Pa – 1 no 605-125Pa – 1 no
Measuring range	0 – 1500Pa (for carbon bed) 0 – 250Pa (for prefilter and demister) 0 - 125Pa (for after filter)
Accuracy	Electrical : +/- 0.5% Mechanical : +/-2%
Size	4" dial face
Display	Pointer
Connection	1/8" NPT (F) and 6mm PE tubing
Output signal	4-20mADC
Power requirement	10-35VDC (2-wire)

Dwyer

SERIES RHP

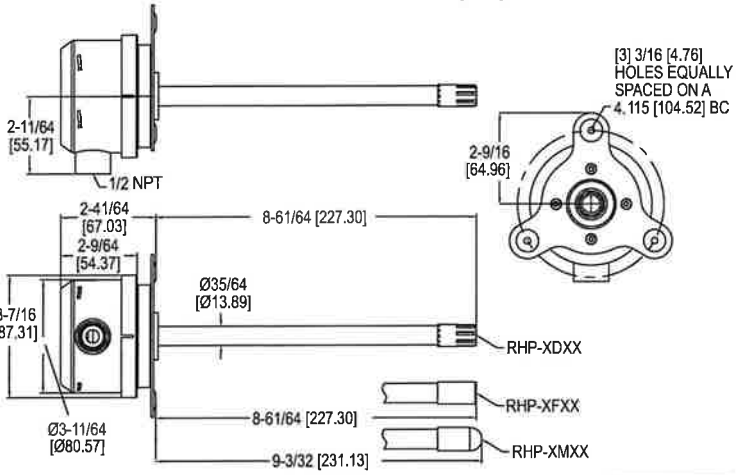
HUMIDITY/TEMPERATURE TRANSMITTER

Passive Temperature Outputs, Sintered Filter Options



Duct Mount

Duct Sintered



The **SERIES RHP** Temperature and Humidity Transmitter combine the voltage or current humidity transmitter output with a passive temperature thermistor or RTD output. Featuring polymer capacitance humidity sensors, models are available with 2%, 3% or 5% accuracies. Duct mounted transmitters are available with an optional two-line alpha numeric LCD display.

FEATURES/BENEFITS

- 2%, 3%, or 5% accuracy models
- Optional LCD display on duct mount models
- Radiation shield option for outdoor installation in direct sunlight

APPLICATIONS

- Air economizers
- Outdoor temperature and relative humidity reference
- Pool room humidity monitoring

MODEL CHART

Example	RHP	-2	D	1	A	-LCD	RHP-2D1A-LCD
Series	RHP						RH/passive temperature sensor transmitter
Accuracy		2					2% accuracy
		3					3% accuracy
		5					5% accuracy
Housing Type			D				Duct mount w/ membrane filter
			F				Duct mount w/ SS sintered filter
			M				Duct mount w/ HDPE filter
			O				OSA (outside air)
			S				OSA w/sintered filter*
			R				Radiation shield
RH Output				1			4 to 20 mA
				2			0 to 10 V
				3			0 to 5 VDC
Temperature Sensor					0		None
					1		4 to 20 mA
					2		0 to 10 VDC
					3		0 to 5 VDC
					A		10K @ 25°C thermistor type III
					B		10K @ 25°C thermistor type II
					C		3K @ 25°C thermistor
					D		100 Ω RTD DIN 385
					E		1K Ω RTD DIN 385
					F		20K Ω @ 25°C thermistor
Options						LCD	LCD display
						NIST	NIST traceable calibration certificate

*Use OSA with sintered filter models when purchasing Series RHRS radiation shield separately.

SPECIFICATIONS

Relative Humidity Range: 0 to 100% RH.
Temperature Range: -40 to 140°F (-40 to 60°C).
Accuracy, RH: RHP-2XXX ±2% 10-90% RH @ 25°C; RHP-3XXX ±3% 20-80% RH @ 25°C; RHP-5XXX ±5% 20-80% RH @ 25°C.
Accuracy, Thermistor Temp Sensor: ±0.2°C @ 25°C (±0.36°F @ 77°F).
Accuracy, RTD Temp Sensor: DIN Class B; ±0.3°C @ 0°C (±0.54°F @ 32°F).
Accuracy, Solid State Band Gap: ±0.9°F @ 77°F (±0.3°C @ 25°C).
Hysteresis: ±1%.
Repeatability: ±0.1% typical.
Temperature Limits: -40 to 140°F (-40 to 60°C).
Storage Temperature: -40 to 176°F (-40 to 80°C).
Compensated Temperature Range: -4 to 140°F (-20 to 60°C).
4 to 20 mA Loop Powered Models: Power requirements: 10 to 35 VDC; Output signal: 4 to 20 mA.
0-5/10V Output Models: Power requirements: 15 to 35 VDC or 15 to 29 VAC; Output signal: 0 to 10 V @ 5 mA max.
Solid State Band Gap Temperature Sensor Output Ranges: Switch selectable, -20 to 140°F (-28.9 to 60°C); 0 to 100°F (-17.8 to 37.8°C); 40 to 90°F (4.4 to 32.3°C); -4 to 140°F (-20 to 60°C).
Response Time: 15 seconds.
Electrical Connections: Removable screw terminal block.
Conduit Connection: Duct mount: 1/2" NPS; OSA: 1/2" (22.3 mm).
Drift: < 1% RH/year.
RH Sensor: Capacitance polymer.
Temperature Sensor: Types 1, 2, 3: Solid state band gap; Curves A, B, C: Thermistor; Curves D, E: Platinum RTD DIN 385.
Enclosure: Duct mount: PBT; OSA: Polycarbonate.
Enclosure Rating: Duct mount: NEMA 4X (IP66) for housing only; OSA: NEMA 4X (IP66).
Display: Duct mount only, optional 2-line alpha numeric, 8 characters/line.
Display Resolution: RH: 0.1%; 0.1°F (0.1°C).
Weight: Duct mount: .616 lb (.3 kg); OSA: 1 lb (.45 kg).
Agency Approvals: CE.
Warranty: 5 year limited warranty.

Project : Proposed Development at Ma Wan Park Phase II, Ma Wan
(To be known as Ma Wan Lot No. 739, Ma Wan Village)

Equipment Schedule

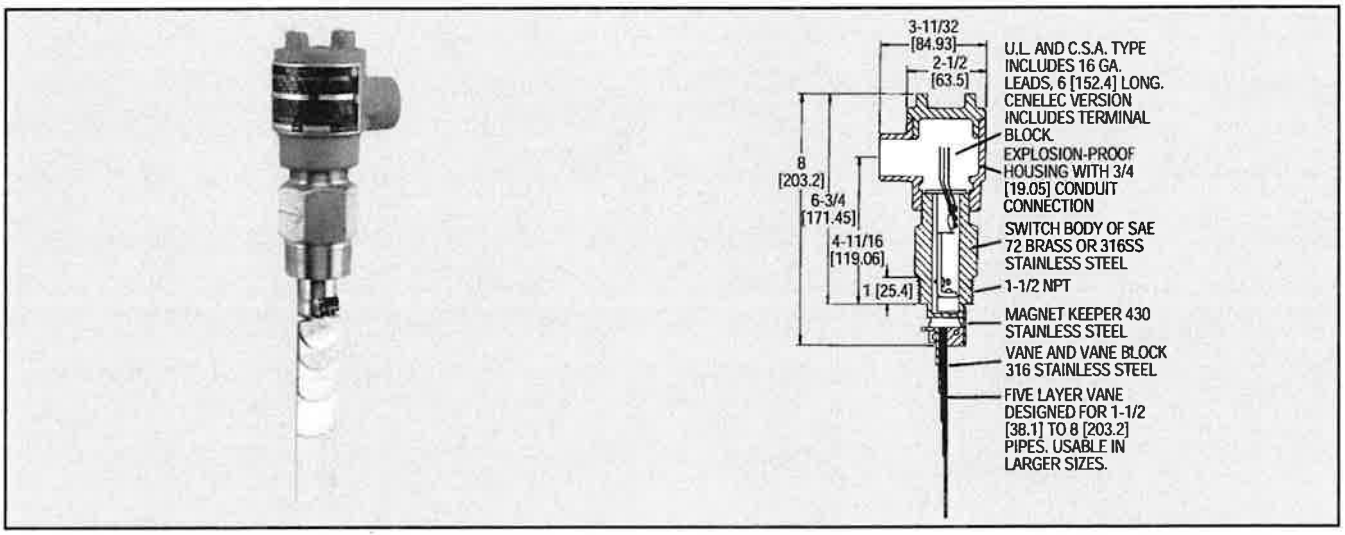
12i. RH Transmitter

Manufacturer	Dwyer
Country of Origin	USA
Model	RHP-3D11
RH Range	0-100% RH
Temperature Range	-40 to 60℃
Accuracy	+/- 3% @20-80% RH @25℃ +/- 0.2℃ @25℃
Repeatability	+/- 0.1% typical
Response time	15 sec
Output signal	4 – 20mADC
Power requirement	10 – 35VDC
Mounting	Duct mount
Conduit connection	½" NPT (F)
Quantity	1 no

Series V4

FLOTECT® Vane Operated Flow Switch

Field Adjustable – Dependable Protection Against Flow Variation or Stopping in Pipelines for Fluids, Gases and Flowing Solids



Rugged and reliable the Series V4 Flotect® flow switch operates automatically to protect equipment and pipeline systems against damage from reduction or loss of flow. The V4 is time tested being installed in thousands of pipelines and processing plants around the world. A unique magnetically actuated switching design gives superior performance. There are no bellows, springs, or seals to fail. Instead, a free-swinging vane attracts a magnet within the solid metal switch body, actuating a snap switch by means of a simple lever arm.

FEATURES

- Leak proof body machined from bar stock
- Choice of custom vane calibrated for your application, Model V4, or field adjustable multilayer vane, Model V4-2-U (see set point chart)
- Weatherproof, designed to meet NEMA 4
- Explosion-proof (listing included in specifications)
- Installs directly and easily into pipeline with a thredolet, tee, or flange (see application drawings)
- Can be used in pipes 1-1/2" and up
- Electrical assembly can be easily replaced without removing the unit from installation so that the process does not have to be shut down
- High pressure rating of 1000 psig (69 bar) with the brass body and 2000 psig (138 bar) with the 316 SS body

APPLICATIONS

- Protects pumps, motors and other equipment against low or no flow
- Controls sequential operation of pumps
- Automatically starts auxiliary pumps and engines
- Stops liquid cooled engines, machines and processing when coolant flow is interrupted
- Shuts down burner when air flow through heating coil fails
- Controls dampers according to flow

Model	Description
V4-2-U	Brass body, universal vane
V4-SS-2-U	316SS* body, universal vane
V4	Brass body, custom vane
V4-SS	316SS* body, custom vane

*316SS body with 430SS magnet keeper.

Consult factory for price and availability of fittings for V4 installation. Thredolets, bushings, and tees are available in a variety of sizes and materials.

For custom vane models, please supply factory with following information: pipe size, flow direction (horizontal, up), mounting, pressure, temperature, specific gravity, flow rates (maximum normal, actuation/deactuation*), etc.
*When both values are supplied, note which is critical.

SPECIFICATIONS

Service: Gases or liquids compatible with wetted materials.
Wetted Materials:
Vane: 316 SS.
Body: Brass or 316 SS standard.
Magnet Keeper: 430 SS standard, 316 SS optional.
Options: Other materials also available, consult factory (e.g. PVC, Hastelloy, Nickel, Monel, Titanium).
Temperature Limit: -4 to 275°F (-20 to 135°C) standard, MT high temperature option 400°F (205°C) [MT option not UL, CSA, ATEX, or SAA].
Pressure Limit: Brass body 1000 psig (69 bar), 316 SS body 2000 psig (138 bar), optional 5000 psig (345 bar) available with 316 SS body and SPDT switch only.
Enclosure Rating: Weatherproof (meets NEMA 4 (IP65)) and Explosion-proof. Listed with UL and CSA for Class I, Groups C and D; Class II, Groups E, F, and G. ATEX CE 0344 Ex II 2 G EEx d IIB T6 -20°C≤Tamb≤75°C; EC-Type Certificate No.: KEMA 03ATEX 2383; SAA: Exd II C T6 (T amb=60°C). Zone I. Also FM approved.
Switch Type: SPDT snap switch standard, DPDT snap switch optional.
Electrical Rating: UL, FM, ATEX and SAA models 10A @ 125/250 VAC (V~). CSA models: 5A @ 125/250 VAC (V~); 5A res., 3A ind. @ 30 VDC (V⎓). MV option: 1A @125 VAC (V~); 1A res., .5A ind. @ 30 VDC (V⎓). MT option: 5A @ 125/250 VAC (V~). [MT and MV option not UL, CSA, FM, ATEX or SAA].
Electrical Connections: UL and CSA models: 16 AWG, 6" (152 mm) long. ATEX and SAA unit: Terminal block.
Conduit Connection: 3/4" female NPT.
Process Connection: 1-1/2" male NPT.
Mounting Orientation: Within 5° of vertical for proper operation. Units for horizontal installation (vertical pipe with up flow) available.
Set Point Adjustment: For universal vane: five vane combinations.
Weight: 4 lb 8 oz (1.9 kg).
Agency Approvals: UL, CSA, CE, FM, SAA, and ATEX.

OPTIONS (add as a suffix to the model number):
-D, DPDT contacts
-MV, Gold Plated Contacts, options for dry circuits (see electrical rating in specification, no listings or approvals)
-MT, High Temperature, option rated 400°F (204°C) (see electrical rating in specifications, no listings or approvals)
-TRI (increasing flow), -TRD (decreasing flow), Time Delay Relay, option with 2 SPDT contacts, adjustable from 0-1 to 0-31 minutes. (no listings or approvals)
-316, 316 SS Magnet Keeper, option to replace standard 430 SS
-SAA, SAA listed construction
-V, Vertical Up Flow, option for upward flow in vertical pipe
-AT, ATEX listed construction

V4 Universal Vane Flow Charts

Values shown in both charts are nominal. If normal flows exceed actuation rates by less than 10%, custom vanes are recommended.
Figures are based on standard vertical installation in a 1-1/2" Threaded Branch Connection in a horizontal run of pipe.

Approximate Actuation/Deactuation Flow Rates for Cold Water.
Upper Figures in GPM. Lower Figures in LPM.

Vane Layers	1.5" Pipe	2" Pipe	3" Pipe	4" Pipe	6" Pipe	8" Pipe	10" Pipe	12" Pipe	14" Pipe	16" Pipe	18" Pipe	20" Pipe
1	7-3	15-8	45-22	95-40	210-120	375-175	600-300	900-450	1200-600	1400-800	2000-1000	2400-1200
	26.67-11.67	56.7-30	167-83.3	367-150	800-450	1417-667	2267-1133	3400-1700	4550-2267	5300-3033	7567-3783	9083-4550
1&2		7-4	23-14	50-35	130-90	230-150	450-250	650-350	900-500	1200-650	1450-800	1800-1000
		26.7-15	86.7-53.3	190-132	500-333	867-567	1700-950	2467-1317	3400-1900	4550-2467	5483-3033	6817-3783
1,2,&3			11-7	27-19	80-60	160-115	300-180	450-275	600-350	750-450	1000-600	1200-700
			41.7-26.7	102-71.7	300-233	600-433	1133-683	1700-1033	2267-1317	2750-2083	3783-2267	4550-2650
1,2,3,&4				17-12	60-45	120-90	230-150	310-200	430-280	550-360	700-450	850-550
				65-45	233-167	450-333	867-567	1167-750	1633-1067	2083-1367	2650-1700	3217-2083
1,2,3,4,&5					40-30	80-65	135-100	200-140	290-200	360-250	460-325	575-400
					152-113	300-250	517-383	750-533	1100-750	1367-950	1733-1233	2183-1517

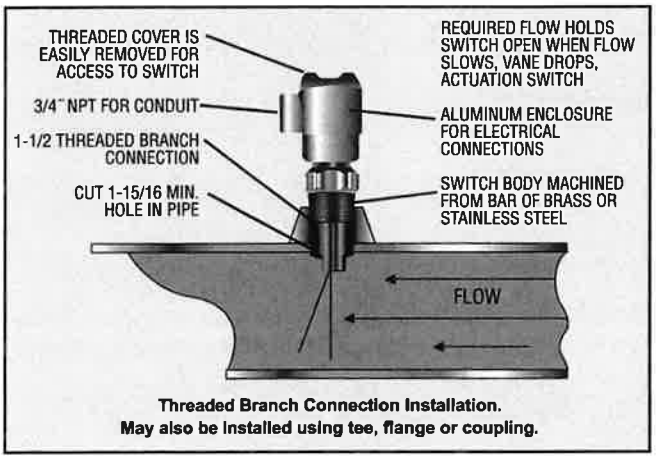
Actuation rates are based on cold water at a specific gravity of 1.0.
For fluids of different specific gravity, actuation rates may be approximated by dividing the rate shown by the square root of the specific gravity.

Approximate Actuation/Deactuation Flow Rates for Cold Air.
Upper Figures in SCFM. Lower Figures in LPS.

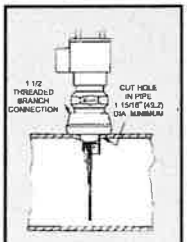
Vane Layers	1.5" Pipe	2" Pipe	3" Pipe	4" Pipe	6" Pipe	8" Pipe	10" Pipe	12" Pipe	14" Pipe	16" Pipe	18" Pipe	20" Pipe
1	32-17	65-32	210-105	400-200	950-475	1550-850	2400-1300	3450-1900	4700-2600	6400-3500	8000-4400	10000-5500
	15-8	30-20	100-50	190-90	450-220	730-400	1100-600	1600-900	2200-1200	3000-1700	3800-2100	4700-2600
1&2		23-13	120-70	195-140	550-375	1100-700	1850-1200	2700-1750	3400-2200	4800-3100	6000-3900	7400-4800
		10-6	60-30	90-70	260-180	520-330	870-570	1300-800	1600-1000	2300-1500	2800-1800	3500-2300
1,2,&3			60-48	135-100	375-265	725-500	1200-850	1850-1300	2600-1800	3350-2350	4300-3000	5300-3700
			30-20	60-50	180-130	340-240	570-400	870-610	1200-800	1600-1100	2000-1400	2500-1700
1,2,3,&4				65-50	260-200	500-400	875-700	1250-1000	1900-1500	2500-2000	3100-2500	3900-3100
				30-20	120-90	240-190	410-330	590-470	900-710	1200-900	1500-1200	1800-1500
1,2,3,4,&5					130-100	310-250	650-525	1000-800	1600-1250	2200-1750	2800-2250	3550-2850
					60-50	150-120	310-250	470-380	760-590	1040-830	1300-1100	1700-1300

Actuation rates are based on air at standard conditions. For gases at other pressures, temperatures, or specific gravities, consult factory for equivalent flow approximations.

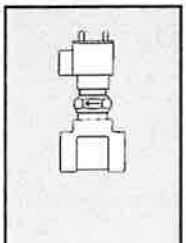
Application Drawings
For Flotect® Automatic Flow Switches



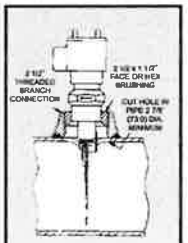
Threaded Branch Connection Installation.
May also be installed using tee, flange or coupling.



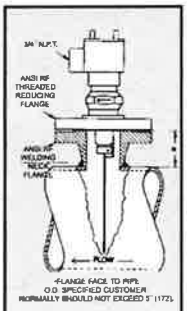
Standard Installation



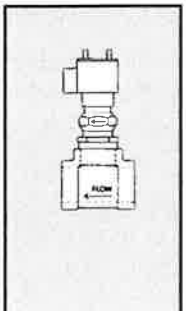
1-1/2" x 1-1/2" x 1-1/2" Tee Installation



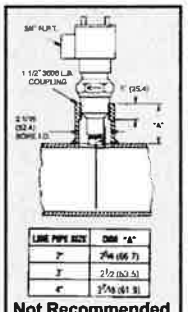
2-1/2" Threaded Branch Connection



Flange Installation



2" x 2" x 2" Tee Installation



Not Recommended, Unless Coupling is Bored Out to 2-1/16" (52.4) As Shown

Project : Proposed Development at Ma Wan Park Phase II, Ma Wan
(To be known as Ma Wan Lot No. 739, Ma Wan Village)

Equipment Schedule

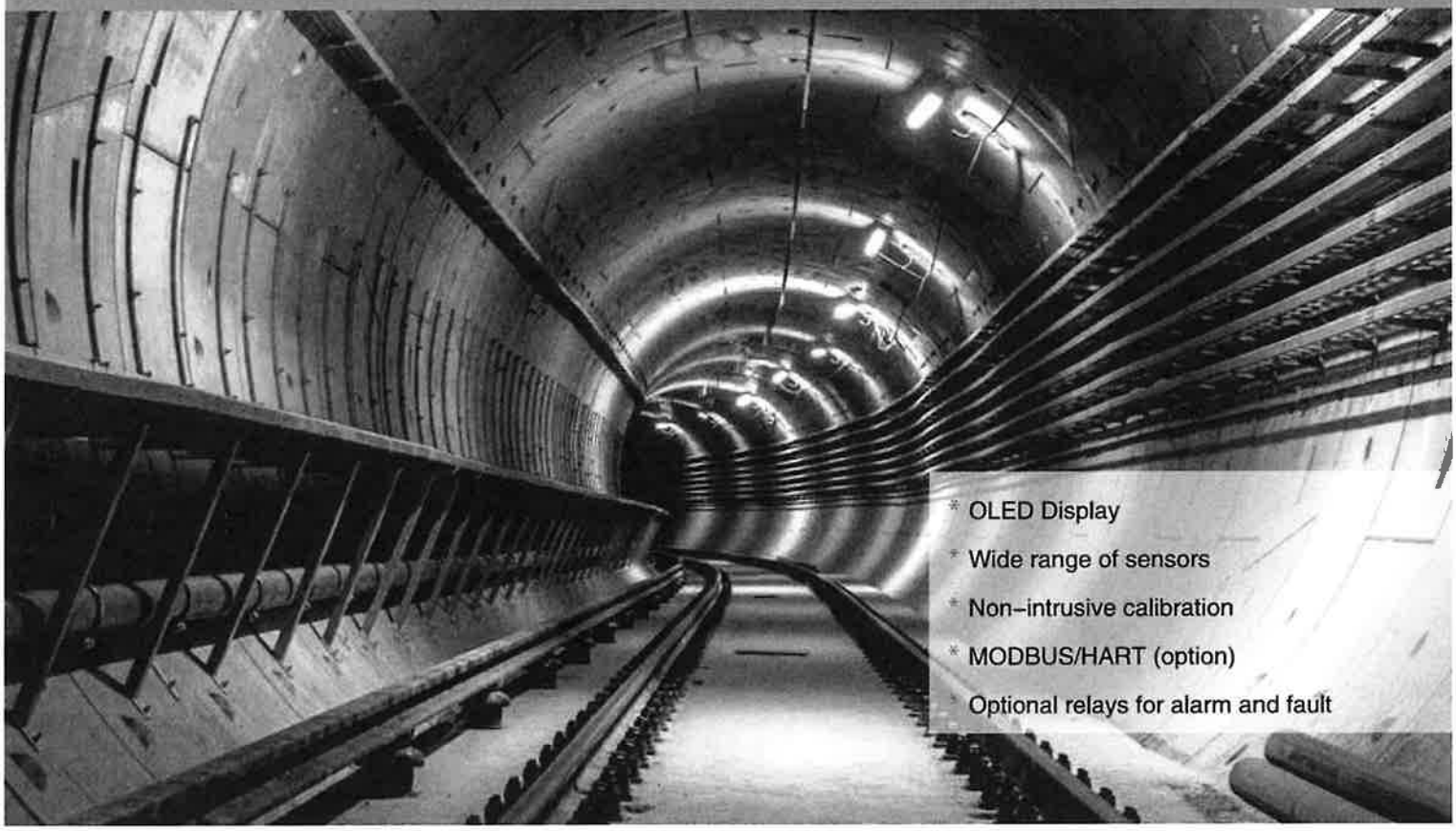
12j. Air Flow Switch

Manufacturer	Dwyer
Country of Origin	USA
Model	V4-SS-2-U
Material	316 SS body and vane
Range	upto 1,650m^3/h or 971scfm
Vane layer	One
Temperature limit	-20 to 135℃
Pressure limit	Upto 2000psig (138 bars)
Protection rating	NEMA4 (IP65)
Switch type	SPDT (10A/250VAC)
Conduit connection	¾" NPT (F)
Process connection	1-½" NPT (M)
Quantity	2 sets

CROWCON
Detecting Gas Saving Lives

Xgard Bright

Fixed Point Gas Detectors with OLED Display



* OLED Display
* Wide range of sensors
* Non-intrusive calibration
* MODBUS/HART (option)
* Optional relays for alarm and fault

Xgard Bright

Fixed Point Gas Detectors with OLED Display

When lives and property are at risk and you need gas detection equipment that is totally reliable, you need Crowcon. For over 47 years Crowcon has been developing and manufacturing high quality products with a reputation for reliability and technical in–novation.

The Xgard Bright range is a comprehensive selection of fixed point gas detectors that meet the diverse requirements for gas detection in industries throughout the world, including water treatment, oil and gas, power, research facility and manufacturing installations.

Xgard Bright wide range of sensor options allow monitoring of flammable, toxic and oxygen gas in hazardous environment while providing ease of operation with one common look and feel. The need for training across products is greatly reduced as Xgard Bright supports over 20 different measurement with a single detector. The large LCD with OLED display allows user to configure and calibrate detector without the need to open the unit, saving both time and cost. Xgard Bright' s compact design means smaller footprint and space saving.

Wide sensor option

- Supports flammable, toxic, oxygen, IR & PID sensor in one instrument
- Optional relay, MODBUS & Hart output
- Stainless steel or aluminium enclosure
- Explosion proof housing
- IP65 or IP66 rating (with weatherproof cap)

Ease of installation

- Plug in type terminal blocks for easy wiring
- Choice of M20 or ½" NPT conduit connection
- Plug in relay module
- Optional sounder/beacon

Compact size

- Small footprint
- Low power requirement (~3W max)
- Lightweight (1kg for Aluminum enclosure)
- Suitable for wall or 2" pipe mounting

Ease of operation

- Configuration via magnetic key
- Non–intrusive calibration without removing cover
- MODBUS or Hart communication for remote access

Xgard Bright Specification:

Junction box material	Aluminium or 316 Stainless Steel
Dimensions	156×166×109mm (6.1×6.5×4.3inches)
Weight	Alloy: 1kg (2.2lbs) Stainless steel: 3.1kg (6.8lbs) approx.
Ingress protection	IP65 or IP66 (with weatherproof cap)
Cable entries	M20 or 1 /2" NPT or 3 /4" NPT
Terminations	0.75~2.5mm^2
Sensor type	Electrochemical/Pellistor/IR
Operating temperature	-40~60°C (-40~140°F)
Humidity	5%-90%RH
Repeatability	+/-2% FSD (Typ.)
Zero drift	+/-2% FSD/$_{month}$ (Typ.)
Operating voltage	10-30V dc
Power requirements	3w max
Display	OLED
Alarm	Sound and Light (Opt)
Relay	Alarm1/Alarm2/Fault Alarm
Contact rating	1A@30V dc
Electrical output	4~20mA (Three-Wire) /Modbus /HART(Optional)
Approvals	ATEX: II 2 G Ex db IIC T6 Gb CCCF GB15322.1-2003, GB12358-2008 IECEx: Ex db IIC T6 Gb

Xgard Bright Gases and Ranges:

Gas type	Ranges Available:
Hydrogen (H_2)	0-100%LEL or 0-200,2000ppm
Methane (CH_4)	0-100%LEL
Ethane (C_2H_6)	0-100%LEL
Propane (C_3H_8)	0-100%LEL
Butane (C_4H_{10})	0-100%LEL
Pentane (C_5H_{12})	0-100%LEL
Ethylene (C_2H_4)	0-100%LEL
Petrol Vapour	0-100%LEL
LPG	0-100%LEL
Hydrogen sulphide(H_2S)	0-1,5,10,20,25,50,100, 200,250,300,1000 ppm
Oxygen (O_2)	0-25%vol
Carbon Monoxide(CO)	0-25,50,100,200, 250,300,1000,2000 ppm
Sulphur Dioxide (SO_2)	0-10,20,50,100,250 ppm
Nitric oxide (NO)	25,50,100ppm
Nitrogen Dioxide (NO_2)	0~10,50,100 ppm
Carbon Dioxide (CO_2)	0~2%vv and 5%vv
IR LEL	0-100% LEL

Notes: Other sensors and ranges may be available, please contact Crowcon.

Project : Proposed Development at Ma Wan Park Phase II, Ma Wan
(To be known as Ma Wan Lot No. 739, Ma Wan Village)

Equipment Schedule

12k. H2S Gas Detector

Manufacturer	Crowcon
Country of Origin	UK
Model	Xgard Bright
Type	Electromagnetic cell
Gas Type	Hydrogen Sulphide
Measuring range	0-20ppm (for activated carbon filter inlet) 0-1 ppm (for activated carbon filter outlet)
Output	4 – 20mA
Power requirement	10-30VDC
Operating temperature	-40 to 60℃
Operating humidity	5-90 %
Physical size	156 x 156 x 109mm
Weight	Approx 1 Kg
Material	Aluminum junction box
IP rating	IP65
Accessories	Air sampling box
Quantity	One each

RAGE INC.
PLUMSTEADVILLE, PA 18949

ECOLO
ENVIRONMENTAL INDUSTRIES

Job Reference of 'Rage' DO system for DSD

	Job Description	Type	Quantity	Air volume	Completion
1	Odour removal at RL P/S at Siu Ho Wan STW (Supply and installation)	Chemical Scrubber	1 set	0.4 m^3/s	2007
2	SO_2 fume recovery system at Stonecutter Island STW (Supply and installation)	A/C filter	1 set	0.17 m^3/s	2009
3	Odour removal at Shui Cheong Street Sewage Pumping Station (Supply and installation)	A/C filter	1 set	1.11m^3/s	2010 /12
4**	Odour removal at Siu Hong Sewage Pumping Station (Supply and installation)	Biofilter & A/C filter for polishing	1 each	0.14 m^3/s	2011 /6
5	Deodourising system for Shatin Sewage Treatment Works (Supply and installation)	Biotrickling filter	2 sets	19,000m^3/h 25,000m^3/h	2012 /2 2012 /6
6	Deodourising system for Sewage Pumping Station and Desilting Compound at Jordon Valley Box Culvert (Supply and installation)	A/C filter	2 sets	3.5 m^3/s 40.0m^3/s	2013 /6
7	Deodourising system for Siu Ho Wan Sewage Treatment Works (Supply and installation)	Biotrickling filter	1 set	8,800m^3/h	2014 /10
8 **	Upgrading of DOU system 2 at Pak Kok Sewage Pumping Station (Supply and installation)	Biofilter & A/C filter for polishing	1 each	850m^3/h	2014 /10

	Job Description	Type	Quantity	Air volume	Completion
9	Deodourising system for Wanchai East PTW - screening plant (Supply only)	Biotrickling filter	1 set	15,000m^3/h	2014 /4
10	Deodourising system for Wanchai East PTW - pumping station (Supply only)	Biotrickling filter	1 set	15,000m^3/h	2015 /1
11	Deodourising system for Tin Liu Ha SPS (Supply only)	Biofilter	1 set	648m^3/h	2015 /1
12	Deodourising system for Tong Min Tsuen SPS (Supply only)	Biofilter	1 set	720m^3/h	2015 /6
13	Deodourising system for North Point PTW (Supply only)	Biotrickling filter	1 set	10,000m^3/h	2015 /10
14	Deodourising system for Central PTW (Supply only)	Biotrickling filter	1 set	25,000m^3/h	2015 /10
15 **	Upgrading of DOU system at Stonecutter Island STW Sludge Holding Tank 1-5 (Supply and installation)	Biofilter & A/C filter for polishing	5 each	324m^3/h	2015 /11
16	Deodourising system for Wanchai East PTW (Supply only)	A/C filter	1 set	2,500m^3/h	2015/12

	Job Description	Type	Quantity	Air volume	Completion
17	Deodourising system for Central PTW (Supply only)	A/C filter	1 set	2,640m^3/h	2016/2
18	Deodourising system for North Point PTW (Supply only)	A/C filter	1 set	2,500m^3/h	2016/7
19 **	Upgrading of existing DO system (DO1) at Sham Tseng Sewage Treatment Works New DO system (DO2) at Sham Tseng Sewage Treatment Works (Supply and installation)	Biofilter Biofilter & A/C filter for polishing	1 set 1 set	6,000m^3/h 10,000m^3/h	2016 /12
20 **	Upgrading of existing DO system at So Kwun Wat Sewage Pumping Station (Supply and installation)	Biofilter & A/C filter for polishing	1 set	4500m^3/h	2017/ 5
21	Deodourising system for To Kwa Wan PTW (Supply & mechanical installation)	A/C filter	2 sets	720m^3/h	2018/10
22	Deodourising system for Shek Wu Hui Sewage Treatment Works (Supply and installation)	A/C filter	1 set	1,000m^3/h	2019/
23 **	Deodourising system for North West Kowloon PTW (Supply and installation)	Biofilter & A/C filter for polishing	1 set	4,000m^3/h	2019/
24	Temporary deodourising system for Shek Wu Hui Sewage Treatment Works (Supply and installation)	A/C filter	1 set	2,100m^3/h	2020/

RAGE INC.
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ENVIRONMENTAL INDUSTRIES

	Job Description	Type	Quantity	Air volume	Completion
25 **	Deodourising system for Ma On Shan area 108 Sewage Pumping Station (Supply and installation)	A/C filter	1 set	4,320m^3/h	2021/ 2

** Direct order from DSD

Updated on 2021-5

shall be incorporated. Operation of the cleansing unit shall not affect the detector output signal. A liquid sensing system shall be provided downstream of the detector head to inhibit the operation of the cleansing unit when the liquid level in the pipe falls below the designed operating level of the unit. The signal cable between the detector head and the transmitter shall have no cable joint.

(6) The indicating transmitter shall be installed at the control kiosk safe and easily accessible to the operator.

(7) The indicating transmitter shall be of minimum 50mm LCD type with scale calibrated in litres per second for the flow range as specified. The system shall be automatically adjusted to zero and no zero adjustment shall be required at start up or any time during subsequent operation.

(8) Installation of electromagnetic flowmeter shall be in accordance with manufacturer's recommendations. Sufficient straight run for inlet and outlet of flowmeter as recommended by the supplier shall be provided.

(9) The flowmeter shall be tested and certified by the manufacturer or approved equivalent for the accuracy limit. The test shall be carried out throughout the whole range of flow. Not less than four (4) test points shall be verified for the flowmeter during the test.

(10) The *Contractor* shall supply and deliver to the Site, one separate piece of spool pipe of each size for replacing the flowmeter detector head when the flowmeter would be removed from the pipework for maintenance. The ductile iron pipe section shall have the same nominal diameter and length as the flowmeter detection head. The ductile pipe section shall comply with the requirements as specified in this Particular Specification.

DEODORIZATION SYSTEM

General 32.43

(1) The *Contractor* shall design, supply, install, setup, test, commission and be liable to defects within the Defects Liability Period of one (1) set of Deodorization System complete with an activated carbon filter unit, extraction fans, volume control dampers, odor ducts, inlet and outlet hydrogen sulphide sensors, pre and after air filter, demister, dehumidifier and all other necessary accessories for the MWSPS.

COMPLY

(2) The deodorization system shall be designed according to the following table:

COMPLY

Type	Regenerated Type Catalytic Activated Carbon
Design Treatment Capacity	1,500 m^3/hr
Hydrogen Sulphide Concentration	Min. 5ppm
Design Removal Efficiency	99.5%
Design Breakthrough Time	Min. 12 Months
Odour Extraction Fan	1 duty 1 standby

DESIGN BREAKTHROUGH TIME 16 MONTHS

(3)

(3) All components of the deodorization system shall be fabricated from stainless steel 316 or glass fibre reinforced resin (GRP) or polyethylene (PE) unless otherwise specified. Supporting framework and maintenance platform for the deodorization system shall be made of GRP or stainless steel. The entire system shall be factory assembled.

FRAMEWORK & PLATFORM BY OTHERS

(4) The deodorizer manufacturer shall have a minimum of five (5) years' experience in supplying similar systems with successful operation. A work reference list showing similar installations including locations, names of clients and design capacity of the deodorizers shall be submitted to the *Architect* for approval.

COMPLY

(5) Activated carbon adopted for the deodorization system shall be appropriate type agreed and accepted by the *Architect*

Comply

(6) The *Contractor* shall provide the initial filling of the filter media at installation stage and arrange a complete replacement of the used filter media at the end of the Defects Liability Period. The *Contractor* shall provide test certificate to verify the capacity of the activated carbon for initial filling. The replacement filter media shall only be delivered to the Site towards the end of the period between completion date and the defects date as instructed by the *Architect*.

Comply

(7) The filter media shall be totally inorganic, non-toxic, and self-incombustible and shall not support any microbial growth. The design air velocity through the filter media shall be recommended by the manufacturer but not be greater than 0.3m/s.

Comply

(8) The corresponding breakthrough time of the activated carbon filter beds shall not be less than sixteen (16) months

under continuous design operating conditions.

Vessel of the Activated Carbon Filter Unit 32.44

Comply

(1) The vessel shall be constructed of corrosion resistant stainless steel 316 or glass reinforced plastic (GRP) or other material accepted by the *Architect*. The resin of the GRP shall be premium grade chemical resistant vinyl ester resin. The resin shall have fire resistance rating of Class 1 (frame spread rating less than 25) when tested in accordance with ASTM E-84 or equivalent. The external final coat shall be resin rich coat with pigment and with integral UV inhibitors in the resin applied. The construction of the GRP for the vessel shall have resin rich inner surface, an interior corrosion barrier, an interior structural layer and an exterior layer and UV resistant coating.

(2) The vessel shall be designed to support the required number of media layers and treatment stages. All materials of construction shall be corrosion resistant.

(3) Access manholes for inspections, removal and maintenance of all internal parts shall be provided. Access manholes shall be provided with flat GRP plate. Lifting and hold down lugs shall be provided.

Mist Eliminator 32.45

Comply

(1) A mist eliminator shall be located before the pre-filter unit. Mist eliminator shall meet the following performance criteria:

(a) The mist removal efficiency shall not be less than 98% on 20 micron moisture droplet.

(b) The demister shall be made of stainless steel housed in stainless steel frame.

Pre-filter and After-filter Unit 32.46

Comply

(1) A pre-filter and after-filter unit shall be installed at the inlet and outlet of the activated carbon filter respectively for the removal of particulate. It shall be in a readily accessible and removable frame and have an average efficiency of not less than 40% when tested in accordance with ASHRAE 52-76. The framework shall be made of stainless steel. The pre-filter shall be made of stainless steel. The pre-filter shall be designed so as to facilities side removal of the filter elements. After-filter shall have at least 90% particulate removal efficiency and shall be of disposable type.

Dehumidifier 32.47

Comply

(1) The *Contractor* shall design, supply, deliver to Site, install, setup, test, commission and be liable to defects within the Defects Liability Period of one (1) set of dehumidifiers for drying the incoming foul air to each deodorization system.

Comply

(2) Fresh air shall be drawn into the dehumidifier, dried and then discharged into the foul air stream. The mixed air is then conveyed to the activated carbon filter. No foul air shall be in

contact with the dehumidifier.


Comply

(3) Dehumidifier shall be provided to reduce the relatively humidity of the foul air to 85%RH (max) under any conditions.


Comply

(4) The dehumidifier shall be adsorption type and shall complete with high efficiency, incombustible, non-toxic silica gel impregnated rotor, process air fan, reactivation air fan, electrical heater, air filters, control panel and duct type remote humidistat. The rotor shall be washable.


Comply

(5) The cabinet of the dehumidifier constructed from stainless steel.

(6) Stainless steel or Glass Reinforced Plastic (GRP) weatherproof enclosure shall be provided for the dehumidifier.

Hydrogen Sulphide Sensors 32.48

(1) The *Contractor* shall provide electrochemical cell type hydrogen sulphide sensor for monitoring the concentrations of hydrogen sulphide diverted from the odour extraction locations of the MWSPS to the activated carbon filter. Measuring range of the hydrogen sulphide concentration shall from 0ppm to 20ppm as appropriate and shall be displayed on the Deodorization System Field Control Panel (Field Control Station). The enclosures for the sensor and transmitter shall have IP65 protection or better.


Comply

(2) The *Contractor* shall provide at the outlet of the activated carbon filter an electrochemical cell type hydrogen sulphide sensor for monitoring the concentrations of hydrogen sulphide. Measuring range of the hydrogen sulphide concentration shall from 0 ppb to 1,000 ppb as appropriate. The enclosures for the sensor and transmitter shall have IP65 protection or better.


Comply


Comply

(3) Inlet and outlet H_2S sensors measurement indication shall be available at the Deodorization System Field Control Panel, and MACS for monitoring, alarm and logging purpose.

Differential Pressure Sensors 32.49

(1) Differential pressure sensors including transmitters and indicators gauges shall be provided to measure the pressure drop across all filters, including activated carbon filters, pre-filter and after-filter.


Comply

(2) Filter high differential alarm shall be available in the Deodorization System Field Control Panel, and MACS for monitoring, alarm and logging purpose.

Supporting Framework and Maintenance 32.50

(1) Supporting frameworks, maintenance and access platforms and stairs including hand railing, toe boards, non-skid tread surface, etc. for the activated carbon absorber shall be

Platform

provided for the operation and maintenance (calibration, adjustment, replacement, etc.) and inspection of internals (e.g. instrumentation, media conditions, etc.) via the inspection ports. Appropriate access and guard railing around the perimeter of vessel top shall be provided for mist eliminator. The entire system shall be factory assembled and made of stainless steel or GRP. The supporting frameworks, maintenance and access platforms and stairs shall not impose undue stress on the vessel. The maintenance and access platform and stair shall be designed, certified and endorsed by a Registered Structural Engineer (RSE).

Odour Extraction Fans 32.51

(1) The odour extraction system shall be designed by the *Contractor* to meet the requirements of this Particular Specification. The odour extraction fans shall be capable of providing the sufficient odour extraction rate against the respective system losses.

(2) The *Contractor* shall provide one (1) duty and one (1) standby extraction fans for each of the Activated Carbon Filter. The extraction fans shall be heavy duty type equipped with non-return dampers to extract odour from the specified locations to the Activated Carbon Filter for treatment. Isolation dampers for duty and standby fan switching shall be provided.

(3) The fans shall be constructed of FRP with moulded reinforced housing. The resin of the FRP shall be premium grade chemical resistant vinyl ester resin. The resin shall have fire resistance rating of Class 1 (frame spread rating less than 25) when tested in accordance with ASTM E-84 or equivalent. The external final coat shall be resin rich coat with pigment and with integral UV inhibitors in the resin applied.

(4) The fans shall be designed for continuous operation. The fan shaft shall be constructed of stainless steel grade 316 and oversized to run below critical speed. The impeller and shaft assemblies shall be statically and dynamically balanced.

(5) The requirements of the drive motors are as follows:

(a) Motor: IP55 protection, 380V, 3-phase and 50 Hz

(b) Insulation Class: Class F insulation for Class B Operation

(6) The fans shall be provided with variable speed drive. The fan cowl of the motor shall be provided with separately-driven fan for motor cooling. The fan motor shall have a service factor of 1.15 times the rated shaft power and sized to operate throughout the entire fan performance curve.

(7) The fan shall not generate a noise level exceeding 70dBA measured at 1m from the fan in all directions at rated speed. Acoustic enclosure of approved design and silencer complete with stainless steel casing at the discharge outlet and/or the fan motor shall be provided to achieve this requirement. Access opening shall be provided for the acoustic enclosure.

Comply
SILENCER BY OTHERS

(8) The odour extraction fan control shall be designed so that the duty and standby extraction fan shall work on rotational basis once the duty extraction fan operates for an adjustable period of time (8-12hr).

Comply

Air/Odour Ductwork

32.52 (1) The *Contractor* shall provide ductwork connecting SPS and the activated carbon filter, tank vent ducts, and make-up air ducts, including dampers, valves, fittings, etc. and all other items necessary for the proper functioning of the Activated Carbon Filter.

NOTED

(2) All ductwork above ground including fittings shall be fabricated of stainless steel 316 or GRP. All ductwork shall be constructed to the recommendation of the U.K. Heating and Ventilation *Contractors* Association (HVCA) ductwork group as summarised in their publication DW/144: "Specification for Sheet Metal Ductwork - Low, Medium and High pressure/ Velocity Air Systems.

Comply

(3) All ductwork shall be designed for a maximum flow velocity of 5 m/s. No significant audible noise shall be generated through or from any ductworks.

Comply

(4) The odour ductwork shall be flanged connected. The maximum length of straight flanged ductwork shall be limited to 6m. Flanged connections shall be provided for connection to the deodorization system equipment, flanged expansion joints, volume control dampers, isolation dampers and other duct fittings such as elbows, crosses, tees, reducers, etc. Gaskets of EDPM shall be provided and all bolts, nuts and washers shall be stainless steel 316.

Comply

(5) Flanged expansion joints shall be provided where the ductwork connects to the deodorization system equipment, odour extraction points of the corresponding odour source and at suitable locations of the ductwork system to allow expansion and contraction due to temperature changes and differential settlement without damage to the ductwork system.

Comply

(6) Expansion joints shall be of a material resistant to UV light. Expansion joint material shall be stiff enough to prevent sagging or contraction due to internal vacuum. Expansion joints shall be capable of compressing and elongating 50mm at least and shall allow lateral deflection of up to 50mm at

Comply

least. Flanged expansion joints shall have split stainless steel or GRP retaining rings. Stainless steel bolts, nuts and washers shall be provided

(7) Volume control dampers shall be provided in the main air ducts, branch-offs and all odour extraction points and make-up air intake points for air volume regulation and balancing of the air distribution. All dampers shall be sufficiently rigid to prevent fluttering. Each air intake ductwork shall also be completed with a non-return damper to avoid the egress of foul gases.

COMPLY

(8) Isolation air dampers shall be provided at the inlets and outlets of the odour extraction fans.

COMPLY

(9) Dampers shall be of the butterfly type. Dampers shall be constructed of GRP with spindles constructed of stainless steel. The stainless steel damper shaft shall be fully encapsulated within the damper blade and supported with top and bottom bearings. The shaft bushing and sealing shall be by Telfon or similar seals. The sealing faces between the blade and damper body shall be neoprene or EPDM.

COMPLY

(10) Damper adjustment rods shall be sealed to prevent leakage of air. Suitable damper locking devices shall be provided and be positioned for easy access of rod adjustment and damper locking.

COMPLY

(11) All dampers shall have flanged ends. Stainless steel bolts, nuts and washers shall be provided.

COMPLY

(12) All ductwork shall be supported by hangers, brackets, and other appropriate form of supports made of stainless steel or GRP. Noise and vibration shall not be transmitted to the structure or any other element through hangers and brackets. Maximum sag of horizontal round duct shall not exceed 2 percent of diameter after installation. Support and hanger details and a detailed layout showing the locations of all duct supports and hangers shall be submitted to the *Architect* for approval.

BY CONTRACTOR

(13) The ductwork shall be installed and supported at overhead location and 2.4m clearance between the bottom of the ductwork and the floor shall be provided for the operational staff to pass through without obstruction. All damper locations shall also be easily accessible.

BY CONTRACTOR

(14) GRP or stainless steel access platforms and stairs including hand railings, toe boards, no-skid tread surface, etc. over the ductwork shall be provided if the ductwork obstructs the operational access passage.

BY OTHERS

BY CONTRACTOR

(15) The *Contractor* shall demonstrate the air tightness of the ductwork to the satisfaction of the *Architect.*

(16) Drains shall be provided at suitable locations of the odour ductwork to avoid the accumulation of condensation for the odour. The drains shall be completed with suitably sized stainless steel valve and pipeworks. The drains shall be connected to the nearest sewerage system.

COMPLY

Deodorization System Field Control Panel 32.53

(1) The *Contractor* shall provide a Deodorization System Field Control Panel adjacent to the Deodorization Unit.

COMPLY

(2) Deodorization System Field Control Panel shall include the following but not limited to the following:

COMPLY

(a) "Start" and "Stop" push buttons for the odour extraction fans and dehumidifier;

(b) System Emergency Stop Button;

(c) Inlet and outlet H_2S sensors measurements indications;

(d) Pre filter, activated carbon filter and after filters differential pressure measurements indications; and

(e) All necessary indication lamps for operation status indications and alarms annunciation.

NOTED

(3) Exact locations of this panel shall be proposed by the *Contractor* and agreed on site with the *Architect.*

Deodorization System Control Requirements 32.54

(1) The *Contractor* shall provide the control circuits and other accessories for the operation of the Deodorization System. The Deodorization System shall have three modes of operation, "Field Manual", "MACS Manual" and "MACS Auto". One (1) no. of three way selector switch with key lock "Field/Off/MACS" selector shall be provided on the Deodorization System Field Control Panel at the field.

COMPLY

(2) "Field Manual" Mode:

COMPLY

(a) Manual initiation of the odour extraction fans and dehumidifier via "Start" and "Stop" push buttons via the Deodorization System Field Control Panel.

COMPLY

(b) Operation status and monitoring of the extraction fans shall be available at the Deodorization System Field Control Panel and MACS interface.

(3) "MACS" Mode:

- "MACS Manual" and "MACS Auto" shall be selectable at the MACS interface.

Comply

(4) "MACS Manual" Mode:

(a) When Selected, manual operation of the Deodorization System at the MACS operator interface shall be enabled.

Comply

(5) "MACS Auto" Mode:

(a) When the selector is put in "MACS Auto" mode, the deodorization system shall be controlled automatically by the PLC operating with the odour extraction fan operating at the normal speed.

(b) Upon detection of failure of the duty odour extraction fan, the standby odour extraction fan shall cut in automatically to continue the operation.

Comply

(c) Operation status (Running/ Stop / Tripped/ Dehumidifier Tripped/ H_2S Breakthrough/ Emergency Stopped/ Power Availability) and monitoring (pre-filter, after-filter and activated carbon filter differential pressure drop) of the deodorization system shall be available both on the Field Control Panel and MACS interface. All alarms at the Field Control Panel and MACS shall be both visual and audible.

(d) The control shall also be designed such that the odour extraction fans shall operate on automatic duty rotation. The rotation shall be triggered by a settable timer control.

(6) On pressing the emergency stop buttons adjacent to the odour extraction fans, and dehumidifier, deodorization system field control panel, or on the corresponding switchboard section, the operation of all deodorization system equipment shall stop immediately regardless of its mode of operation. The control status of the Deodorization System shall be sent to the MACS system for control and indication purpose.

Comply

Commissioning Test of Deodorization System

32.55 (1) The design, supply and installation of the Deodorization System (DOU) shall be certified by the manufacturer of the equipment before commencing testing of the contaminant removal efficiency.

Comply

(2) The *Contractor* shall include in his scope of work all sampling and laboratory analysis tasks. Laboratory analyses

shall be done by an independent testing laboratory. The laboratory responsible of the testing shall have documented QA/QC standards for the analysis and accredited under HOKLAS for the testing laboratory shall obtain approval from the *Architect* before executing the work.

(3) Testing shall include H_2S testing as outlined below to demonstrate the H_2S removal efficiency of the DOU. Removal efficiency is defined as: % removal = (inlet concentration-outlet concentration)/inlet concentration x 100.

(4) The commissioning tests shall not be carried out until the *Contractor* is satisfied that the equipment has reached its optimum operational performance. The commissioning testing is to be carried out within forty-five (45) calendar days after completion of the activated carbon filter installation.

(5) The method statement for collection and testing procedures for analysis of the odorous air samples shall be submitted for approval by the *Architect.*

(6) The *Employer's* staff shall have personnel present during the testing who may take any samples, record procedures and operating conditions to confirm the measurements taken by the *Contractor*. The *Contractor* shall provide full access and cooperation

(7) The Deodorization System shall be operated, to the satisfaction of the *Architect*, for seven (7) consecutive calendar days without any major faults or alarms requiring attendance on the Site.

(a) At the completion of the commissioning tests for the Deodorization System, copies of the commissioning test data log sheets shall be provided by the *Contractor* to the *Architect.*

(b) If the Deodorization System fails to meet the performance requirements, the *Contractor* shall rectify the defects immediately. The *Contractor* shall, at no extra cost to this contract, carry out all work necessary to ensure that the equipment achieves the specified performance.

(c) When rectification work is complete, the Deodorization System shall be retested to verify that the specified performance has been achieved.

(8) During the seven-day testing period for the DOU, the following requirements are to be observed where applicable:

(a) The foul air flow rate and the inlet foul air pressure shall be maintained as close as practical to the design

COMPLY

COMPLY

COMPLY

COMPLY

COMPLY

BY CONTRACTOR, WILL PROVIDE TECHNICAL ADVICE WHERE NECESSARY

BY CONTRACTOR, WILL PROVIDE TECHNICAL ADVICE WHERE NECESSARY

conditions. The *Contractor* must be satisfied that the air flow rate through the DOU is in accordance with the design flow rates and conditions before commencing the commissioning tests.

(b) The flow rate, the pressure losses across the vessel of the DOU shall be either recorded continuously by the online measurement (if applicable), or measured and recorded twice per day, e.g. once in the morning and once in the afternoon.

(c) The inlet and outlet gas temperature and humidity of the DOU are to be either continuously recorded by the online measurement (if applicable), or measured and recorded twice per day, e.g. once in the morning and once in the afternoon.

(d) The atmospheric temperature and humidity are to be either recorded continuously by the online measurement (if applicable), or measured and recorded twice per day, e.g. once in the morning and once in the afternoon.

(e) Other operating parameters such as any unusual events, etc., are to be recorded for each day of the test.

(f) Within ten (10) calendar days of the completion of the test period for the DOU, the *Contractor* shall provide a written test report showing all conclusions of the tests with reference to the performance criteria.

(g) The methods to obtain all measurements and make calculations shall be included in the commissioning test procedures and shall be carried out to the satisfaction of the *Architect*.

(h) At the completion of the commissioning tests for the DOU, copies of the commissioning test data log sheets shall be provided by the *Contractor* to the *Architect*.

(i) If the DOU fails to meet the performance requirements, the *Contractor* shall rectify the defects immediately. The *Contractor* shall, at no extra cost to this contract, carry out all work necessary to ensure that the equipment achieves the specified performance.

(j) When rectification work is complete, the DOU shall be retested to verify that the specified performance has been achieved.

(9) If after two re-tests for the Deodorization System and the performance requirements are still not met, the *Contractor* is required to make system modifications at the sole expense of the *Contractor*, or obtain a replacement at the expense of

BY CONTRACTOR, WILL PROVIDE TECHNICAL ADVICE WHERE NECESSARY

the *Contractor*. If system modifications are deemed necessary, additional tests shall be performed by the *Contractor* until the performance requirements are proven to be met. All costs associated with re-testing shall be borne by the *Contractor*.

(10) The maximum time between each re-test for the Deodorization System will be thirty (30) calendar days.

H_2S Sampling and Testing 32.56 (1) Permanent continuous online H_2S monitoring instruments for the inlet and outlet gas streams of the Deodorization System shall be provided after system calibration. The inlet and outlet readings are to be recorded for the seven (7) consecutive days corresponding with the test period.

NOTED

Analysis of Results 32.57 (1) H2S removal efficiency shall be calculated from the on-line monitoring results for the DOU. The commissioning tests shall be considered successful if, for each day of the test period, the average removal efficiency, at every 15 minutes, shall meet the required removal efficiency performance criteria as stipulated in this Particular Specification.

NOTED

~~LIFTING APPLIANCES~~

General 32.58 (1) The *Contractor* shall design, supply, deliver to the Site, install, test, commission and be liable to defects within the Defects Liability Period of the following lifting appliances of appropriate safe working load (S.W.L.).

(a) LA-SE-01

Serving Location	Sewage Pumping Station Plant Room & Sewage Wet Well
Equipment	Lifting Davit complete with electric chain hoist and lifting chain.
Minimum S.W.L.	500kg
Approx. Span/Length	Min. 1.5 m

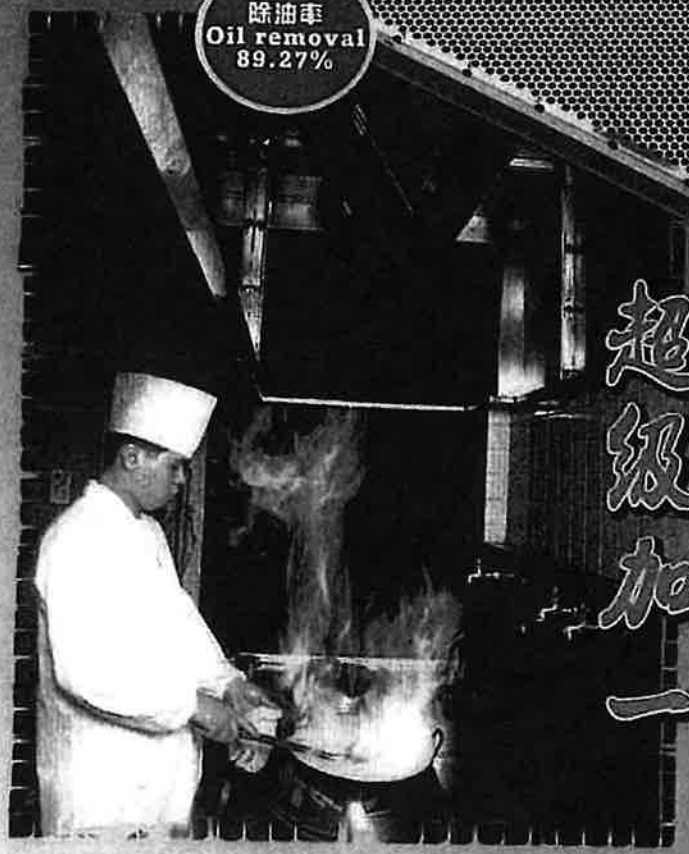
(b) LA-SE-02

Serving Location	Sewage Pumping Station Plant Room & Sewage Wet Well

APPENDIX 2.3. BROCHURE OF THE GREASE FILTER

All STAINLESS GREASE FILTER

PLUS ONE & PLUS ONE SUPER



加一、超級加一

使用不銹鋼製的廚房油煙網
使廚房更安全、更舒適

- Good Ventilation 通風性良好
- Powerful Retention of Fumes 除垢力強避異味
- Light-Weight Filter 耐用全不銹鋼製
- Not Easily Clogged 過濾網不易阻塞
- Save Maintenenance Fee 少維修墊錢省時

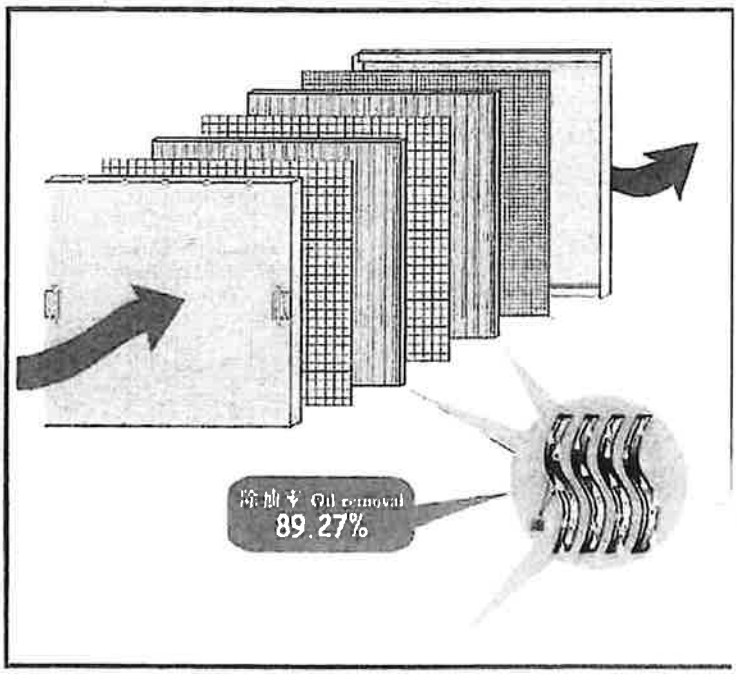
日本廚房工業會的認定品，適合節能省消防設置有關除去油垢的準則，日本廚房工業會認可商標，請以放心使用。

JFEA

KAWASHO

「超級加一」及「加一」的油濾光片

- 「超級加一」及「加一」的優點是通氣性，確實有效地除去油塵的 Long Life 油濾光片。
- 具有通風性和除去油塵的2種性能均能做到兩方平衡的優質 Grease Filter。



由於油濾光片上下方面均是特殊耐熱，加上使用不銹鋼纖維組成，故此在排氣中同時可將油塵捉住及除去。所以當油濾光片累積的油塵減少，相對性便可維持長時間性能效用。

（特許取得 第3141063號）

「超級加一」及「加一」的6個特性優秀點

1) **優質的通風性**

由於擁有優質的良好的換氣能力，故此能夠控制廚房內的溫度上升及可以將廚房的舒通環境得以維持。

2) **卓越的除油性能**

因為長方形斷面上已佈滿特殊耐熱性及不銹鋼纖維，故能夠容易將油塵捉住。

3) **維持更長的高性能**

由於利用編設方法而成的特殊耐熱性及不銹鋼纖維的油濾光片，不但可減少油塵的成份滯留，同時也可以使通風的效能更暢順，更甚者是能夠將除去油塵的性能得以長期性的維持。

4) **全是不銹鋼製的產品，長期使用更加經濟**

因為擁有優良的耐蝕性、耐熱性、耐衝擊性、以及藥品性的抵擋。由於以不銹鋼製成的油濾光片非常堅硬，因此外貌美觀得以更長持久。

5) **節省經費**

擁有優良的通風性和除去性能的不銹鋼纖維，能減輕換風氣用的摩打負擔及減少機器裏污物的積聚，當然亦可省下更多不必要的電費和減少清掃的費用。

6) **優良的洗淨法**

油塵分子的滯留相繼減少，故可將裏面的油塵更容易洗淨。

WE GUARANTEE HYGIENIC KITCHENS 'NO GREASE, AND NO SMELLY ODOR'

This Specially-Designed Cooked Hood Serves the Kitchen Requirements of Businrss Establishments.

Specification :-

1. Good Ventilation - maintains a pleasant environment and does not strain the suction-fan.
2. Powerful Retention of Fumes - more efficient than other cooker hoods.
3. Light-Weight Filter - unique stainless steel which is very light.
4. Not Easily Clogged - fast, powerful and efficient suction and retention of fumes.
5. Annual maintenance fees are kept to the minimum.

KITCHEN HAZARDS : HOW TO OVERCOME THEM

Present-say kitchen environment and conditions which are greasy smoky and sticky may lead to fire hazards. In addition, the fumes which are trapped due to poor ventilation and improper kitchen maintenance may also casue fires.

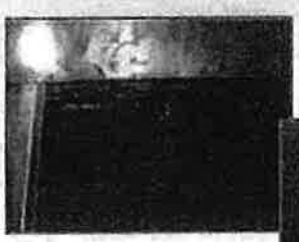
GUIDELINES ON FIRE PREVENTION

The Japanese Fire Department makes it mandatory for all Japanese kitchens to install grease filters and to clean the ducts once a month. This maintenance work is very costly. In spite of these measures, fire still occur in kitchens.

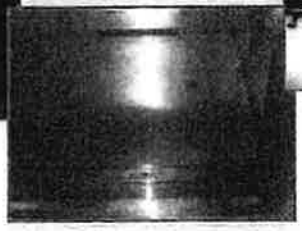
INEFFICIENT SUCTION AND RETENTION OF OIL IN THE FUMES

There is a slow build-up of grease and oil in the filter owing to non-optimum performance of the filter system. This leads to a hazardous situation likely to cause fires in the kitchen! The buffalo-shaped filter does not efficiently retain the oil in the fumes and the sub-standard and unhygenic ventilation system. The factors are the main causes of the high incidence of kitchen fires.

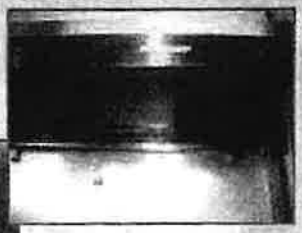
Due to the poor retention of oil by the filter, the filter clogs easily, Causing Oxidation. To overcome all the above problem, our company, the Totaru Plan (m) Sdn. Bhd, has invented the latest state-of-the art cooker hood. It is super efficient in oil retention and provides the highest standard in ventilation. It is hardy, durable and a boon to all consumers!



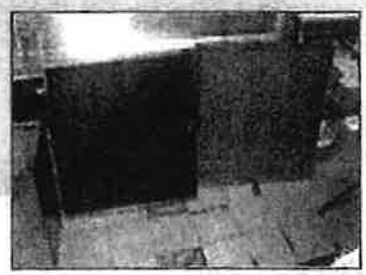
• Before Installation
未安裝 Kawasho 隔油烟網前



• Cleaned air duct and hood with Kawasho grease filter installed
清潔烟罩風槽後及安裝 Kawasho 隔油烟網



• Air duct and hood are still in clean condition
風槽及烟罩內能仍然保持清潔

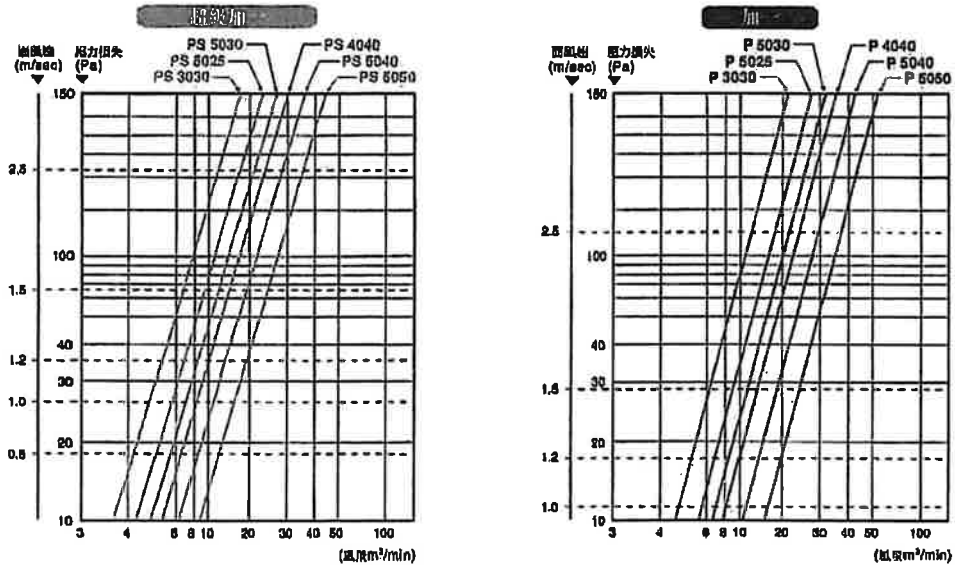


• Front and rear of Filter
隔油網的前後面

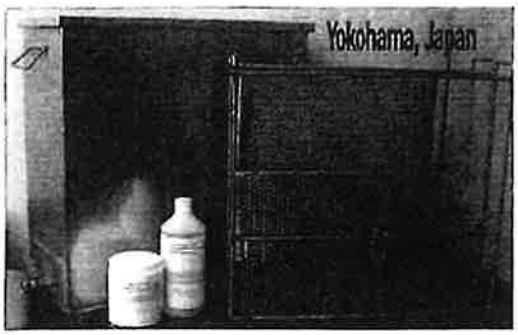
型號尺寸 SIZE CHART

超級加一	加一	幅 (W)	高 (H)	厚 (t)
PS 5050	PS 5050	500	500	25
PS 5050S	PS 5050S	495	500	25
PS 5040	PS 5040	500	400	25
PS 5040S	PS 5040S	495	400	25
PS 5030	PS 5030	500	300	25
PS 5030S	PS 5030S	495	300	25
PS 5025	PS 5025	500	250	25
PS 5025S	PS 5025S	495	250	25
PS 4040	PS 4040	400	400	25
PS 3030	PS 3030	300	300	25

風量特性 VENTILATION



貨品名稱	除去率	付著率	靜壓
超級加一	89.27%	22.32%	21Pa



規格 SPECIFICATIONS	
桶子型號 Bucket Type	G. F. 5
桶子尺碼 Bucket Size	600(高)Hx540(長)Lx220(濶)W
裝量水容量 Capacity	70 (公升)Litres
隔油網容量 Filter Holding Capacity	5 (塊)Pieces
不銹鋼架尺寸 Dimension of Stainless Steel Rack	(Grease Filter) 560(高)H x 520(長)L x 120(濶)W 3(塊用)Pieces 560(高)H x 520(長)L x 80(濶)W 2(塊用)Pieces

生產商
川鉄商事株式会社
Tel : 03-5203-5141

總部
株式会社
Tel : 045-471-8800

TOTARU PLAN (JAPAN)
Web-site : www.totaru.com

海外營業部
多德來(香港)有限公司
Tel : 852-2191-7686

TOTARU PLAN (H.K.) LTD.
Web-site : www.totaru.com.hk

GREASE COOL & FILTER CLEANER

SUPER GREASE FILTER POWDER CLEANER
STAINLESS GREASE FILTER CLEANER
超力油煙網清潔粉劑
不銹鋼油煙網清潔劑

業務用ステンレ製グリスフィルター
Yokohama, Japan

DIRECTIONS FOR USE　　使用方法
Input 750g of Grease Removal Power with water (hot or cool) into TOTARU STAINLESS BUCKET, and then input 1000ml of Grease Removal Cleaner into bucket, after wipe off with dirty filter 8hrs to 48hrs, rinse with clean of water
首先將750克除油粉放入多德來不銹鋼桶內, 然後再加入清水(冷熱皆可), 再將1000毫升除油劑放入桶內及攪和後便可將污垢的隔油煙網放至水中, 待浸 8 至 48 小時後再用清水徹底洗淨便可

TOTARU PLAN (HK) LTD.

TOTARU G.F.BOX

Stainless Steel Grease Filter Cleaning Box

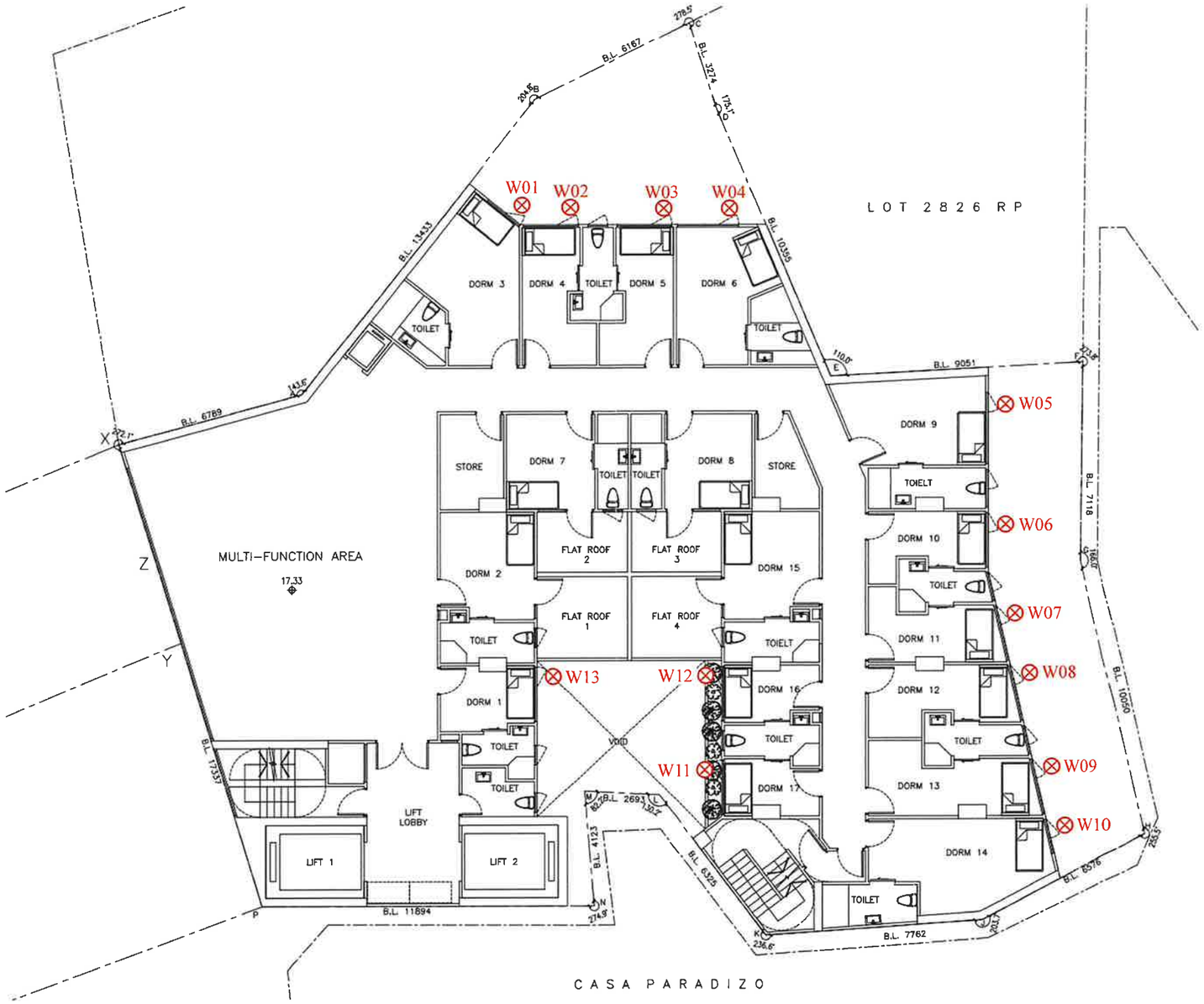
不 銹 鋼 隔 油 網 清 潔 箱

規格 SPECIFICATIONS	
桶子型號 Bucket Type	G.F.5
桶子尺碼 Bucket Size	600 (高)H x 540 (長)L x 220 (闊)W
裝置水容量 Capacity	70 (公升) Litres
隔油網容量 Filter Holding Capacity	5 (塊) Pieces
不銹鋼架 Stainless Steel Rack	(Grease Filter) 560 (高)H x 520 (長)L x 120 (闊)W 3(塊用)Pieces 560 (高)H x 520 (長)L x 80 (闊)W 2(塊用)Pieces

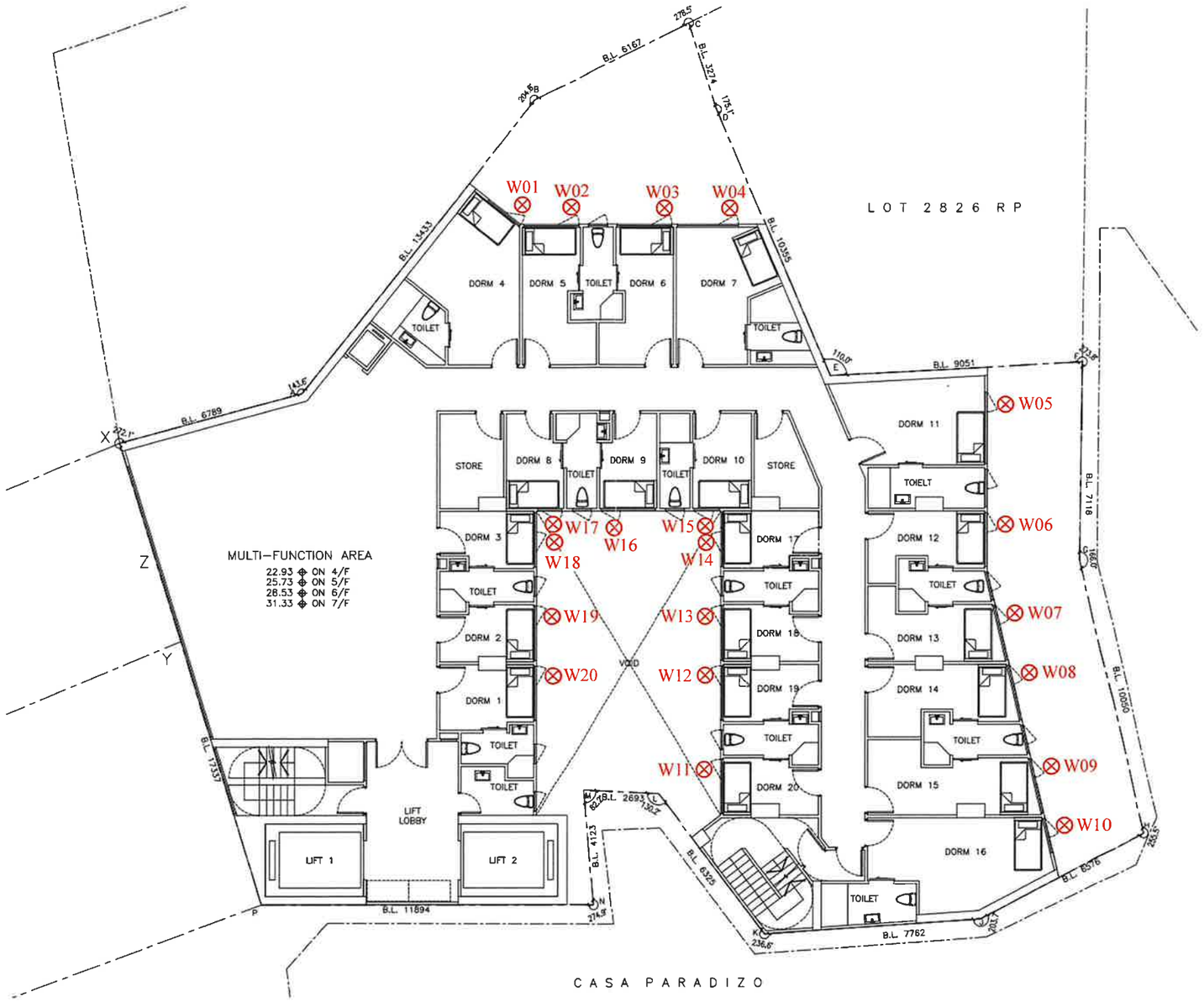
TOTARU PLAN (HK) LTD.

APPENDIX 3.1. TRAFFIC NOISE IMPACT ASSESSMENT

PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.1.1		LEAD ARCHITECT: R Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: NOVOX	PREPARED BY	Phoenix Lee
DRAWING TITLE: REPRESENTATIVE NOISE SENSITIVE RECEIVERS FOR TRAFFIC NOISE IMPACT ASSESSMENT (2/F)	SCALE: N.T.S.	REV: A			CHECKED BY	Eddy Ng
					APPROVED BY	Banting Wong



PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.1.2		LEAD ARCHITECT: R Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: Novox	PREPARED BY	Phoenix Lee
DRAWING TITLE: REPRESENTATIVE NOISE SENSITIVE RECEIVERS FOR TRAFFIC NOISE IMPACT ASSESSMENT (3/F)	SCALE: N.T.S.	REV: A			CHECKED BY	Eddy Ng
					APPROVED BY	Banting Wong

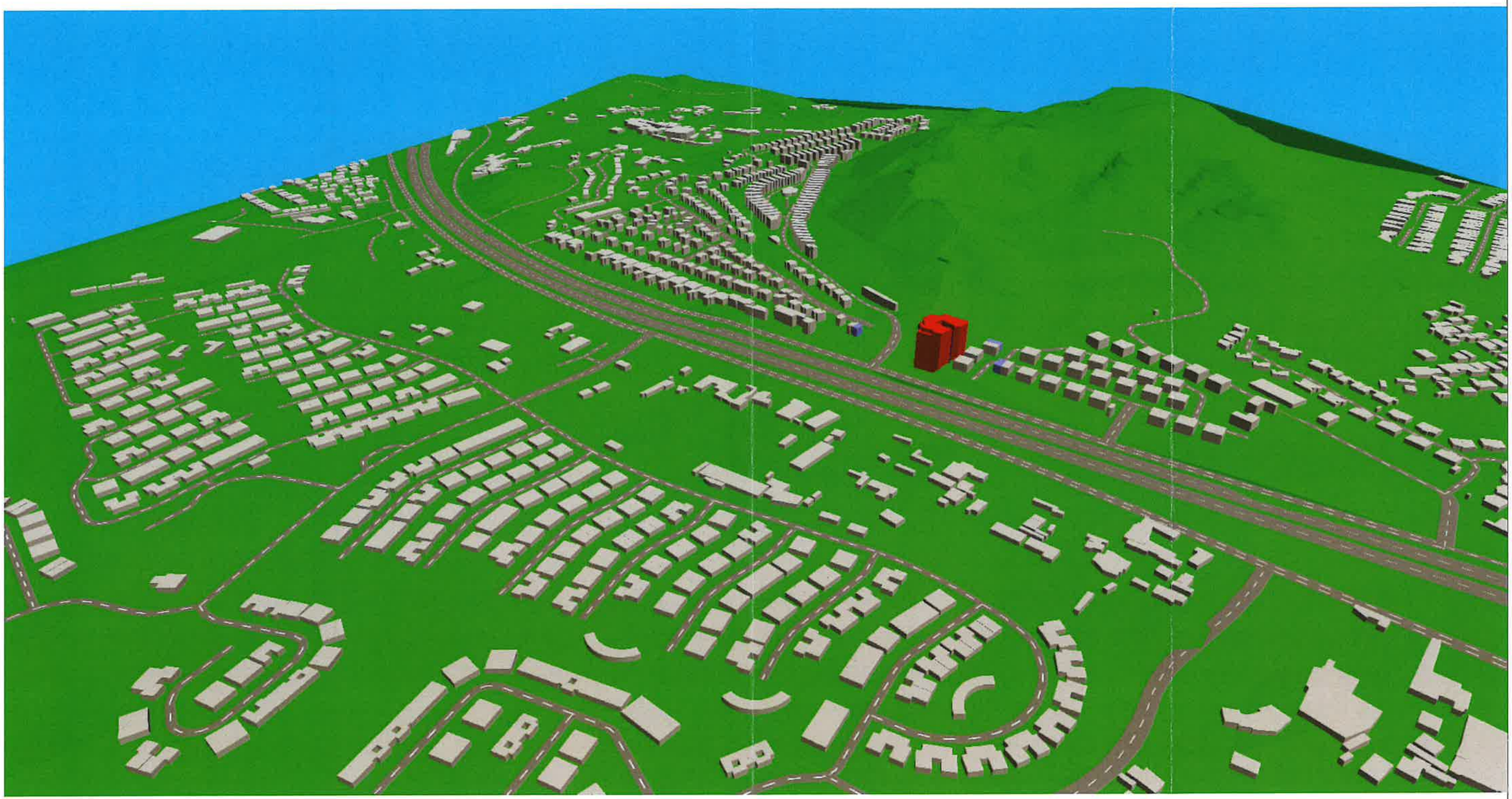


1 G-07 TYPICAL FLOOR PLAN PLAN

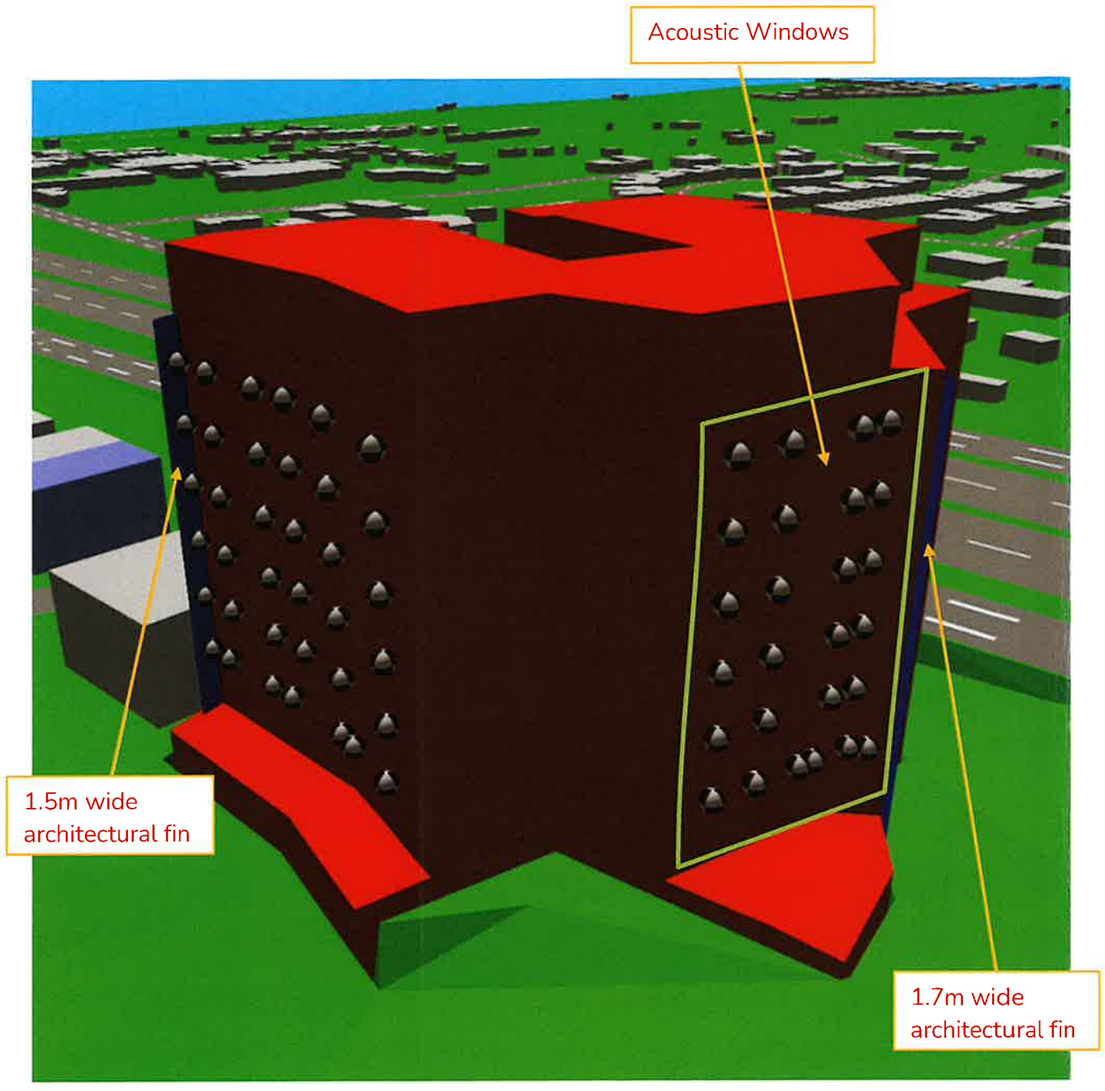
PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.1.3		LEAD ARCHITECT: R Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: Novox	PREPARED BY: Phoenix Lee
DRAWING TITLE: REPRESENTATIVE NOISE SENSITIVE RECEIVERS FOR TRAFFIC NOISE IMPACT ASSESSMENT (4/F TO 7/F TYPICAL)	SCALE: N.T.S.	REV: A			CHECKED BY: Eddy Ng APPROVED BY: Banting Wong

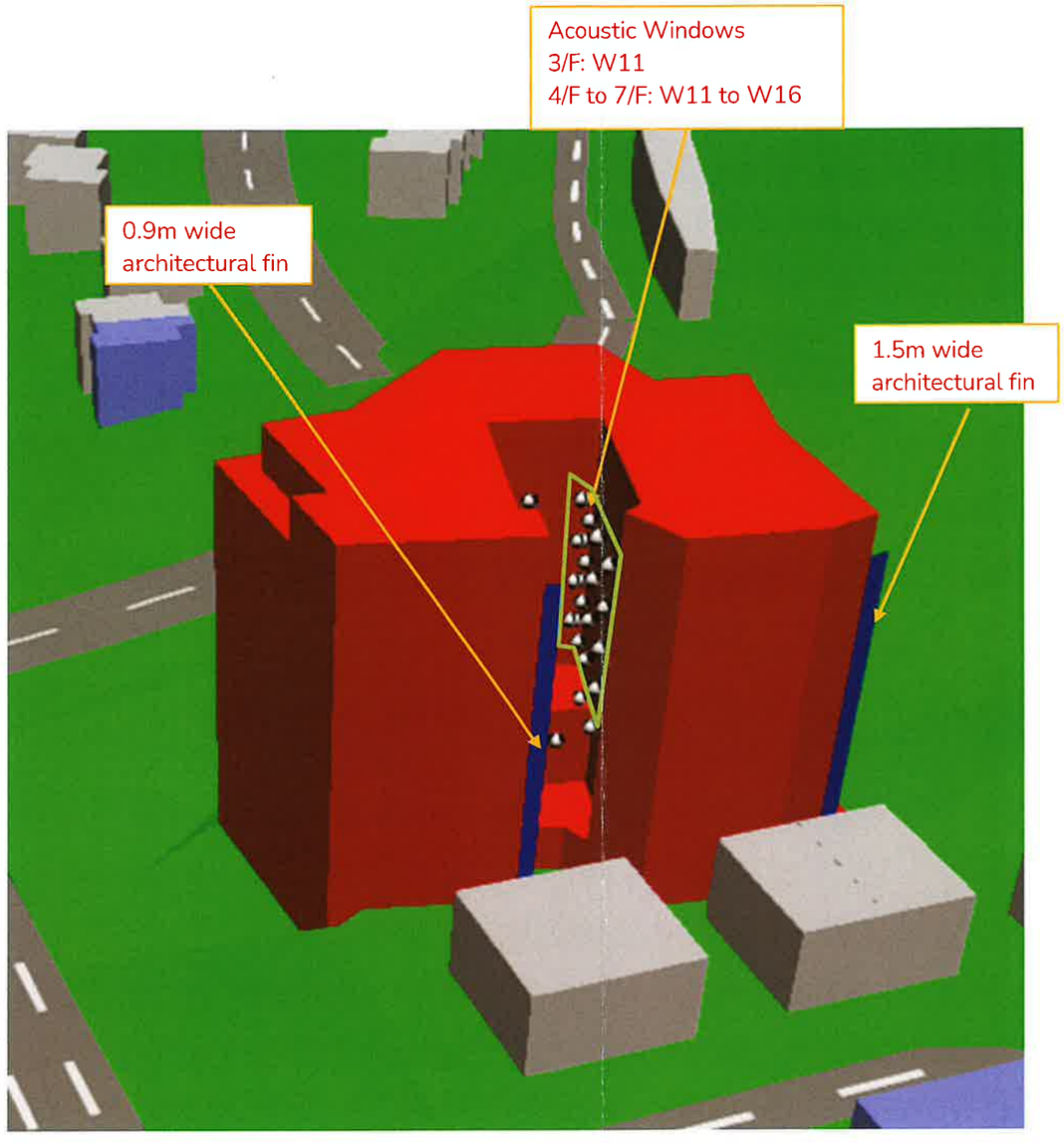
Floor	Dorm	Size(sq.m.)	traffic noise	fixed noise
2F	Dorm 1	33.724		
	Dorm 2	39.464		
	Dorm 3	41.985		
	Dorm 4	26.091		
	Dorm 5	30.522		
	Dorm 6	40.59		
	Dorm 7	68.644		
3F	Dorm 1	7.497		
	Dorm 2	6.403		
	Dorm 3	6.498		
	Dorm 4	10.788		
	Dorm 5	10.594		
	Dorm 6	6.603		
	Dorm 7	6.498		
	Dorm 8	7.225		
	Dorm 9	8.624		
	Dorm 10	9.698		
	Dorm 11	11.018		
	Dorm 12	12.735		
	Dorm 13	18.114		
	Dorm 14	6.498		
	Dorm 15	6.403		
	Dorm 16	6.298		
	Dorm 17	6.203		
	Isolation RM 1	14.435		
	Isolation RM 2	12.359		
	Isolation RM 3	12.711		
TF	Dorm 1	7.497		
	Dorm 2	6.403		
	Dorm 3	6.498		
	Dorm 4	16.798		
	Dorm 5	10.788		
	Dorm 6	10.594		
	Dorm 7	14.713		
	Dorm 8	6.603		
	Dorm 9	6.498		
	Dorm 10	7.225		
	Dorm 11	15.339		
	Dorm 12	8.624		
	Dorm 13	9.698		
	Dorm 14	11.018		
	Dorm 15	12.735		
	Dorm 16	18.114		
	Dorm 17	6.498		
	Dorm 18	6.403		
	Dorm 19	6.298		
	Dorm 20	6.203		
8F	Staff Rm. 1	18.277		
	Staff Rm. 2	16.564		
	Staff Rm. 3	12.94		
	Staff Rm. 4	8.624		
	Staff Rm. 5	9.698		
	Staff Rm. 6	11.018		
	Staff Rm. 7	12.735		
	Staff Rm. 8	18.114		

PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.1.4		LEAD ARCHITECT: R Lee Architects (HK) Ltd	PREPARED BY: Phoenix Lee
DRAWING TITLE: REPRESENTATIVE NOISE SENSITIVE RECEIVERS FOR TRAFFIC NOISE IMPACT ASSESSMENT (4/F TO 7/F TYPICAL)	SCALE: N.T.S.	REV: A	ENVIRONMENTAL CONSULTANT: Novox	CHECKED BY: Eddy Ng APPROVED BY: Banting Wong

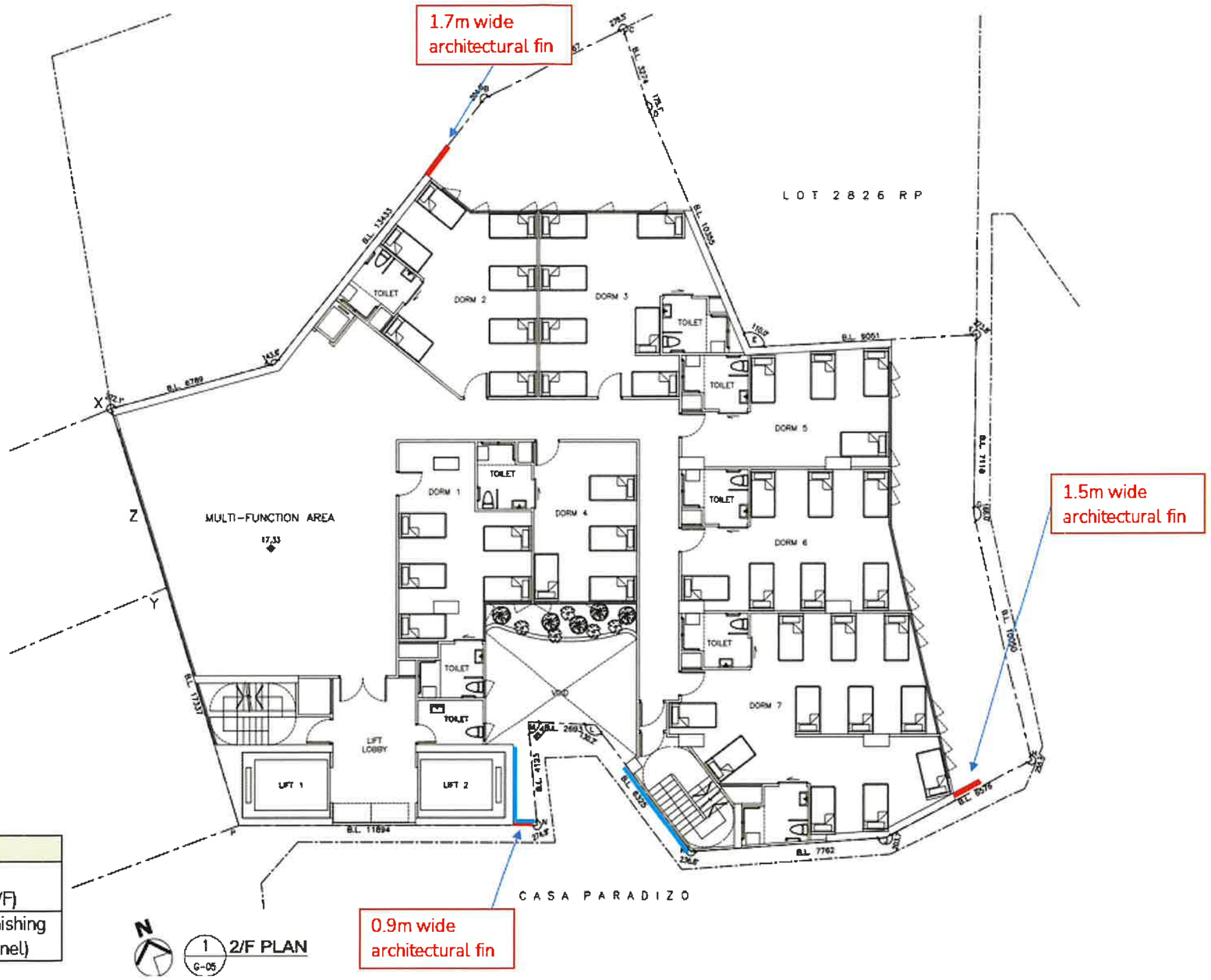


PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.1.4		LEAD ARCHITECT: R Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: Novox	PREPARED BY: Phoenix Lee
DRAWING TITLE: 3D VIEW OF NOISE MODEL, NOISE SOURCES AND REPRESENTATIVE NSRS	SCALE: N.T.S.	REV: A			CHECKED BY: Eddy Ng
					APPROVED BY: Banting Wong



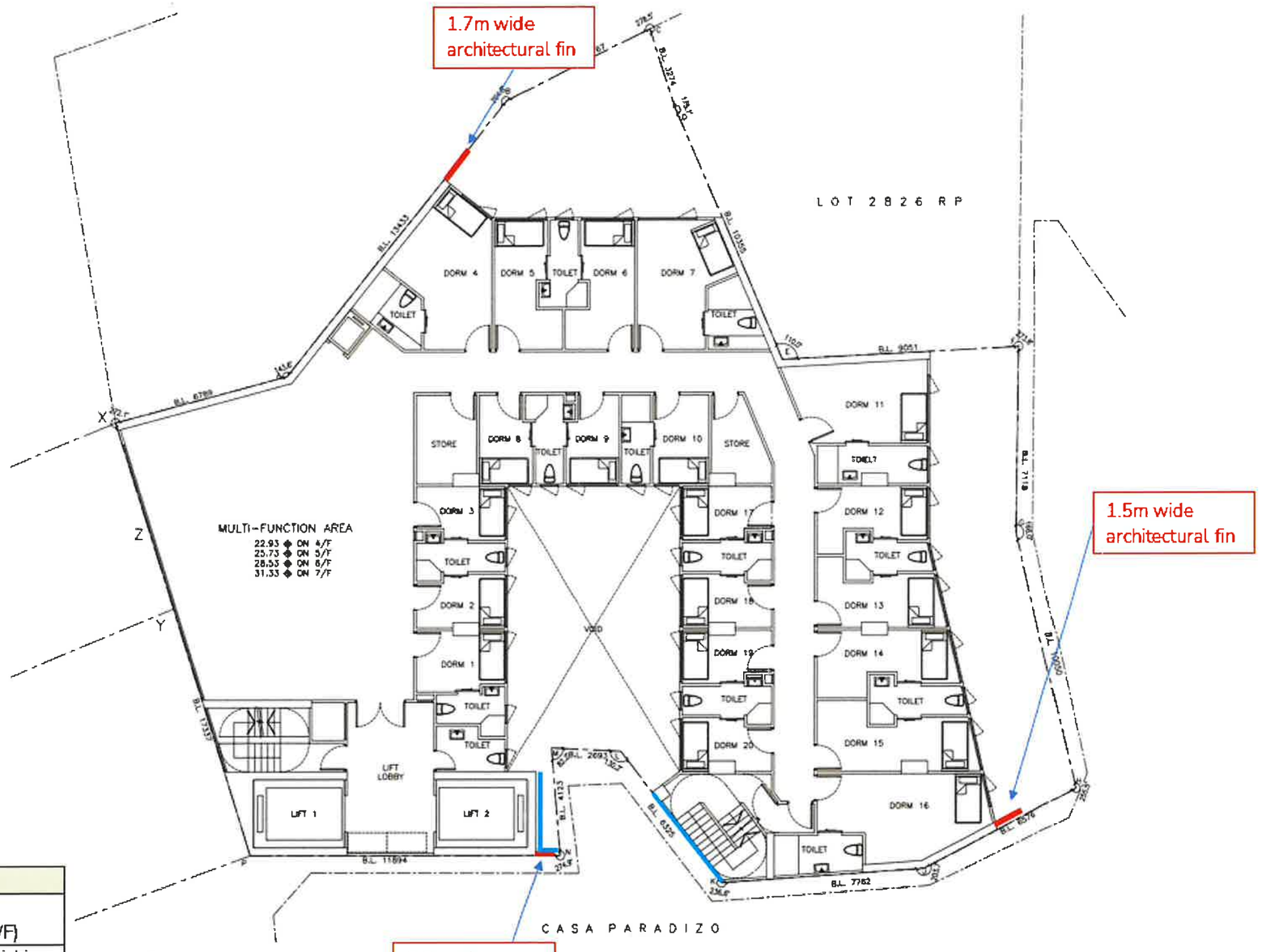


PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.1.5		LEAD ARCHITECT: R Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: Novox	PREPARED BY	Phoenix Lee
DRAWING TITLE: 3D VIEW OF NOISE MITIGATION MEASURES	SCALE: N.T.S.	REV: A			CHECKED BY	Eddy Ng
					APPROVED BY	Banting Wong



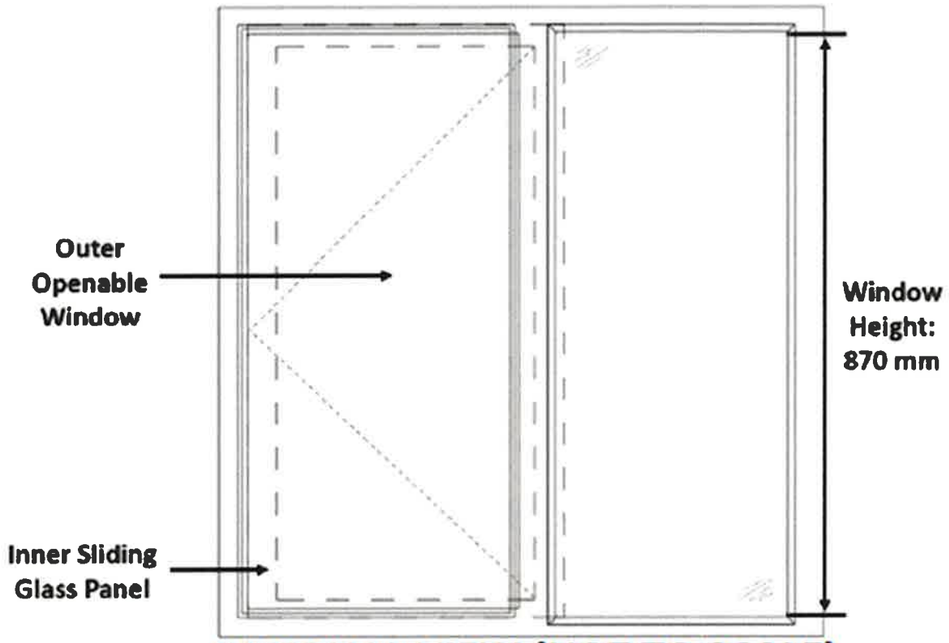
Legend	Description
	Architectural Fins (extend from 2/F to 3/F)
	Sound Absorption Finishing (50mm perforated panel)

PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.1.6	LEAD ARCHITECT: R Lee Architects (HK) Ltd	PREPARED BY	Phoenix Lee
DRAWING TITLE: ACOUSTIC MITIGATION MEASURES FOR ROAD TRAFFIC NOISE (2/F)	SCALE: N.T.S. / REV: A	ENVIRONMENTAL CONSULTANT: Novox	CHECKED BY	Eddy Ng
			APPROVED BY	Banting Wong

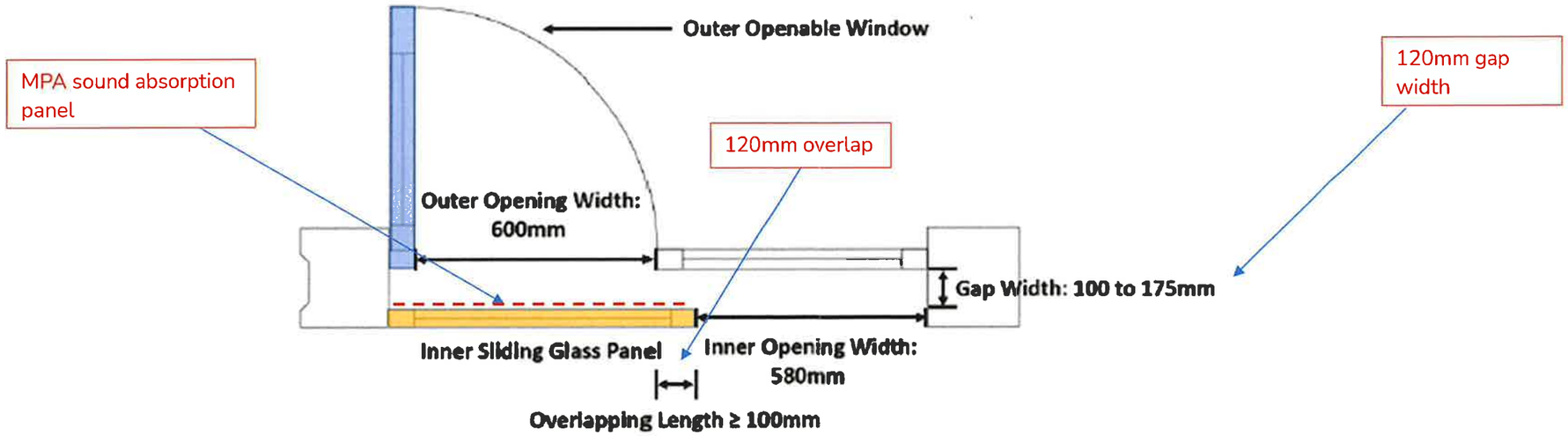


Legend	Description
	Architectural Fins (extend from 3/F to 7/F)
	Sound Absorption Finishing (50mm perforated panel)

PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.1.7	LEAD ARCHITECT: R Lee Architects (HK) Ltd	PREPARED BY	Phoenix Lee
DRAWING TITLE: ACOUSTIC MITIGATION MEASURES FOR ROAD TRAFFIC NOISE (3/F TO 7/F)	SCALE: N.T.S. / REV: A	ENVIRONMENTAL CONSULTANT: Novox	CHECKED BY	Eddy Ng
			APPROVED BY	Banting Wong



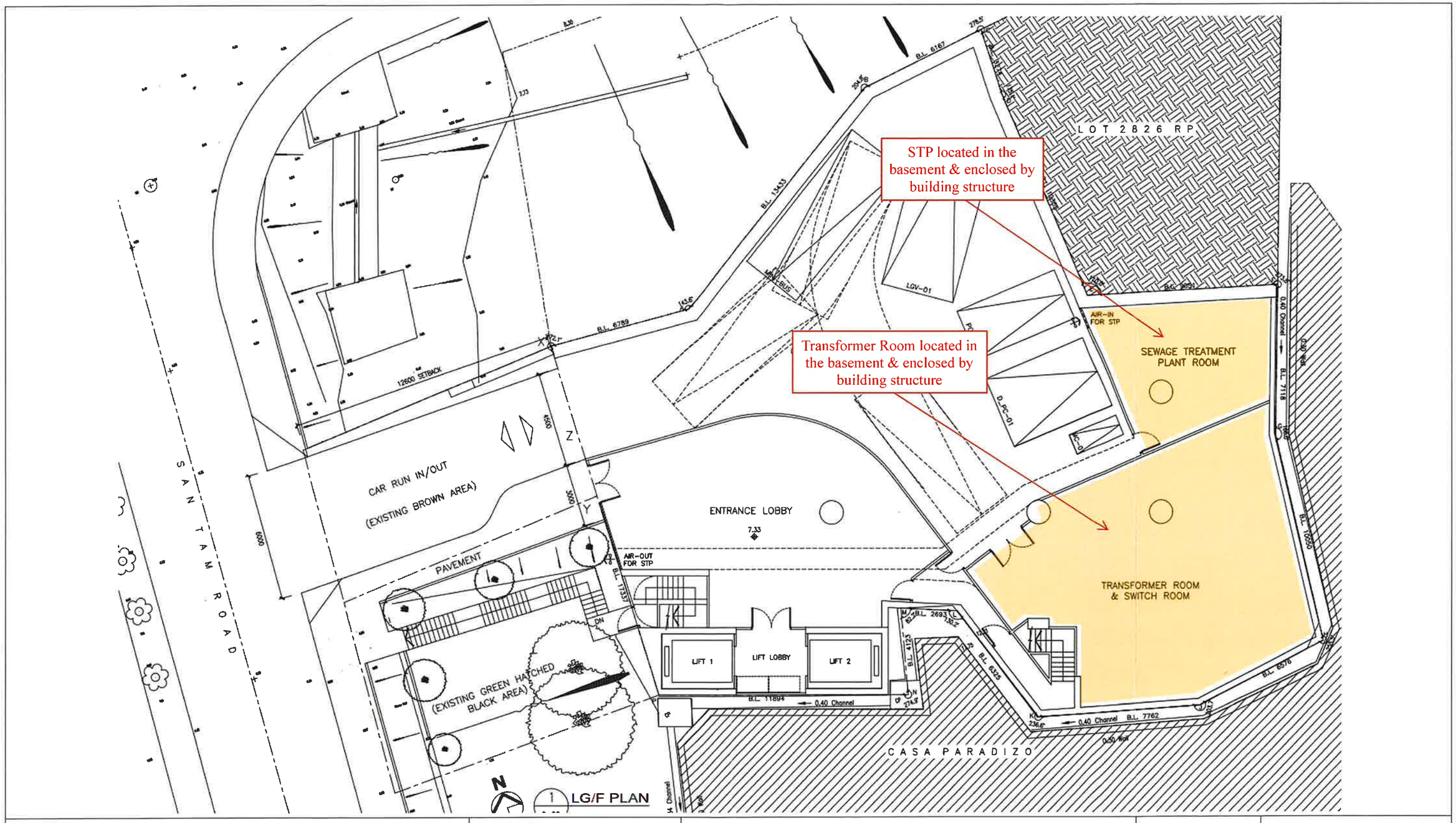
INTERNAL VIEW (NOT TO SCALE)



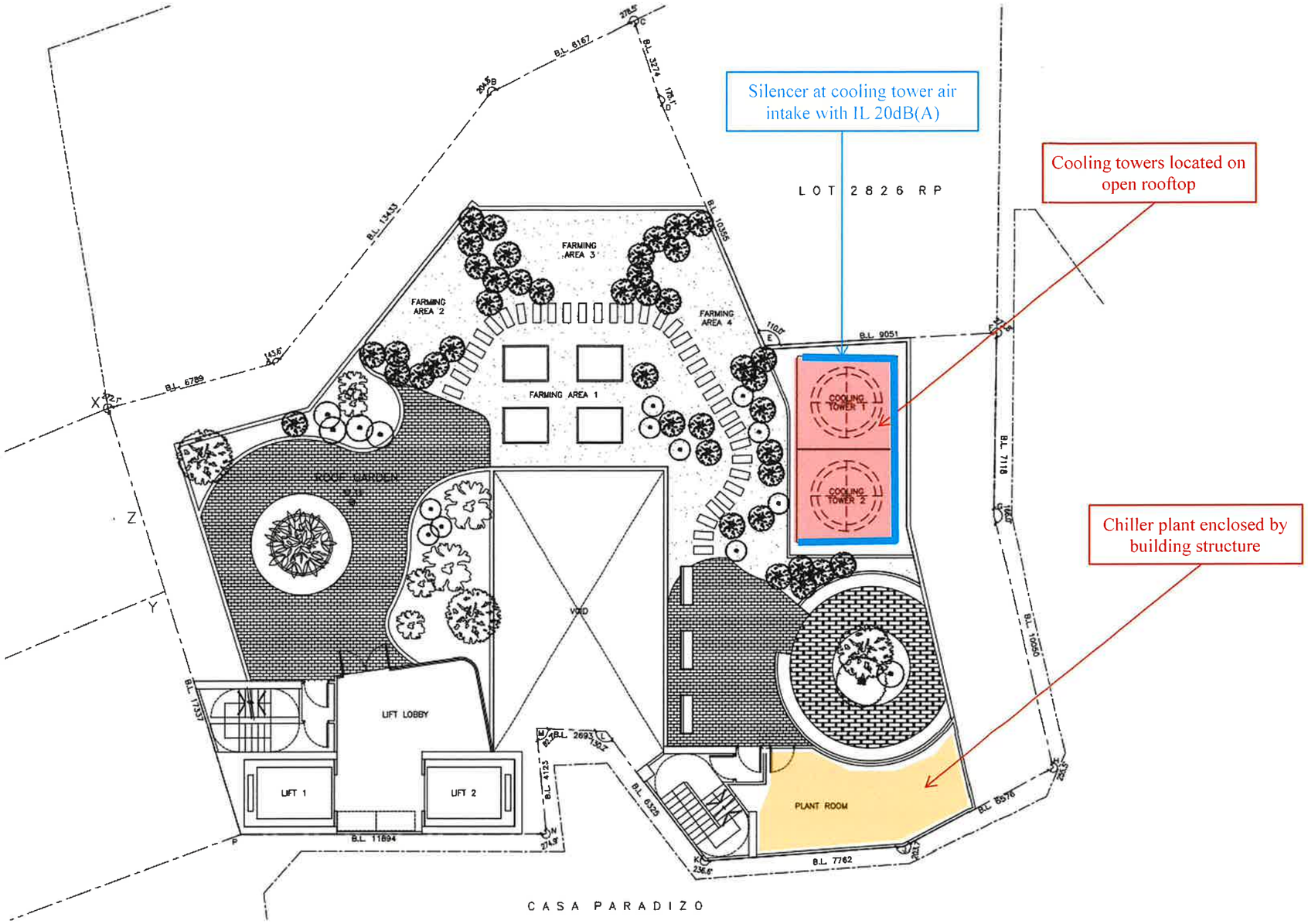
PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.1.8		LEAD ARCHITECT: R Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: Novox	PREPARED BY	Phoenix Lee
DRAWING TITLE: ACOUSTIC MITIGATION MEASURES FOR ROAD TRAFFIC NOISE – ACOUSTIC WINDOW	SCALE: N.T.S.	REV: A			CHECKED BY	Eddy Ng
					APPROVED BY	Banting Wong

PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.1.9			PREPARED BY: Phoenix Lee
		LEAD ARCHITECT: R Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: NOVOX	CHECKED BY: Eddy Ng
DRAWING TITLE: NOISE CONTOUR OF ROAD TRAFFIC NOISE IMPACT (MITIGATED)	SCALE: N.T.S.	REV: A		APPROVED BY: Banting Wong

Appendix 3.2. FIXED SOURCE NOISE ASSESSMENT



PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.2.1		LEAD ARCHITECT: R Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: Novox	PREPARED BY: Phoenix Lee
DRAWING TITLE: FIXED NOISE SOURCES LOCATIONS & MITIGATION TREATMENT (LG/F)	SCALE: N.T.S.	REV: A			CHECKED BY: Eddy Ng
					APPROVED BY: Banting Wong



PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.2.2		LEAD ARCHITECT: R. Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: NOVOX	PREPARED BY: Phoenix Lee
DRAWING TITLE: FIXED NOISE SOURCES LOCATIONS & MITIGATION TREATMENT (R/F)	SCALE: N.T.S.	REV: A			CHECKED BY: Eddy Ng
					APPROVED BY: Banting Wong

1

The ryowo Group is the pioneer and manufacturer of fiberglass-reinforced polyester (FRP) cooling towers in Hong Kong.

We offer a full range of product lines in FRP, stainless steel and galvanized steel water-cooling towers. With our vital production station, Shenzhen RYOWO Cooling Tower Company Limited, we manufacture, market and service a full range of water-cooling towers. Over 90% of the cooling tower parts are from our own factory and, as a result, control of cost and quality are ensured.

RYOWO has been a member of the Cooling Technology Institute since 1982. With our own R&D Department and testing facilities, we have five lines of product which are CTI-201 certified.

In 2004, our R & D department successfully developed a CTI STD-201 rated product line, the FWS series, the highest standard of water-cooling towers with guaranteed cooling capacity. In order to expand the application of our cooling towers, we developed the integrated drift eliminator, and used the super low noise fan as an option in this series.

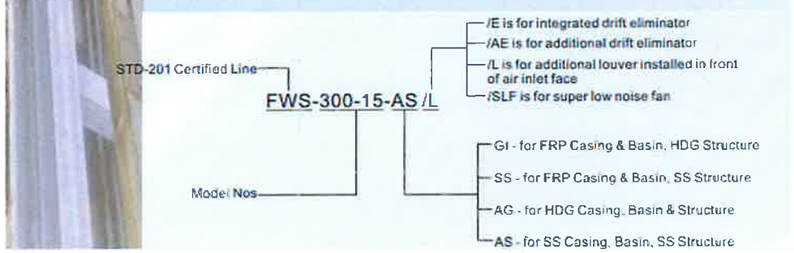
FWS

Low Noise Cross Flow Type

MANUFACTURER'S PUBLISHED THERMAL PERFORMANCE IS CERTIFIED BY THE COOLING TOWER INSTITUTE UNDER THE PROVISIONS OF STD-201 (02) CERTIFICATION VALIDATION NUMBER

THE COOLING TOWER YOU CAN RELY ON

MODEL DESIGNATION



ryowo

3 SPECIFICATION

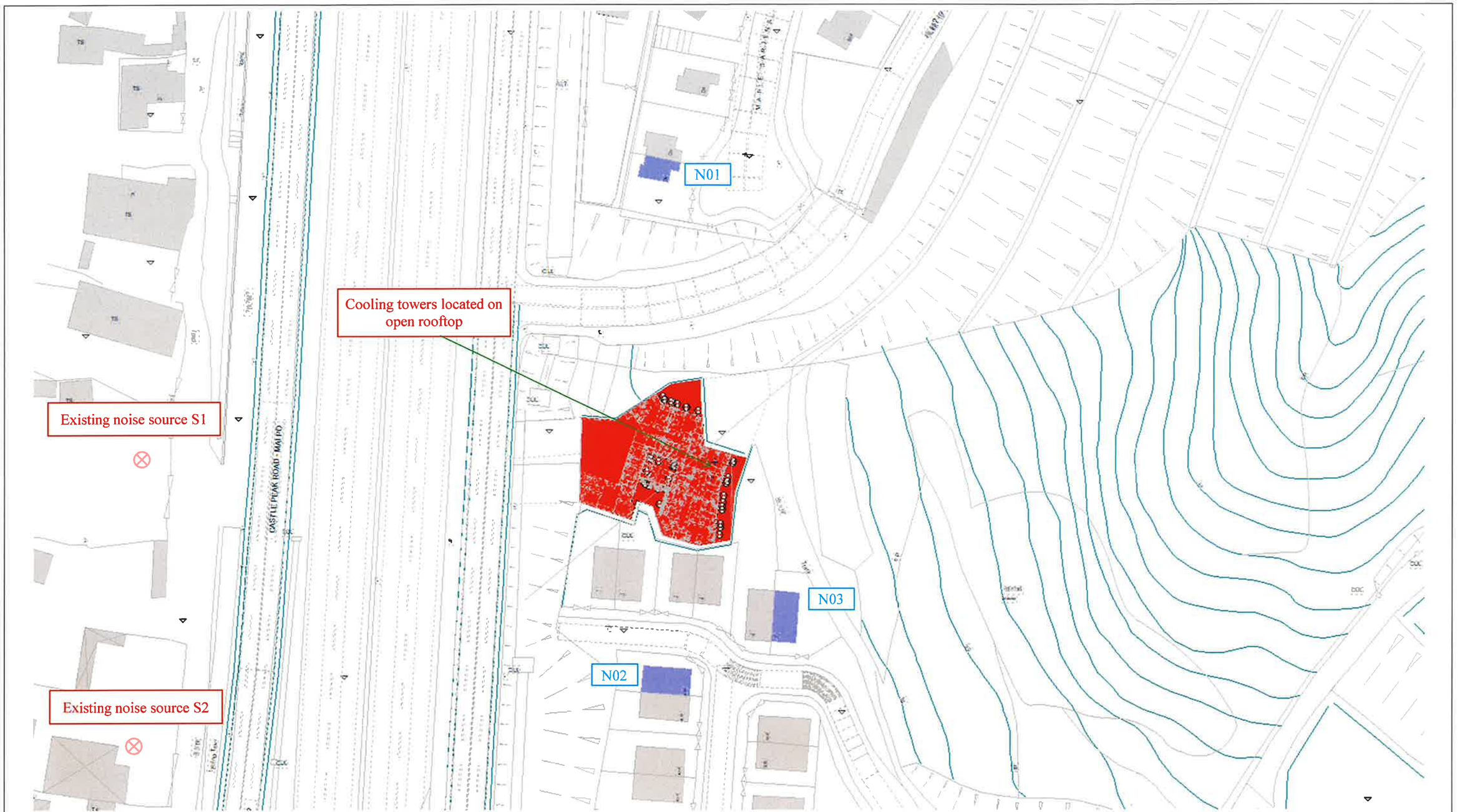
Cooling Tower selected for 81 San Tam Road Yuen Long
Model FWS-94-7.5 by Ryowo, two units are required to be installed.

Model	Nominal Water Flow l/s	Dimension L mm	W mm	h mm	H mm	Fan Motor kW	Fan Dia mm	Piping In mm	Out mm	Fv mm	Ot mm	Dr mm	Sound Power Level	Weight Dry kgs	Wet kgs
FWS-94-3.7	94	4000	2000	4125	4625	3.7	1600	100x2	150	25	50	50	88	1335	2300
FWS-94-5.5	107				4705	5.5							91	1385	2350
FWS-94-7.5	119				4745	7.5							93	1400	2365
FWS-127-5.5	127	4400	2300	4125	4705	5.5	1800	100x2	150	25	50	50	90	1570	3000
FWS-127-7.5	141				4745	7.5							92	1585	3015
FWS-127-11	160				4825	11							94	1650	3080
FWS-169-7.5	169	4400	2600	4125	4745	7.5	2000	125x2	200	25	50	50	93	1690	3700
FWS-169-11	192				4825	11							94	1760	3770
FWS-169-15	212				4870	15							95	1770	3780
FWS-200-7.5	190	4600	2600	4125	4785	7.5	2400	125x2	200	40	80	50	91	2195	4000
FWS-200-11	215				4865	11							93	2250	4055
FWS-200-15	235				4910	15							95	2255	4060
FWS-250-7.5	210	4800	3200	4345	4985	7.5	2450	125x2	200	40	80	50	90	2890	5000
FWS-250-11	240				5065	11							93	2945	5055
FWS-250-15	265				5110	15							94	2950	5060
FWS-275-7.5	235	5200	3200	4145	4745	7.5	2900	150x2	200	40	80	50	89	3050	5160
FWS-275-11	255				4865	11							92	3105	5215
FWS-275-15	285				5910	15							94	3110	5220
FWS-300-7.5	235	6000	3200	4345	4895	7.5	2400	150x2	200	40	80	50	89	3310	6500
FWS-300-11	270				5065	11							91	3365	6555
FWS-300-15	300				5110	15							93	3370	6560
FWS-300-18.5	320				5175	18.5							94	3410	6600
FWS-300-22	340				5215	22							95	3470	6660
FWS-330-7.5	260	6300	3200	4145	4755	7.5	2900	150x2	250	50	80	50	88	3405	6595
FWS-330-11	300				4865	11							91	3460	6650
FWS-330-15	330				4910	15							93	3465	6655
FWS-330-18.5	350				5174	18.5							94	3505	6695
FWS-330-22	375				5215	22							95	3565	6755
FWS-350-7.5	275	5400	3600	5435	6065	7.5	3000	150x2	250	50	80	50	89	3580	6770
FWS-350-11	315				6145	11							91	3635	6825
FWS-350-15	350				6190	15							93	3640	6830
FWS-350-18.5	375				6255	18.5							94	3680	6870
FWS-350-22	400				6295	22							95	3740	6930
FWS-400-7.5	255	6600	3600	4345	4965	7.5	3000	125x4	250	50	80	50	87	3630	7000
FWS-400-11	325				5065	11							89	3685	7055
FWS-400-15	360				5110	15							91	3690	7060
FWS-400-18.5	385				5135	18.5							92	3730	7100
FWS-400-22	410				5195	22							93	3790	7160
FWS-400-30	450				5255	30							94	3870	7185
FWS-500-7.5	305	6600	4200	5355	5990	7.5	3400	125x4	250	50	80	50	87	4230	8000
FWS-500-11	345				6070	11							90	4285	8055
FWS-500-15	385				6115	15							91	4290	8060
FWS-500-18.5	410				6180	18.5							93	4325	8100
FWS-500-22	435				6220	22							94	4390	8170
FWS-500-30	485				6290	30							95	4415	8145
FWS-550-7.5	315	6600	3600	5455	5990	7.5	3000	125x4	250	50	80	50	87	4350	8080
FWS-550-11	360				6070	11							89	4405	8135
FWS-550-15	400				6115	15							91	4410	8140
FWS-550-18.5	430				6180	18.5							92	4450	8180
FWS-550-22	455				6220	22							94	4510	8240
FWS-550-30	500				6280	30							95	4535	8275
FWS-600-11	435	7000	4200	5500	6255	11	3700	150x4	300	50	80	50	89	5015	9000
FWS-600-15	485				6300	15							91	5020	9005
FWS-600-18.5	520				6365	18.5							92	5060	9045
FWS-600-22	550				6405	22							93	5120	9085
FWS-600-30	610				6465	30							95	5140	9110
FWS-600-37	650				6485	37							96	5330	9300
FWS-700-11	515	7000	5000	5500	6255	11	3700	150x4	300	50	80	50	89	5650	12000
FWS-700-15	570				6300	15							91	5655	12005
FWS-700-18.5	610				6365	18.5							92	5690	12055
FWS-700-22	645				6405	22							93	5755	12120
FWS-700-30	720				6465	30							95	5780	12145
FWS-700-37	765				6485	37							96	5970	12335
FWS-800-11	555	7500	5000	6400	7155	11	4200	150x4	300	50	80	50	88	6905	14880
FWS-800-15	615				7200	15							90	6910	14885
FWS-800-18.5	655				7265	18.5							91	6945	14920
FWS-800-22	695				7305	22							93	7010	14985
FWS-800-30	760				7365	30							95	7035	15010
FWS-800-37	820				7435	37							98	7225	15200
FWS-800-45	880				7495	45	4200	150x4	350	50	80	50	99	7255	15230
FWS-800-55	940				7495	55							100	7365	15340

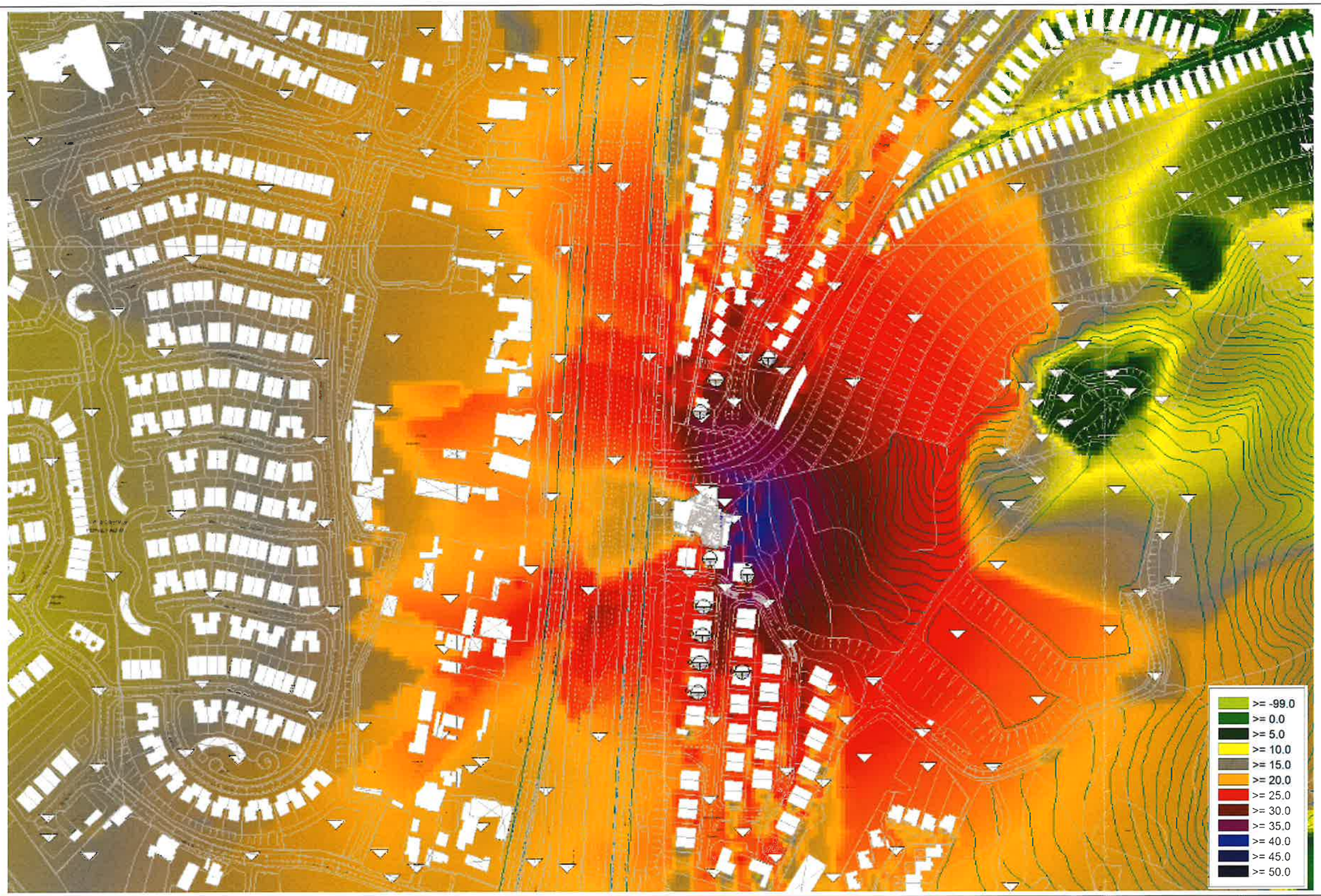
Notes:
1/CTI Certification applies to the operation with the Wet Bulb Temp. between 12.8°C and 32.2°C, Max. Entering Water Temp. 51.7°C, Min. Range of 2.2°C and Min. Approach of 2.8°C.
2/The nominal water flows are based upon 37°C HWT, 32°C CWT, 28°C WBT, 32°C DBT and 101.3 kPa Barometric pressure.
3/Sound Power Level is in dBA re 10 ⁻¹² Watt.
4/Data and specifications are subjected to change without prior notice.

ryowo

PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.2.3	LEAD ARCHITECT: R Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: NOVOX	PREPARED BY	Phoenix Lee
DRAWING TITLE: ACOUSTIC DATA FOR PROPOSED COOLING TOWERS	SCALE: N.T.S. / REV: A			CHECKED BY	Eddy Ng
				APPROVED BY	Banting Wong



PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.2.4		LEAD ARCHITECT:	ENVIRONMENTAL CONSULTANT:	PREPARED BY: Phoenix Lee
DRAWING TITLE: LOCATION OF FIXED NOISE SOURCES & REPRESENTATIVE NSRS	SCALE: N.T.S.	REV: A			CHECKED BY: Eddy Ng
					APPROVED BY: Banting Wong



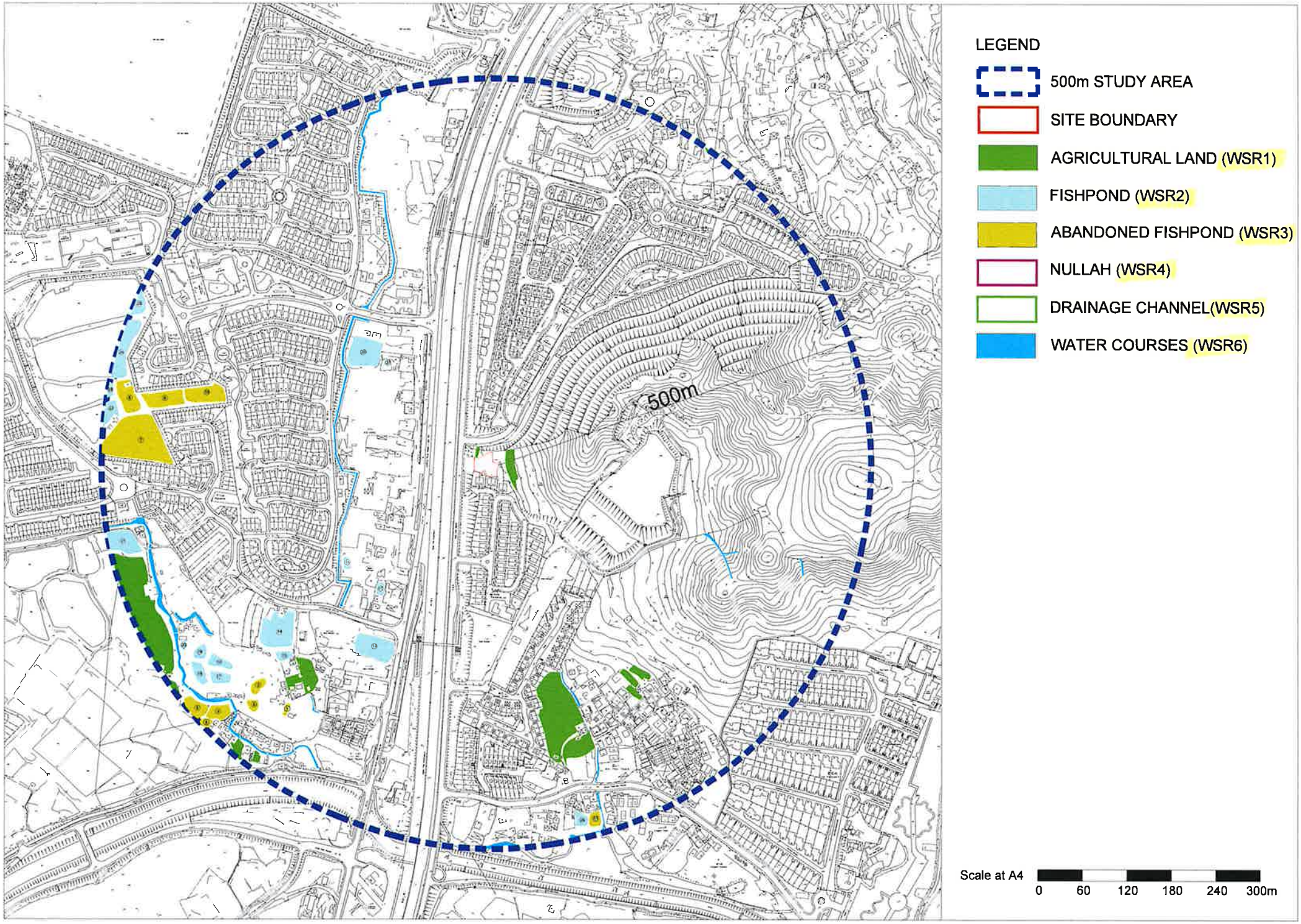
PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 3.2.5		LEAD ARCHITECT: R Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: Novox	PREPARED BY: Phoenix Lee
DRAWING TITLE: NOISE CONTOUR OF FIXED SOURCE NOISE IMPACT (MITIGATED)	SCALE: N.T.S.	REV: A			CHECKED BY: Eddy Ng
					APPROVED BY: Banting Wong

Appendix 4.1. WATER QUALITY STANDARD

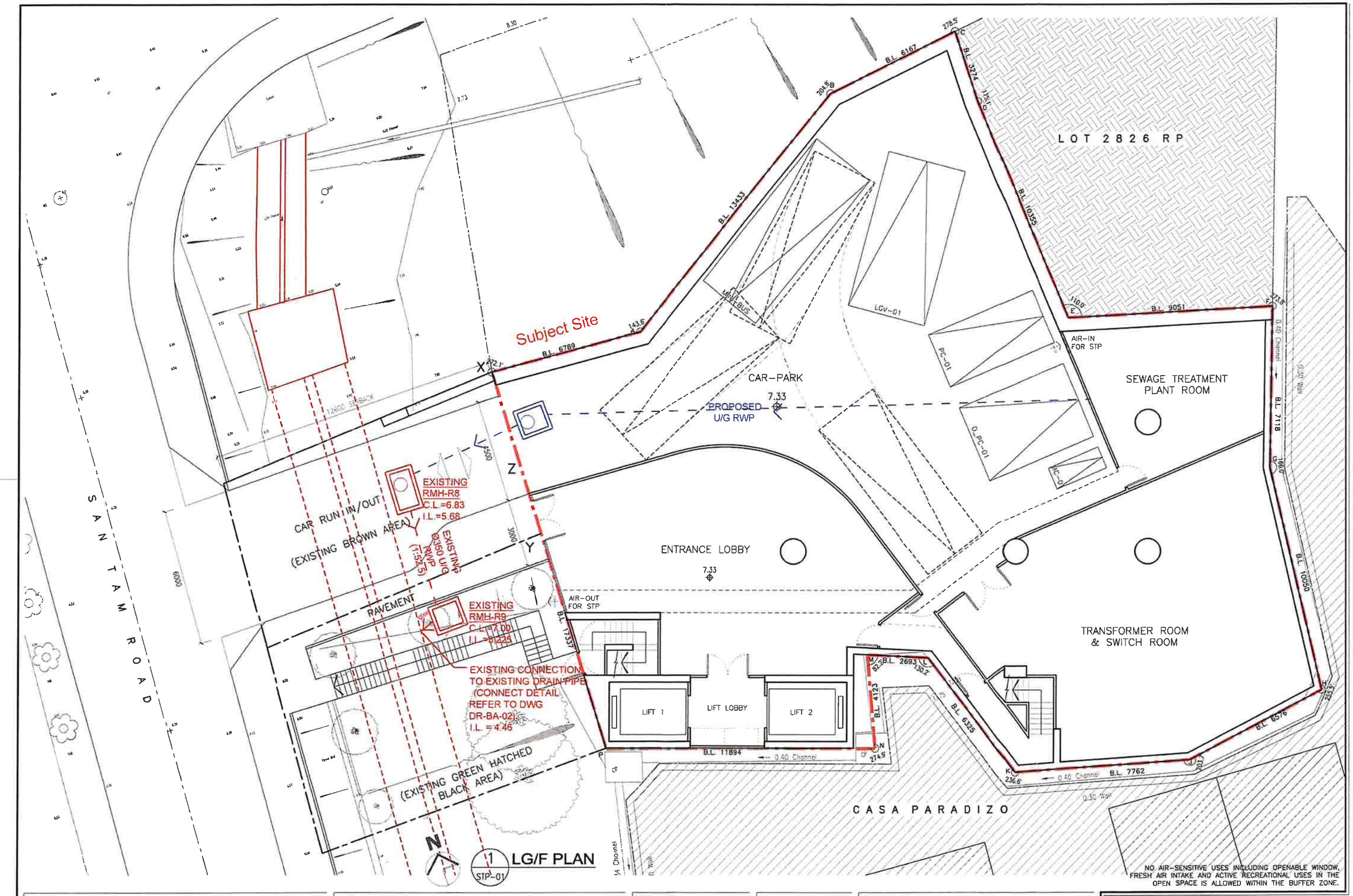
Determinand / Flow rate (m^3/day)	≦10	>10 and ≦200	>200 and ≦400	>400 and ≦600	>600 and ≦800	>800 and ≦1000	>1000 and ≦1500	>1500 and ≦2000	>2000 and ≦3000	>3000 and ≦4000	>4000 and ≦5000	>5000 and ≦6000
pH (pH units)	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9
Temperature (℃)	45	45	45	45	45	45	45	45	45	45	45	45
Colour (lovibond units) (25mm cell length)	1	1	1	1	1	1	1	1	1	1	1.	1
Suspended solids	50	50	50	50	50	50	25	25	25	25	25	25
BOD	20	20	20	20	20	20	10	10	10	10	10	10
COD	80	80	80	80	80	80	50	50	50	50	50	50
Oil & Grease	20	20	20	20	20	20	10	10	10	10	10	10
Iron	10	10	10	7	5	4	3	2	1	1	1	1
Boron	5	4	3	2.5	2	1.6	1.1	0.8	0.5	0.4	0.3	0.2
Barium	5	4	3	2.5	2	1.6	1.1	0.8	0.5	0.4	0.3	0.2
Mercury	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals individually	1	0.5	0.5	0.5	0.4	0.4	0.25	0.2	0.15	0.1	0.1	0.1
Total toxic metals	2	1	1	1	0.8	0.8	0.5	0.4	0.3	0.2	0.14	0.1
Cyanide	0.1	0.1	0.1	0.1	0.1	0.08	0.06	0.04	0.03	0.02	0.01	0.01
Phenols	0.5	0.5	0.4	0.3	0.25	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Sulphide	5	5	5	5	5	5	2.5	2.5	1.5	1	1	0.5
Total residual chlorine	1	1	1	1	1	1	1	1	1	1	1	1
Total nitrogen	100	100	100	100	100	100	80	80	50	50	50	50
Total phosphorus	10	10	10	10	10	10	8	8	5	5	5	5
Surfactants (total)	15	15	15	15	15	15	10	10	10	10	10	7
E. coli (count/100ml)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 4.1.1		LEAD ARCHITECT: R Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: Novox	PREPARED BY: Phoenix Lee
DRAWING TITLE: STANDARDS FOR EFFLUENTS DISCHARGED INTO THE COASTAL WATERS OF DEEP BAY WATER CONTROL ZONE	SCALE: N.T.S.	REV: A			CHECKED BY: Eddy Ng
					APPROVED BY: Banting Wong

Appendix 4.2. WATER SENSITIVE RECEIVERS


LEGEND
500m STUDY AREA
SITE BOUNDARY
AGRICULTURAL LAND (WSR1)
FISHPOND (WSR2)
ABANDONED FISHPOND (WSR3)
NULLAH (WSR4)
DRAINAGE CHANNEL(WSR5)
WATER COURSES (WSR6)
500m
Scale at A4
0
60
120
180
240
300m

Appendix 4.3. PRELIMINARY DISCHARGE ROUTE AND DESIGN CALCULATION OF STP



NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202

PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

LG/F PLAN
DISCHARGE ROUTE OF THE STP

STP-01 | 1:150 (A3) | - | OCT. 2022

Do not scale drawing.
Contractors are required to verify exact dimensions on site.
The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate.
The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified.
This drawing is not for construction purposes unless expressedly certified.

RLEE

Design Calculation

Revision 1

for

Sewage Treatment Plant (MBR)

For Ngau Tam Mei Lot no. 4823 in DD104 for

Residential Care Home Services

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BASIS OF DESIGN

I. BASIC OF DESIGN

Hydraulic Loading and Organic Loading

A) From Residents

No. of Residents	:	200 head/Day
Unit Flow	:	0.37m^3/head/day
BOD_5 Loading for Residents	:	0.055 kg/head/day
SS Loading for Residents	:	0.055 kg/head/day

Daily Flow from Residents
= 200 head x 0.37 m^3/head/day
= 74 m^3/day

BOD_5 Loading from Residents
= 200 head x 0.055 kg/head/day
= 11 kg/day

SS Loading from Residents
= 200 head x 0.055 kg/head/day
= 11 kg/day

B) From Staff

No. of Staff	:	50 head/Day
Unit Flow	:	0.07m^3/head/day
BOD_5 Loading for User	:	0.023 kg/head/day
SS Loading for User	:	0.023 kg/head/day

Daily Flow from Staff
= 50 head x 0.07 m^3/head/day
= 3.5 m^3/day

BOD_5 Loading from Staff
= 50 head x 0.023 kg/head/day
= 1.15 kg/day

SS Loading from Staff
= 50 head x 0.023 kg/head/day
= 1.15 kg/day

Influent Condition

Total Daily Flow
= (74+3.5) m^3/day
= 77.5 m^3/day

Average Hourly Flow (DWF)
$= \frac{77.5\ m^3\ /day}{24hr\ /day}$
= 3.23 m^3/hr

Peak Hourly (6 DWF)
= 3.23 m^3/hr x 6
= 19.38 m^3/hr

Design Flow (3DWF)
= 3.23 m^3/hr x 3
= 9.69 m^3/hr

Total BOD_5 Loading
= (11+1.15) kg/day
= 12.15 kg/day (156.774 mg/l)

Total SS Loading
= (11+1.15) kg/day
= 12.15 kg/day (156.774 mg/l)

Required Standard of Treated Water

BOD_5	:	≦ 10 mg/L
SS	:	≦ 10 mg/L
E. coli	:	≦ 100 count/100ml
TN	:	≦ 20mg/l
Amonia Nitrogen	:	≦ 5mg/l
TP	:	≦ 2mg/l

PROCESS DESCRIPTION

II. PROCESS DESCRIPTION

Sewage arising from development will be collected by the sewerage collection network to the Equalization Tank for the treatment process via the automatic coarse bar screen of bar spacing 20mm (one auto duty and one manual standby).

a) Equalization Tank

Primary screened sewage then flows by gravity into the Equalization Tank. The Equalization Tank acts to equalize the flow in terms of both hydraulic and organic loading. Aeration and mixing in the Equalization Tank is provided by two submersible air ejector (one duty) to prevent sewage from becoming septic and to prevent solids from settling. Two sewage transfer pumps (one duty and one standby) are provided to transfer equalized sewage from the Equalization Tank to automatic fine bar screen of bar spacing 2mm (one auto duty and one manual standby) to flows by gravity into the MBR Tank.

b) MBR Tank

Equalized and screened sewage transfers to the Membrane Bioreactor (MBR) Tank and then mixed & aerated together with the Mixed Liquor Suspended Solids (MLSS) for the removal of organic pollutants such as BOD. The MBR system is a suspended growth activated sludge system followed by micro-filtration for sludge-liquid separation by the membrane modules. Submerged, outside-in, flat sheet type membrane module (four duty) will be installed in the MBR Tank.

This membrane will separate treated effluent from MLSS (pore size smaller than 0.08 μm) and no further secondary sedimentation is required. The effective retention of MLSS provided the long Sludge Retention Time (SRT) and short Hydraulic Retention Time (HRT) for the treatment process. In-built bubble diffusers of MBR module and diffusers in MBR tank will provide aeration in the MBR System. Scrubbing of the membrane will effectively be achieved by the continuous aeration. Compressed air will be supplied by positive displacement blowers (one duty and one standby).

Pressure Transmitter (one duty) across the membrane and pump will be provided indicate the running pressure of permeate pumps (two duty and one standby). The dissolved oxygen monitor is provided to monitor the dissolved oxygen content in MBR tank which indicate the aeration condition inside the tank.

Two submersible de-sludge pumps (one duty and one standby) will be provided in MBR Tank. Duty de-sludge pump transfers surplus activated sludge to the Sludge Holding Tank for further treatment. The operation of de-sludge depends on the real situation of MBR tank such as the thickness of active sludge bed or the concentration of MLSS. At the early stage, the operation of de-sludge pump shall be manual and would switch to timer control once the system is deemed as mature.

c) Disinfection and Effluent Discharge

MBR treatment system can provide highly efficient suspended solids removal by physical separation. Three permeate pumps (two duty and one standby) will operate by level controller to draw the effluent through the membrane filter to UV disinfection system (one duty and one standby) for elimination of growth of E.Coli.

This UV sterilizer equipped with advanced automatic wiping system. The unfiltered solid may coat on the UV quartz sleeve and reduce transmittance strength. The wipe ring which surrounded the UV quartz sleeve will automatically wipe out the solid coated on the sleeve surface under the factory pre-set timer.

Electromagnetic flowmeter (one duty) is provided at the discharge pipe after UV sterilizer for effluent monitoring purpose.

d) Sludge Holding Tank

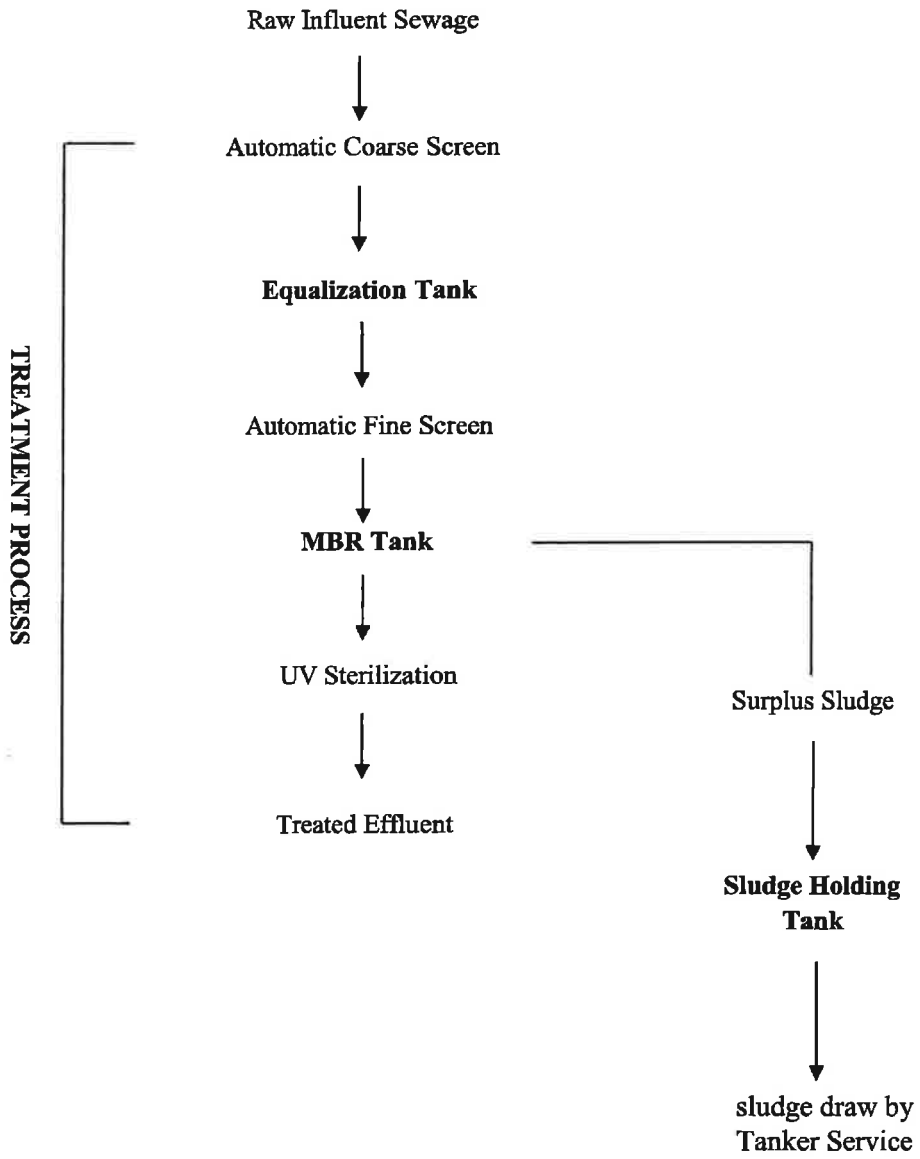
Waste sludge is an end product of all aerobic processes. It may be allowed to build up in the MBR Tank to a certain extent as an increase in mixed-liquor solids, or in the Sludge Holding Tank.

Surplus activated sludge of approximately 1% solids content is wasted from the MBR Tank to the Sludge Holding Tank by the de-sludge pump. This sludge wasting is regulated on a time basis according to sludge growth rate as measured by the rate of increase in mixed liquor suspended solids (MLSS). The sludge in the Sludge Holding Tank will be further digested aerobically by aeration through the submersible air ejector (one duty).

Aeration in sludge holding tank will be stopped regularly for gravity thickening of the sludge. The Sludge Holding Tank is designed to hold wasted sludge for a minimum of twenty (20) days. Digested sludge will be disposed by sludge dewatering system frequently.

TREATMENT PROCESS SCHEMATIC

III. TREATMENT PROCESS FLOW DIAGRAM



DESIGN CALCULATION

IV. DESIGN CALCULATION

A. Automatic Coarse Bar Screen

An automatic coarse bar screen is installed before Equalization Tank to removal debris from entering raw sewage.

Bar Spacing: 20mm
Flow capability = 70 m^3/hr > Peak hourly flow 19.38 m^3/hr

B. Equalization Tank

The minimum retention time of Equalization Tank should be 2 hours of peak hourly Flow.

(i) Size of Tank

The minimum effective value = 2 hr x (Peak hourly flow –Design hourly flow)

= 2 hr x (19.38 – 9.69) m^3/hr
= 19.38 m^3

Tank size = 3.5 m (L) x 3 m (W)
Tank Height = 3 m
Top water level (TWL) = +2.7
Bottom water level (BWL) = +0.0
Water depth (WD) = 2.7 m
Effective water level = 2.1 m
Effective volume = 3.5 m(L) x 3 m(W) x 2.1 m (H)
= 22.05 m^3

(ii) Retention time = $\frac{22.05 m^3}{(19.38-9.69) m^3/hr}$ = 2.28 hrs > 2hrs, **OK**

(iii) Check pump Start/stop frequency

Pump stop level = +0.6
Pump start level = +0.8
Pump start/stop volume = 3.5 m (L) x 3 m (W) x 0.2 m
= 2.1 m^3

Pump start/stop frequency = $\frac{15 \times 9.69 m^3/hr \div 60 min/hr}{2.1}$

= 1.15 time/hr < 10 times/hr, **OK**

(iv) Air requirement for mixing = 20m^3/min per 1000m^3 of tank volume

$$= 20 \text{ m}^3/\text{min} \times \frac{3.5 \text{ m} \times 3 \text{ m} \times 2.7 \text{ m}}{1000 m^3}$$

$$= 0.567 \text{ m}^3/\text{min}$$

$$= 34.02 \text{ m}^3/\text{hr}$$

Provide two submersible pumps, (one duty and one standby) in the Equalization Tank to transfer sewage with equalized flow of 19.5 m^3/hr at 5 m head to MBR Tank.

Provide one sets of submersible ejector at air capacity 45 m^3/hr in 3mAq.

C. Automatic Fine Bar Screen

An automatic fine bar screen is installed before Equalization Tank to removal fine debris from entering raw sewage.

Bar Spacing: 2mm
Flow capability = 26 m^3/hr > Peak hourly flow 9.69 m^3/hr

D. Membrane Bioreactor Tank (MBR Tank)

Pre-treated sewage will be pumped at a constant rate, from Equalization Tank to MBR Tank. Air is provided for biological treatment.

(i) Size of Tank

Tank Size = 3.5 m (L) x 3.7 m (W)
Tank Height = 3 m
Top water level = +2.7
Bottom water level = +0.0
Water Depth = 2.7 m

Tank capacity
= 3.5 m (L) x 3.7 m (W) x 2.7 m (WD)
= 34.97 m^3

(ii) Retention time = $\frac{34.97 m^3}{9.69 m^3/hr}$

= 3.4 hrs > 3hrs, **OK**

(iii) Calculation of F/M ratio of MBR Tank

After passing through the Bar Screen, the BOD loading before entering the MBR tank will be removed by 7.5%
Influent BOD loading = 12.15 Kg/day

BOD loading before entering the MBR Tank
= 12.15 kg/day x 0.925
= 11.24 kg/day (145.02 mg/l)

Assume MLSS = 5000 mg/l,

F/M ratio
= 11.24 kg/day / (5000 mg/l x 10^{-6} kg/mg x 10^3 l/m^3 x 47.25 m^3)
= 0.064 Kg BOD/ Kg MLSS –day

(iv) Nos. of Membrane module required

Design flux rate of membrane sheet = 35 litre/m^2-hr

Minimum filtration area required:
= (9.69 m^3/hr x 1000 l/m^3) / 35 litre/m^2-hr
= 277 m^2

Three sets of "Toray" NHP210-150S membrane module is adopted , each of membrane filtration aera of 105 m^2 to provide total filtration area of 315m^2 for this tank.

(v) Calculation of Volumetric BOD Loading

After passing through the Bar Screen, the BOD loading before entering the MBR tank will be removed by 7.5%
After passing through the Bar Screen BOD loading = 11.24 kg/day (145.02 mg/l)

$$\frac{Q\ m^3/\text{day} \times 10^{3} \times S\ \text{mg/l}}{V\ m^3 \times 10^{3}}$$

= (77.5 m^3/day x 145.02mg/l) / 34.97 m^3
= 321.43 mg/l-day
= 0.321 Kg BOD/ m^3 –day

(vi) Ammonia Nitrogen removal

Assume Ammonia Nitrogen = 20mg/l

Ammonia Nitrogen of influent sewage : Total flow x 20mg/l
= 77.5m3/day x 20mg/l
= 1550 g/day
= 1.55 kg/day

(vii) Calculation of oxygen requirement

(a) Air requirement for BOD removal:
Recommended by manufacturer is 110 m^3 air /kg - BOD removed.

Minimum air requirement for BOD removal
= (145 - 20) mg/l x 77.5 m^3/day x 110 m^3/kg x 10^{-6} kg/mg x 10^3 l/m^3
= 1065.76 m^3/day
= 44.4 m^3/hr (0.74 m^3/min)

(b) Air requirement for air scour of membrane module
From manufacturer design, 1 m^3/min air is required for air scour of one membrane module.

Total air required for air scour of membrane modules
= 1 m^3/min x 60 min x 3 modules
= 180 m3/hr (3 m^3/min)

(c) Air requirement for Ammonia Nitrogen removal:
Recommended by manufacturer is 380 m^3 air /kg - BOD removed.

Minimum air requirement for Ammonia Nitrogen removal
= (20 - 2) mg/l x 77.5 m^3/day x 380 m^3/kg x 10^{-6} kg/mg x 10^3 l/m^3
= 530.1 m^3/day
= 22.1 m^3/hr (0.368 m^3/min)

Total minimum air required for air blower
= (44.4 + 180 + 22.1) m^3/hr
= 246.5 m^3/hr(4.1 m^3/min)

Provide two air blowers (one duty and one standby) with airflow of 4.74m^3/min (284.4m3/hr) at 3.0mAq.

(viii) Check pump Start/stop frequency

Pump stop level = +1.5
Pump start level = +1.7
Pump start/stop volume = 3.5 m (L) x 3.7 m (W) x 0.2m
= 2.59 m3

Pump start/stop frequency = $\frac{15 \times 9.69 m^3/hr \div 60 min/hr}{2.59}$
= 0.94 time/hr < 10 times/hr, OK

E. UV Sterilization

UV Sterilizer is selected with nominal flow capacity of 24 m^3/hr to disinfect filtered effluent of design flow capacity (9.69 m^3/hr).

Dose requirement = 30000 $\mu W/cm^2$ for achieve 99.99% E. Coli removal
UV Chamber inner diameter = 150mm (15cm)
Quartz sleeve outer diameter = 28mm (2.8cm)
Total watt of UV lamp = 200W (200 x 10^6 μW)
UV lamp arch length = 1000mm (100cm)
Liquid transmission over 1cm = 1.0
Quartz sleeve transmission loss = 10% (assume)
UV output loss = 20% (assume)

UV chamber effective volume
= Water flow through UV chamber area x Lamp arch length
= $[(15/2)^2 - (2.8/2)^2]$ x π x 100 cm
= 17055 cm^3
= 17.055 L

Retention Time
=Volume / flow rate
= 17.055 L / (9.69m3/hr x 1000L / 3600sec)L/s
= 6.34 sec.

UV intensity at Chamber wall
= [Watt of UV lamp / (π x Chamber inner diameter x Lamp arch length)] x Liquid transmission x Quartz sleeve transmission loss x UV output loss
= [200 x 10^6 μW / (π x 15cm x 100cm)] x 1 x 0.9 x 0.8
= 42441 x 1 x 0.9 x 0.8
= 30558 $\mu W/cm^2$

UV Dose at Chamber wall
= Retention time x UV intensity at Chamber wall
= 6.34 sec. x 30558 $\mu W/cm^2$
= 193737 $\mu Ws/cm^2$ (>30000 $\mu Ws/cm^2$, **OK**)

F. Sludge Holding Tank

A Sludge Holding Tank for holding primary sludge and secondary sludge for 60 days. Wet sludge will be disposed by tankers regular. Submersible ejector is installed in the tank to prevent stagnant condition and remove odor of the wastewater. The submersible ejector will be controlled by timer and only operated at certain time interval which does not affect the settling efficiency.

(i) Size of Tank (Holding time)

A Sludge Holding Tank for holding the secondary sludge for 60 days. The sludge holding time is calculated as follows:

Tank Size = 2.9 m (L) x 3.7 m (W)
Tank Height = 3 m
Top water level = +2.7
Bottom water level = +0.0
Water Depth = 2.7 m

Tank capacity = 2.9 m (L) x 3.7 m (W) x 2.7 m (WD)
= 28.97 m^3

With 7.5% BOD removed after fine bar screen
BOD loading for biological treatment
= 11.24 kg/day

BOD removal rate
= 77.5 m^3/day x 1000 litre/m^3 x (145 - 20) mg/liter x 10^{-6} kg/day
= 9.69 kg/day

Sludge yield from biological processes is taken as 1 kg solid/1 kg BOD removed. Therefore sludge production rate is calculated as follows:
Sludge production rate = 9.69 kg/day x 1.0 kg/kg BOD removal
= 9.69 kg/day

Assuming that the wet sludge solid content is 2% and specific gravity of 1.01

Volume of wet sludge produced = $\frac{9.69\ kg/day}{0.02x1.01x1000kg/m^3}$

$= 0.48\ m^3/day$

Storage time = $\left(\frac{28.97m^3}{0.48m^3/day}\right)$

$= 60.4$ days > 60days, **OK**

(ii) Air requirement for aeration and mixing

$= 30\ m^3/min$ per $1000m^3$ x tank volume
$= (30\ m^3/min \times 28.975\ m^3) / 1000\ m^3$
$= 0.87\ m^3/min$
$= 52.15\ m^3/hr$

Provide a submersible ejector with air flow of 80 m^3/hr at 3 mAq.

MAJOR EQUIPMENT LIST

V. MAJOR EQUIPMENT LIST

1. Automatic Coarse Bar Screen

   1set – 'Tsurumi' model KS-200S-20mm with bar opening of 20mm and flow capacity of 70 m^3/hr

   1set – Manual Bar Screen with bar opening of 20mm

2. Equalization Tank

   2sets – 'Tsurumi' model TOS-50B2.75 submersible pump, one duty and one standby , each of flow capacity of 19.4m^3/hr vs 5m c/w 0.75 kw motor (3ph/50Hz/380V), w/SS316 lifting chain

   1set – 'Tsurumi' model TOS-22BER5 submersible ejector, in 45m^3/hr vs 3mAq c/w 2.2 kw motor (3ph/50Hz/380V), w/ SS316 lifting chain

   1set – Level switches for the above pumps

3. Automatic Fine Bar Screen

   1set – 'Tsurumi' model KE-200S-2mm with bar opening of 2mm and flow capacity of 26 m^3/hr

   1set – Manual Bar Screen with bar opening of 2mm

4. MBR Tank

   4sets –'Toray' model NHP210-150S flat-sheet type membrane module provided individually 315 m^2 area of membrane plat at pore size of 0.08 micron with flux rate of 35 litre/m^2/hr.

   3sets –"Liverani" model EP 40"-M TF non-submersible permeate pump, two duty and one standby, in flow capacity of 4.8 m^3/hr(21.1gpm) vs 12.5m head c/w 1.1 kw motor (3ph/50Hz/380V)

   2sets –'Tsurumi' model TOK-50UT2.4 submersible pump, one duty and one standby , each of flow capacity of 12m^3/hr vs 5m c/w 0.4 kw motor (3ph/50Hz/380V), w/SS316 lifting chain

   2sets –"Tsurumi" model RSR-80 air blowers, one duty and one standby, in 284.4m3/hr vs 3mAq c/w 5.5 kw motor (3ph/50Hz/380V)

1set – Level switches for the above pumps

5. Sludge Holding Tank

   1set –'Tsurumi' model 50UT2.4 submersible pump, one duty of flow capacity of 12m3/hr vs 5m c/w 0.4 kw motor (3ph/50Hz/380V), w/SS316 lifting chain

   1set – 'Tsurumi' model TOS-37BER5 submersible ejector, in $80m^3$/hr vs 3mAq c/w 3.7 kw motor (3ph/50Hz/380V), w/ SS316 lifting chain

6. UV Sterilizer

   2sets –"Triogen" model SLP150-50-1 UV Sterilizer, one duty and one standby, each of flow capacity of $24m^3$/hr c/w 0.2 kw motor (3ph/50Hz/380V)

7. One set of pressure transmitter, dissolved oxygen monitor, MLSS monitor and electromagnetic flow meter indicating the suction pressure dissolved oxygen sensor and MLSS sensor in MBR tank and the final discharge flow.

8. Centralized PLC Control panel for above sewage treatment system

9. Interconnecting pipe, valves and fittings for above sewage treatment system

10. Interconnecting cable, conduit and fitting for above sewage treatment system

APPENDIX 5.1 FSD AND EPD'S REPLY ON LAND CONTAMINATION

消 防 處
香港九龍何文田常安街1號
消防處總部大廈

FIRE SERVICES DEPARTMENT
FIRE SERVICES HEADQUARTERS BI II DING,
No.1 Heung Chong Road,
Yau Ma Tei East, Kowloon,
Hong Kong.

本處檔號 OUR REF. : (120) in FSD GR 6-5/4 R Pt. 44
來函檔號 YOUR REF. :
電子郵件 E-mail : hkfsdenq@hkfsd.gov.hk
圖文傳真 FAX NO. : 2739 5879
電 話 TEL NO. : 2733 7741

6 December 2022

NOVOX Limited
Room L, 7/F, Block 2,
Kinho Industrial Building,
14-24 Au Pui Wan Street, Fotan, Shatin
(Attn: Mr. Eddy NG, Project Manager)

Dear Mr. NG,

Proposed Residential Care Home for Elderly at Lot 4823 in DD 104, 81 San Tam Road, Yuen Long
Request for Information of Dangerous Goods & Incident Records

I refer to your letter of 14.10.2022 regarding the captioned request and reply below in response to your questions:-

Please be advised that neither records of dangerous goods license, nor incidents of spillage / leakage of dangerous goods were found in connection with the given conditions of your request at the subject location.

If you have further questions, please feel free to contact the undersigned.

Yours sincerely,

(NG Wing-chit)
for Director of Fire Services

Ref. number and date should be quoted in reference to this letter

Eddy NG (Novox)

From: leolau@epd.gov.hk
Sent: Wednesday, June 29, 2022 4:02 PM
To: eddy.ng@novox.com.hk
Cc: arthurtau@epd.gov.hk; leolau@epd.gov.hk
Subject: Fw: Proposed RCHE at 81 San Tam Road - Request for Information about Spillage/Leakage of Chemical Waste or Chemicals
Attachments: Proposed RCHE at 81 San Tam Road_RFI Chemical Leakage.pdf

Dear Sir/Madam,

Re. your letter and email of 28.6.2022 below.

This Office has no record of any reported chemical spillage / leakage incident at the captioned locations. Nonetheless, you are advised to check with other relevant parties / departments for such information as appropriate.

For record of Chemical Waste Producers Registration, a registry is available at our Territory Control Office in Wan Chai. Please contact our Mr. Eric FUNG at 2835 1027 or our Mr. MA at 6308 0705 for details during the office hours.

Yours faithfully,

(Leo K.Y. LAU)
for Director of Environmental Protection

Tel. - 2158 5833

---- Forwarded by Leo KY LAU/EPD/HKSARG on 29/06/2022 15:57 ----

From: "Eddy NG (Novox)" <eddy.ng@novox.com.hk>
To: <leolau@epd.gov.hk>
Cc: <banting.wong@novox.com.hk>
Date: 28/06/2022 15:03
Subject: Proposed RCHE at 81 San Tam Road - Request for Information about Spillage/Leakage of Chemical Waste or Chemicals

Dear Sir,

A construction project is under planning at the captioned site. As part of the environmental assessment, we are required to undertake a land contamination assessment in order to identify any potential contaminated issues within the Project Area, shown in below Figure as per attached. For this, we would like to request for the following information of the Project Area:

- Any records of spillage/ leakage of chemical waste or chemicals at the Project Area.

PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 5.1.1		LEAD ARCHITECT: R Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: NOVOX	PREPARED BY	Phoenix Lee
DRAWING TITLE: FSD AND EPD'S REPLY ON LAND CONTAMINATION	SCALE: N.T.S.	REV: A			CHECKED BY	Eddy Ng
					APPROVED BY	Banting Wong

APPENDIX 7.1 TD'S REPLY ON TRAFFIC FORECAST

CTA Consultants Limited
Transportation, Planning, Engineering, Research and Development
We commit We deliver

Our Ref: 22069HK/hor/ykl/04

By E-mail only
(Email: eddy.ng@novox.com.hk)

24 May 2023

Novox Limited
Room L, 7/F, Block 2, Kinho Industrial Building
14-24 Au Pui Wan Street
Fotan, Shatin
Hong Kong

Attn: Mr. Eddy Ng

Dear Sir,

S12A Amendment of Plan Application,
Approved Ngau Tam Mei Outline Zoning Plan No. S/YL-NTM/12
Proposed Rezoning from "R(C)" to "G/IC" for a Proposed "Social Welfare Facilities"
(Residential Care Homes for the Elderly) (RCHE)
At Lot 4823 in DD 104, 81 San Tam Road, San Tin, N.T.
Year 2042 Traffic Forecasts for Traffic Noise Impact Assessment (TNIA)

We refer to our submission of traffic forecasts via our letter [Ref.: 22069HK/hor/ykl/03] dated 8 February 2023 and e-mail dated 23 May 2023, and the e-mail reply from Transport Department dated 22 and 23 May 2023 regarding the captioned subject.

We write to confirm that Transport Department's endorsed methodology prepared by us has been strictly adopted in preparing the traffic forecast for the Noise Impact Assessment Report prepared by Novox Limited.

Should you have any queries or require further information, please do not hesitate to contact the undersigned at 2214 0849.

Thank you very much for your kind attention.

Yours Faithfully,
For and on behalf of
CTA Consultants Ltd.

Horace Mak
Director

CTA Consultants Limited 志達顧問有限公司
Unit 2108, 21/F, Westlands Centre, 20 Westlands Road, Quarry Bay, Hong Kong
香港鰂魚涌華蘭路 20 號華蘭中心 21 樓 2108 室
Tel: (852) 2214 0849 / Fax: (852) 2214 0817
Email: cta@ctaconsultants.com / website: www.ctaconsultants.com

Subject: RE: S12A amendment of OZP no. S/YL-NTM/12 - Proposed RCHE at 81 San Tam Road, San Tin, NT

Chi Kong LEUNG <chikongleung@td.gov.hk>
to Agnes Lee, Evonne Li, Horace Mak, Ming Yip TSE
Tue, 23 May, 20:41

You are viewing an attached message. R Lee Architects (HK) Ltd Mail can't verify the authenticity of attached messages.

Dear Agnes,

I have no further comment on the captioned submission from traffic engineering point of view.

Thank you.

Regards,
Donald Leung
E/IP, TE/NTW
Transport Department
Tel. 2399 2778

From: "Agnes Lee" <agneslee@ctaconsultants.com>
To: "Chi Kong LEUNG" <chikongleung@td.gov.hk>
Cc: "Evonne Li" <evonneli@ctaconsultants.com>, "Horace Mak" <horacemak@ctaconsultants.com>, "Ming Yip TSE" <mingyiptse@td.gov.hk>
Date: 23/05/2023 03:48 PM
Subject: RE: S12A amendment of OZP no. S/YL-NTM/12 - Proposed RCHE at 81 San Tam Road, San Tin, NT

Dear Donald,

Please be advised that the value of trip generation attraction of Application no. YYL-NSW/9 in Table 3.10 was due to typos. Please find attached the replacement page for Table 3.10 for your review and reference.

Thanks.

Agnes Lee
CTA Consultants Limited
Unit 2108, 21/F, Westlands Centre, 20 Westlands Road, Quarry Bay, H. K.
Tel: (852) 2214 0849 Fax: (852) 2214 0817
Email : cta@ctaconsultants.com

From: Chi Kong LEUNG <chikongleung@td.gov.hk>
Sent: Monday, May 22, 2023 5:18 PM
To: Agnes Lee <agneslee@ctaconsultants.com>
Cc: 'Evonne Li' <evonneli@ctaconsultants.com>; 'Horace Mak' <horacemak@ctaconsultants.com>; Ming Yip TSE <mingyiptse@td.gov.hk>
Subject: RE: S12A amendment of OZP no. S/YL-NTM/12 - Proposed RCHE at 81 San Tam Road, San Tin, NT

PROJECT: PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY AT 81 SAN TAM ROAD, YUEN LONG, N.T.	DRAWING NO.: C220410W-01 Figure 6.1.1		LEAD ARCHITECT: R Lee Architects (HK) Ltd	ENVIRONMENTAL CONSULTANT: Novox	PREPARED BY	Phoenix Lee
DRAWING TITLE: TD'S REPLY ON TRAFFIC FORECAST	SCALE: N.T.S.	REV: A			CHECKED BY	Eddy Ng
					APPROVED BY	Banting Wong

S12A AMENDMENT OF PLAN APPLICATION
APPROVED NGAU TAM MEI
OUTLINE ZONING PLAN NO. S/YL-NTM/12

PROPOSED REZONING FROM "R(C)" TO "G/IC"
FOR A PROPOSED "SOCIAL WELFARE FACILITIES"
(RESIDENTIAL CARE HOMES FOR THE ELDERLY)
(RCHE)

AT LOT 4823 IN D.D.104, 81 SAN TAM ROAD,
SAN TIN, N.T.

APPENDIX 4

LANDSCAPE MASTER PLAN

RLEE

RLEE Architects (HK) Ltd

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2 Planting Species for Greenery Coverage, Green Hatched Black Area and Brown Area

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12 Perspective View through Sky Garden

13 Front View Showing Greenery

14 Green Coverage Calculation

15 Open Space Calculation

16 Tree Felling Proposal & Retained Tree Location

1. Introduction

1.1 The Landscape Master Plan is prepared and submitted in support of the S12A application for a proposed amendment to the approved Ngau Tam Mei Outline Zoning Plan ("the approved OZP") No. S/YL-NTM/12. The proposed amendment is to rezone a Site from "R(C)" zone to "G/IC" zone to facilitate the development of a proposed RCHE at No.81 San Tam Road, Lot No. 4823 in D.D. 104.

1.2 The Indicative Landscape Master Plan is presented in ***Figure 2*** to ***Figure 8***, two Sections in ***Figures 9 & 10***, and Diagrams in ***Figures 14 &15***.

2. Existing Site Condition

2.1 The application site with an area of Approx. 736.3m^2 and is accessible from San Tam Road at level +7.33 mPD by the West. It adjoins an access road to "Crescendo" to the North and a low-rise residential development "Casa Paradiso" to the South. To the East is a small mountain full of Greenery.

2.2 By situating in R(C) zone, the surroundings are predominately low-rise, low-density development. However, the situation may undergo rapid change since a number of adjoining Planning Applications are underway.

2.3 In this rezoning, the gentle slope and greenery on the existing Green Hatched Black Area outside boundary would be generally maintained except with the addition of a concrete path with steps to facilitate a staircase discharge from the building.

2.4 All the trees in the Green Hatched Black Area outside boundary will be retained in the same location (Table 1), which includes a Cinamomum Camphora, a Celtis Sinensis retained and Five Gracina Spicata as compensatory planting proposed in the Tree Felling Application for the existing house development and was approved by DLO on 15/06/2016 (Ref No. (25) in DLOYL 515/YLT/2012D). ***Figure 16*** shows the details of that Tree Felling Proposal.

Tree	Species			Measurement			
Quantity	Botanical Name	Chinese Name	Location	Height	Spread	DBH	remarks
5	Garcinia Spicata	福木	Green Hatched Black Area	3000	1500	100	Straight trunk & Balance form
1	Cinnamomum Camphora	樟	Green Hatched Black Area	12000	8000	600	
1	Celtis Sinensis	朴樹	Green Hatched Black Area	12000	600	650	

Table 1 : Existing Tree in Brown Area and Green Hatched Black Area.
(As approved by DLO on 15/06/2016, (Ref No. (25) in DLOYL 515/YLT/2012D))

2.5 There is NO additional compensatory planting required for the proposed development as there is NO tree exists on Site.

3. Proposed Development Perspective

3.1 The proposed development is an 8-storey RCHE comprising about 142 bed spaces. It would make optimal use of scarce land resources to address the demand for elderly home care services in the vicinity.

Please refer to ***Figure 1*** for the Proposed RCHE Design.

3.2 The proposed development is accessible from San Tam Road at the run in/out provided. The access road will be reduced to 4.5 m wide in order to provide a pavement to the Entrance Lobby. Entrance Lobby, Car Park with accessible parking and loading/unloading bay together with all necessary Plant Rooms are provided on LG/F.

3.3 The proposed development has already set back by 12.6m from San Tam Road. The development will further set back above 2/F at the Northern & Eastern side. A Void on the Southern Side is designed to create "Stack Effect" for better ventilation.

4. Landscape Design Proposal

4.1 The Conceptual design of the Landscape Master Plan is illustrated as per ***Figure 2*** to ***Figure 8***, and Sections on ***Figures 9 & 10***. ***Figure 12*** shows the perspective view through the covered Sky Garden. ***Figure 13*** shows the front view form San Tam Road with the Landscaping features like the Vertical Greenery, etc.

4.2 The captioned Figures aim to introduce future landscape expectation and perspectives, providing a sense of the relationship between the landscape and Architecture to present the high quality and diverse open space and green coverage for the user.

4.3 The landscape design proposal will introduce the main concept followed by a brief of the landscape element planning with thoughtful arrangement with hard and soft landscape and components.

5. Landscape Design Objectives

5.1 The main design objectives for the landscape are listed below:

Propose a distinctive luxury landscape that is specially designed for elderly use.

Integrate the visual context of the development and preview the new look of the site and architecture.

Softened the visual impact for the surroundings with vegetation screening

Balancing the Green coverage and Open Space for the user to maximize the potential of the outdoor space

Adapting to the thermal climate of Hong Kong and ensuring the outdoor area is comfortable for the user through reasons in Hong Kong.

6. Open Space

6.1 The proposed development has provided a required amount of open space in accordance with the requirement of Hong Kong Planning Standard and Guidelines (HKPSG) with $1m^2$ per user for the proposed development. The components and facilities in the open space satisfy the requirement of the elderly and are easy to be managed by the staff.

6.2 Approx. 142 beds will be provided in the captioned development which indicates equal to the population of the development. ***Figure 15*** shows the scheme will provide not less than $142m^2$ of open space for the resident which satisfies the requirement of HKPSG and the needs of future residents.

6.3 All the landscaping and open space within the site boundary, Green Hatched Black Area and Brown Area would be constructed, managed, and maintained by the developer and relevant authorities after the completion of the Defects Liability Period and Establishment Period.

6.4 Due to the climate affecting the resident, Sky Garden on 1/F provide covered and outdoor open space for the elderly. This aims to provide an alternative option for the elderly so as to escape from direct sunlight and rain in summer.

7. Green Coverage

7.1 The Site Area of the proposed development does not conform to the minimum size requirement to provide Greenery coverage in the building. However, in order to improve the environmental quality of the urban space and open space, we are pleased to offer Greenery Space in accordance with the requirement for the development of 1000 m^2 - 2000 m^2 site area as detailed in Buildings Department Practice Notes PNAP APP-152, Sustainable Building Design Guidelines; and DEVB Technical Circular (Works) No. 3/2012. The design has included a minimum of 10% Greenery in the Primary Zone (15 m above main street level) and a total of 20% coverage.

7.2 The site area of the Proposed Development is 736.3 m^2. The Green Coverage shall not be less than 147.26 m^2 in total with and 73.63 m^2 in primary zone. ***Figure 14*** shows the location and amount of the Greenery Coverage.

7.3 On Sky Garden floor, part of the greenery will be extended to the covered area in order to maintain the consistency of the greenery view. Those species would be carefully selected in order to live in both outdoor and covered conditions.

7.4 Only Vertically uncovered Greenery Space has been counted as Green Coverage.

8. Landscape Design Components

8.1 The following description of the Components aim to improve the user experience for the potential user, staff, and visitor for the proposed development and minimize the visual impacts via various vegetation planting and greenery coverage. Facilitates and spaces are all accessible, barrier-free, and elderly-friendly to ensure the feasibility.

8.2 The Proposed Landscape design should refer to ***Figure 2*** to ***Figure 10*** and including several main components detailed as follow:

The Entrance Landscape

8.3 The gentle slope and trees in the Green Hatched Black Area between the application site and San Tam Road would be mostly retained the original form. Existing trees will reduce the noise from San Tam Highway and counselling the building block from the sight of the Highway to reduce the visual impact on the landscape view. ***Figure 3*** shows the landscape and the location of the trees in the Green Hatched Black Area.

Widened Pedestrian Pavement

8.4 The proposed Brown Area would undergo slight change to provide a pavement with the access road reduced to 4.5m wide. The Pavement leading to the Entrance door will be 3m wide which makes the main entrance more accessible for users with any equipment passing by. The pavement also provides a safer and independent path to separate pedestrian from vehicles.

Accessible Parking

8.5 The Car Park provides extra space for the loading/unloading bay & accessible Parking for visitor and resident, which complies with The Technical details and design on parking for drivers with disabilities in Volume 6 Chapter 8 of TPDM and the third schedule to the Building (Planning) Regulation (Cap 123F).

8.6 Signage clearly indicates the exact locations of the designated parking spaces for users for all the circulation. The signage will not be obscured and can be seen from the driver's seat.

Vertical Greenery

8.7 Vertical Greenerys are provided on Lower Floor Spandrels facing San Tam Road ***(Figure 13).*** Those would enhance the visual composition and signify the Entrance at the same time. Fixing and irrigation details are shown on ***Figure 11***.

Sky Garden on 1/F

8.8 The 1/F Sky Garden provides a diverse functional space that provides potential interest for the future user. The Sky Garden spaces are shaded and covered by the building block above. The covered open space allows the elderly to enjoy outdoor space in thermal climate and rainy seasons while escaping from direct sunlight and rain.

8.9 Considering the level of the sky garden might be seen by surrounding building users, the Sky Garden will be surrounded by trees and shrubs to secure user privacy while concealing the surrounding R(C) House from user perspectives. It also provides a natural context landscape view from sky garden to the small mountain at North-East side.

8.10 The Sky Garden provides better ventilation to the Podium and surrounding buildings by providing a ventilation channel from West to East to enhance the environmental sustainability of users and neighbourhood living space by achieving better air ventilation. ***Figure 4*** shows the layout plan of the 1/F Sky Garden and the connection between outdoor and indoors.

Lawn with functional Space on 1/F

8.11 The Lawn is located at the Northern setback platform on 1/F and to be surrounded by vegetation. As a semi-shaded area, the lawn enables use in various weather conditions to enjoy the natural context and to provide a flexible outdoor space for the management team and staff by holding different community events. It also allows interaction with the indoor multi-purpose room.

Japanese Zen Garden on 1/F

8.12 The Japanese Garden is located in the middle of 1/F at the bottom of the void. The Garden is referred to as the traditional Japanese Garden to present a peaceful, mysterious atmosphere. A wooden pavement Pavilion will be provided and surrounded the Japanese Garden. Residents can view the garden landscape by walking across the corridor of 2/F via the curtain glass or by stepping into the Pavilion in order to feel the Tranquillity of the garden.

8.13 In the middle of the Garden, the resident can create their own dry garden (枯山水庭園) which will provide calming effect with thoughtful and peaceful life sentiment.

Flower Planter on 2/F & 3/F

8.14 Mini Flower Planter located at 2/F & 3/F intends to soften the building form in low-level and provide views for the Dorm resident. Flower aims to reduce the anxiety of the resident when they require to stay in the Dorm alone. All the vegetation planted in the flower planter are designed to be slightly higher than the parapet of the dorm to ensure the user can easily notice the greenery through the window in the same level. ***Figure 5 & 6*** shows the flower planter location.

Staff Quarter Flat Roof on 8/F

8.15 In emergency conditions, the staff may require to work in closed-loop management and stay in the building for a longer period. The Staff Quarter Flat Roof provides a staff-only outdoor place that can efficiently improve staff accommodation quality and provide private space for the off-duty staff. Staff may feel anxiety during closed-loop management as they work and rest in the same place. The Flat Roof defines the boundary of working space and resting space for the staff to reduce the negative mental issues. ***Figure 7*** shows the location of the Staff Quarter Flat Roof and the proposed planter on the Flat Roof.

Roof Garden on R/F

8.16 The Roof Garden is a large outdoor area for user entertainment and space for events & activities. Being on the topmost floor, the Roof Garden maintain great advantages of non-distractive sight view and fresh air ventilation. Users can enjoy high-quality views and the equipment in their accommodation experience. ***Figure 8*** shows the layout plan of the Roof Garden accommodated every section location mentioned below.

Observatory Garden

8.17 Located on the Western Side of the Roof Garden, residents are able to have the view of Mai Po Nature Reserve and Wetland Area and observe the skyline without distraction. Seats are provided in the garden for users to relax and rest here.

Urban Farming

8.18 The Farming area is located in the middle of the Roof Garden. The 300m soil layer for farming would be sunken to ensure the user remains accessed at the same level as other sections of the Roof Garden. Four deeper planters will also be provided for the diversity of vegetation planting experiences in urban farming. Both Farming and its products can consequence a better communication and social relationship for the resident to support their mental and psycho-health during accommodation.

Entertainment Playground

8.19 The End of the Eastern side of the Roof Garden is utilized as Entertainment Playground for the resident. This area will be installed with accessible elderly fitness equipment and seats for general sitting during exercise. The playground also provides a variety of spaces for low-impact exercise and muscle training during the daytime. Residents can jog, Tai-chi, and Fitness dance in the captioned area to strengthen their bodies.

Tranquillity Seating Place

8.20 The East End Corner of the Roof is surrounded by concrete seats with wooden paving. The circular seat provides a semi-enclosure and trees were planted in the middle of the space. The space provides a private space for the resident & their family to enjoy the eastern side landscape view and social activities.

9. Soft Landscape Design Elements

9.1 The proposed planting scheme aims to improve the living environment of the potential RCHE resident with Greenery. All trees can provide a secondary shade for the uncovered area for future use of the equipment mentioned. The use of trees, shrubs, and flowers will also provide a soft enclosure to characterize different open spaces and mark the boundary in a more comfortable way. The soft landscape will simulate a natural environment for the user but at the same time respond to the architecture to embrace both.

9.2 Soft Landscape can efficiently reduce the visual impact produced by the newly-built shape, which could benefit the surrounding residential housing by reducing visual impact and the uncomfortable feeling generated by the new development.

9.3 The selected vegetation will characterize the primary theme of the proposed environment, providing a colour version of the expectation of all the Greenery Area. The potential planting species will integrate into the architecture for a welcoming environment for the resident with different colours and textures.

Table 2 : Planting Species for Greenery Coverage, Green Hatched Black Area and Brown Area

Botanical Name	Size(mm)	Spacing(mm)
Trees		
Cinamomum burmannii	Heavy Standard	As shown
Terminalia mantaly	Heavy Standard	As shown
Large Specimen Shrub Species(multi-stem)		
Cascabela thevetia	1500 (h) x 1000 (s)	As shown
Hibiscus Syriacus	1500 (h) x 1000 (s)	As shown
Lagerstroemia Indica	1500 (h) x 1000 (s)	As shown
Murraya paniculata	1500 (h) x 1000 (s)	As shown
Shrub		
Brunfeisia calycina	300 x 300	250
Caesalpinia pulcherrima	300 x 300	250
Camellia sasanqua 'pink snow'	300 x 300	250
Clerdendrum myricoides ' Ugandense'	300 x 300	250
Dichroa febrifuga	300 x 300	250
Duranta repens 'Golden Leaves'	300 x 300	250

Botanical Name	Size(mm)	Spacing(mm)
Ficus microcarpa 'Crassifolia'	1200 x 500	400
Ficus microcarpa ' Golden Leaves'	500 x 500	400
Hibiscus rosa sinensis	500 x 500	400
Ixora coccinea 'Sunkist'	250 x 250	200
Murraya paniculata	300 x 300	250
Schefflera arboricola	600 x 600	500
Tabernaemontana divaricata 'Flore Pleno'	300 x 300	250
Small Shrub Species		
Plumbago auriculata	250 x 200	250
Blechnum orientale	250 x 200	250
Cuphea hyssopifolia	250 x 200	250
Dietes bicolor	250 x 200	250
Lantana montevidensis	250 x 200	250
Nephrolepis exaltata	250 x 200	250
Ground Cover		
Asparagus densiflorus ' Sprengeri'	250 x 200	250
Catharanthus roseus	250 x 200	250
Soleirolia soleirolii (Baby Tears)	250 x 200	250
Syngonium podophyllum	250 x 200	250
Lawn		
Axonopus compressus		

Note: The plant species listed above provide an indication of the future character of the proposed landscape areas only. The design will be subject to review during the detailed design stage of the project. These changes will be reflected in the Landscape Master Plan Submission.

Soil Depth for Greenery Area and Planters

9.4 Three soil depths will be applied in the proposed development to ensure adequate soil for the vegetation planted above. The tree planting area will incorporate at least 1200mm depth soil, 600mm depth for shrubs, and 300mm for the lawn excluding the depth of the drainage requirement. ***Figures 9 & 10*** show the different depths of the planter of the proposed development.

Irrigation and Drainage

9.5 A Manual system with lockable water points will be installed every 40m for the proposed Irrigation system for the development. The proposed source of water supply will be subject to final approval from the Water Services Department. Sub-soil drainage shall be provided for all planting areas with cellular drainage systems such as "Mira-drain" or an approved equivalent. ***Figure 10*** shows the Diagram of drainage outlet.

Feature Paving

9.6 Different paving will be used for aesthetic appearance and to identify different zone on the same level. The pavement on G/F in front of the Entrance Lobby promote the priority of space for pedestrian path while excluding vehicles to avoid accidents. It would be constructed with high-quality materials in feature patterns to respond to the architectural design & function, and to ensure the floor are flattened and easy to access for all residents.

9.7 Non-slip paving materials will be utilized at the site and the proposed finishes and materials are summarized below:

Access road and pedestrian pavements: Subtle shades of natural granite and concrete pavers designated to create visual continuity with the adjacent pedestrian pavement whilst creating a distinct identity at the threshold of the development.

Main Gardens: Combination of natural granite, concrete paving, recycled plastic timber decks, and specialist sport surfacing using both formal paving and naturalistic paving for horizontal surfaces building on the design theme for the architectural and landscape schemes.

9.8 Wherever possible all landscape areas will cater for multiple use needs including people with impaired ability and access for the disabled in accordance with Building Department's Design Manual Barrier Free Access 2008.

9.9 The landscape design considers the requirements of Chapter 6 of the DMBFA for the use of elderly residents whereby the landscape has been designed without steps, thresholds, small ramps, or kerbs, wherever possible. Where changes in level are unavoidable handrails or grab bars will be provided. Floor surface will comply with Division 4. Slip-resistant floor finishes and avoids the use of shiny and reflective floors such as marble, glazed tiles, and the like. Open jointed pavers or aeration paver blocks with uneven or very rough surface will be avoided at external open space.

Planter Walls

9.10 Where possible planters will be at-grade however where raised planters are required the planter walls and coping will be clad with the same cladding materials as building external cladding.

Lighting

9.11 The lighting design concept for the landscape areas should be designated to contribute to the quality of the development in nocturnal views, providing an aesthetically pleasing landscape through the highlighting of the landscape elements. All the landscape areas will be provided with sufficient illumination to meet the requirement of lighting standards, particularly for the entrance areas and pedestrian access paths. The lighting concept will include three types of lighting as follows:

- Amenity lighting highlighting feature trees, walls, sculptures, and planting through the use of spotlights and up-lightings;

- Area lighting involving the use of low-level lighting sources such as lighting bollards and recessed wall lights for sitting areas and main landscape spaces designed to avoid glare/light spillage to adjacent properties; and

- General safety lighting with the minimum lux level which will last between midnight and early morning. The covered area on 1/F will last 24 hours to ensure the illumination level of the areas.

Site Furniture

9.12 The landscape design would include the provision of the site furniture including seating. In addition to its functional attributes, it would also contribute to the perceived quality of the landscape. All the seat shall be provided with seating walls and some location shall potentially provide movable seating. These locations are preliminary at this stage being subject to the detailed design of the landscape spaces and their programme for use

Safety Requirement

9.13 All outdoor facilities will be designed, constructed, and operated in full compliance with relevant safety standards and guidelines.

10. Landscape Management and Maintenance

10.1 Upon completion of the construction works, a 12-months Defects Liability Period (DLP) will be implemented applying to the hard landscape whereby the specialist contractor will be responsible for the maintenance during the first year.

A. Routine Maintenance (Daily - Weekly)

- Rubbish and litter removal
- Sweeping and cleaning
- Water feature cleaning
- Damage inspection, repair of site furniture and light bulb replacement
- Routine management attendance, inspection, and cleaning of surface channels and subsoil drainage, in particular at elevated levels.

B. Annual/ Long-term Maintenance

- Repainting
- Resurfacing of worn pavement
- Replacing worn parts of site furniture, lighting fixtures, and other facilities
- Replacement of damaged landscape furniture

10.2 Similarly, the softworks contractor will be responsible for a 12-month Establishment Period (EP) for the planting after practical completion. This allows a period of time for the proper establishment of the plants and the replacement of any losses.

10.3 At the end of the 12-month DLP/EP, the property owner will be responsible for arrangements to take care of all landscape areas within the development. This includes general tree care and proper tree maintenance in accordance with relevant guidelines promulgated by DEVB.

Tree Risk Assessment

10.4 A Tree Risk Assessment for the target area shall be conducted annually in accordance with the 'Handbook in Tree Management' promulgated by the GLTM Section of DEVB.

S12A AMENDMENT OF PLAN APPLICATION
APPROVED NGAU TAM MEI
OUTLINE ZONING PLAN NO. S/YL-NTM/12

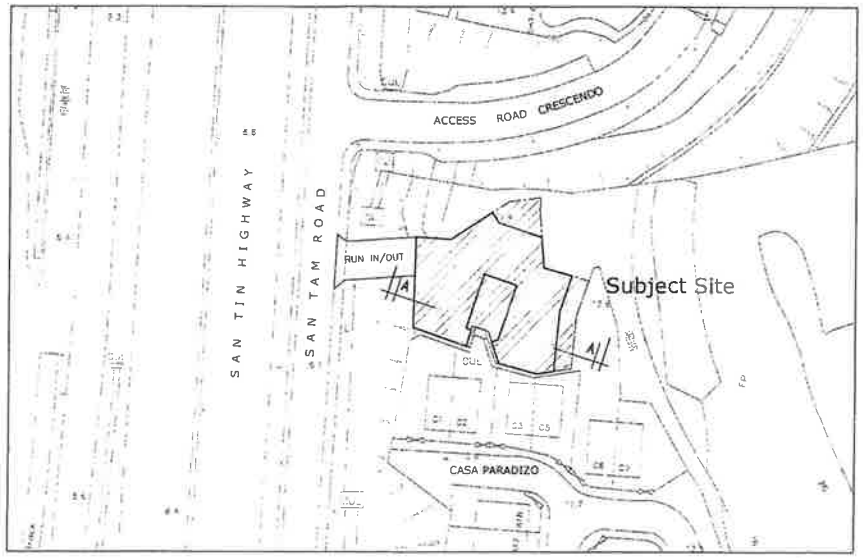
PROPOSED REZONING FROM "R(C)" TO "G/IC"
FOR A PROPOSED "SOCIAL WELFARE FACILITIES"
(RESIDENTIAL CARE HOMES FOR THE ELDERLY)
(RCHE)

AT LOT 4823 IN D.D.104, 81 SAN TAM ROAD,
SAN TIN, N.T.

FIGURE 1
PROPOSED RCHE DESIGN

RLEE

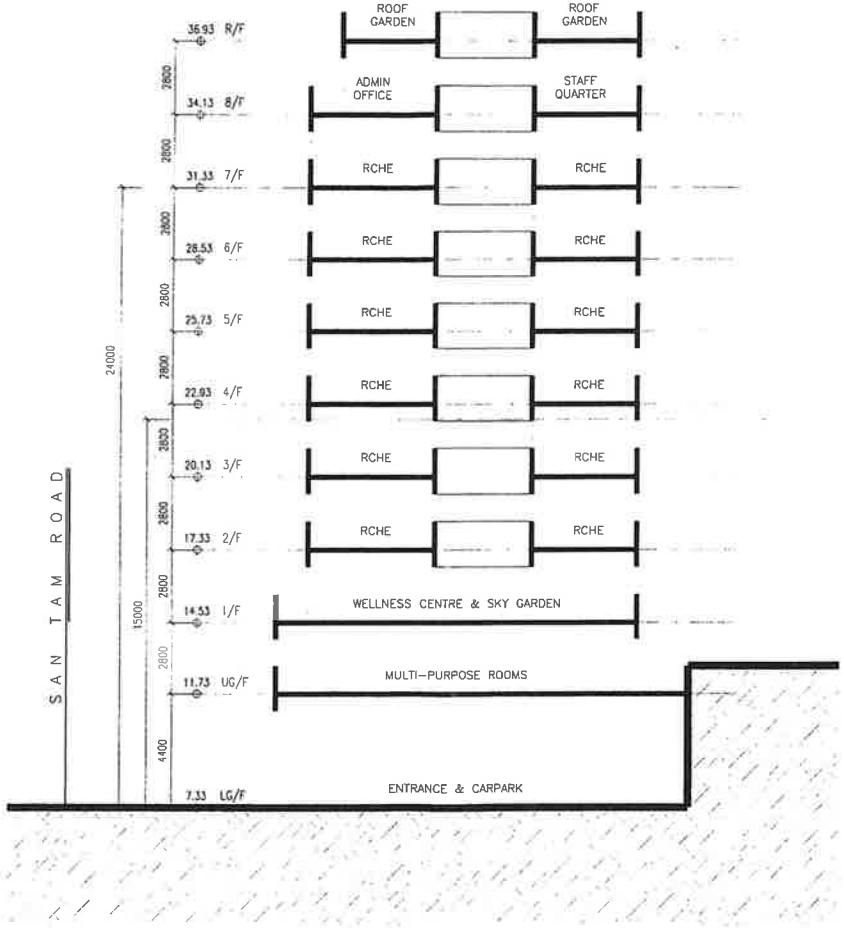
RLEE Architects (HK) Ltd



BLOCK PLAN SCALE – 1:1000

DEVELOPMENT SCHEDULE:

Site Area	:	736.3 m² (7926 ft²)	
Class of Site	:	A	
Proposed Plot Ratio For Non-Domestic	:	7.33	
Proposed Site Coverage above For Non-Domestic (Above 15m)	:	75.558%	
Maximum Gross Floor Area	:	5400 m² (58125.6 ft²)	
Proposed Building Height	:	36.93 mPD	
Absolute Height	:	29.6 m	
Proposed No. Of Storey	:	10 STOREYS	
Proposed Gross Floor Area			
LG/F (ENTRANCE & CARPARK)	:	352.479 m²	
UG/F (MULTI-PURPOSE ROOMS)	:	617.819 m²	
1/F (WELLNESS CENTRE + SKY GARDEN)	:	626.160 m²	
2/F (RCHE)	:	595.090 m²	(45 nos. of bed)
3/F (RCHE)	:	556.330 m²	(17 nos. of bed + 3 nos. of isolation room)
4/F - 7/F (RCHE)	:	556.330 m² x 4 storeys = 2225.32 m²	(20 nos. of bed x 4 storeys)
8/F (ADMIN OFFIC + STAFF QUARTER)	:	426.802 m²	
TOTAL	:	**5400.000 m²**	**(142 nos. of bed + 3 nos. of isolation room)**



SECTION A-A SCALE – 1:200

Parking Spaces :

No. of LGV	: 1 Nos.
No. of Minibus	: 1 Nos.
No. of Private Car Parking	: 1 Nos. + 1 Nos. (Accessible Car Parking)
No. of Motorcycle Parking	: 1 Nos.

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202

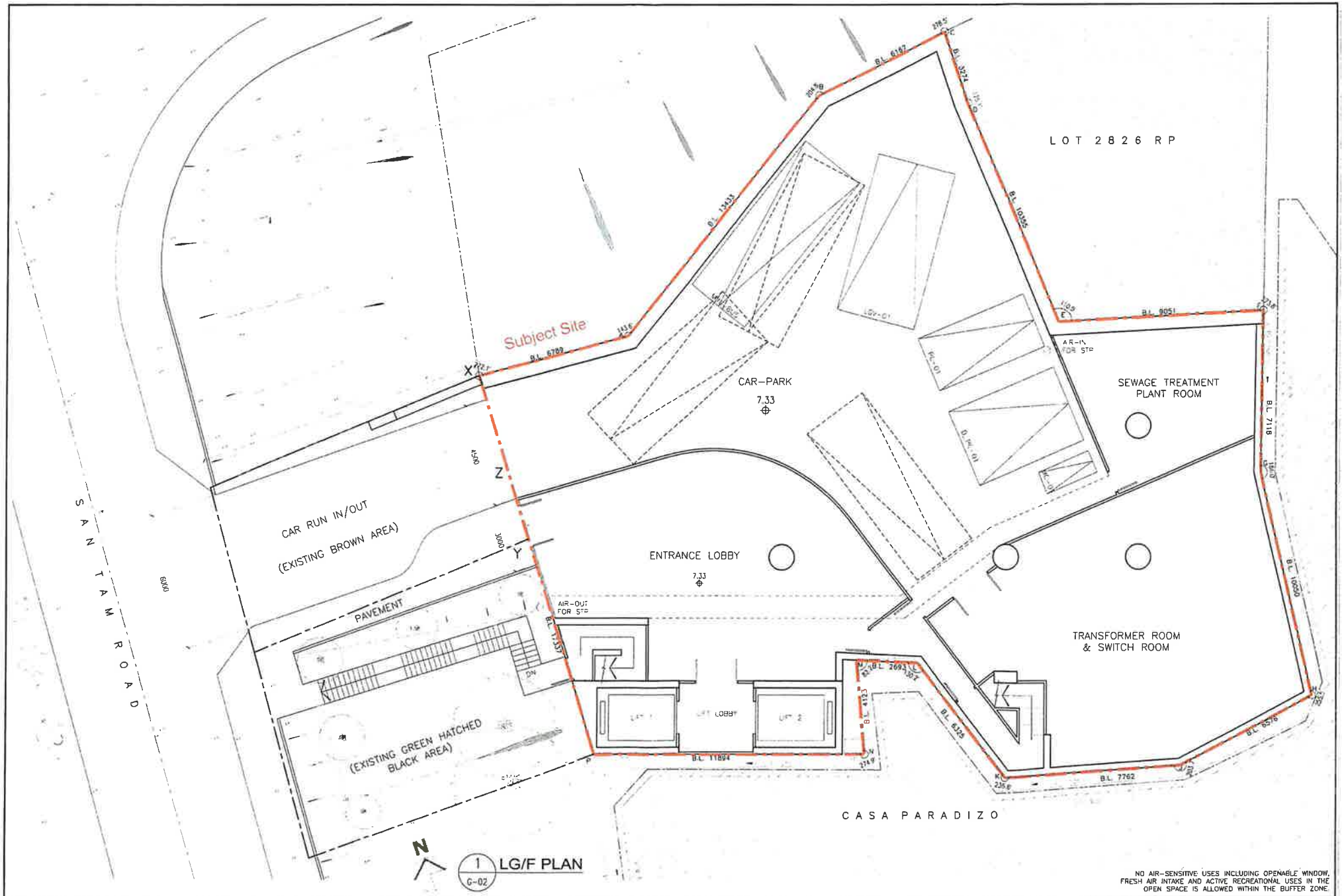
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

DEVELOPMENT SCHEDULE & SECTION

G-01 N.T.S. (A3)

B	OCT. 2022
A	JULY. 2022

RLEE



NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202

PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

LG/F PLAN
ENTRANCE & CARPARK

G-02 1:150 (A3)

B	OCT 2022	
A	JULY 2022	

Do not scale drawing.
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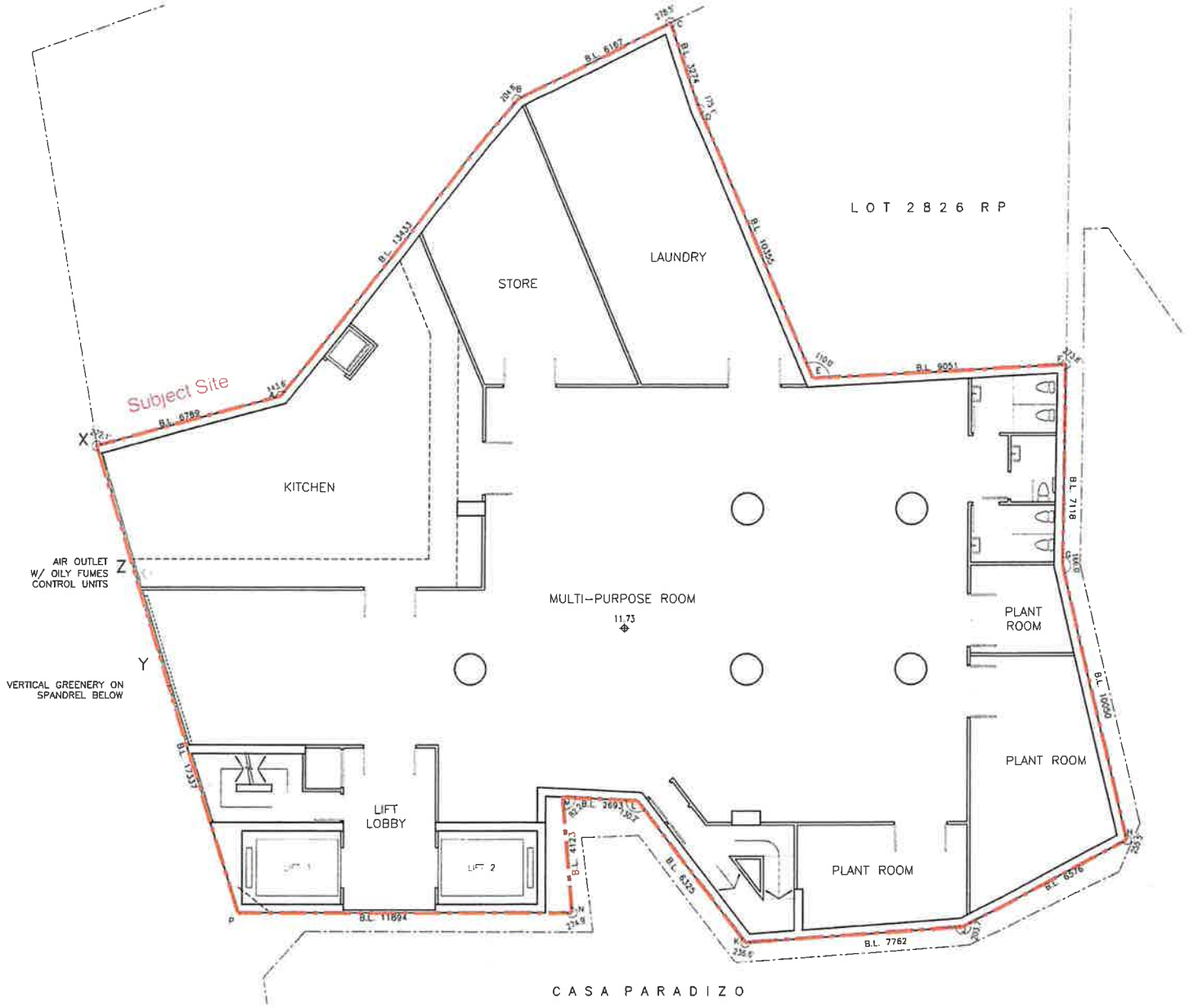
This drawing is not for construction purposes unless expressedly certified.

RLEE



N

1 UG/F PLAN
G-03

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

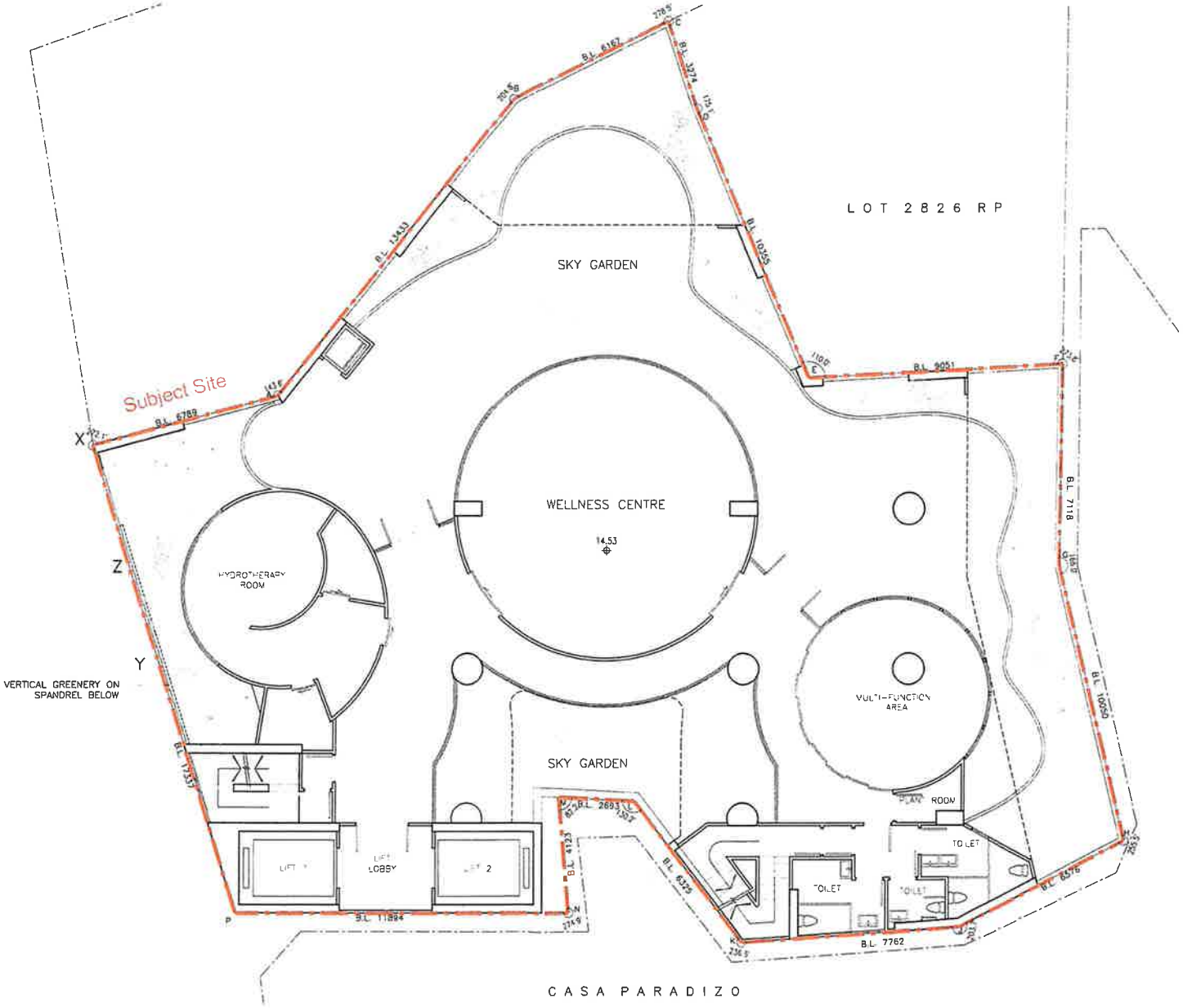
2202

PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

UG/F PLAN
MULTI-PURPOSE ROOMS

G-03 | 1:150 (A3) | B OCT. 2022 | A JULY 2022

RICE



N

1 / G-04 1/F PLAN

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202

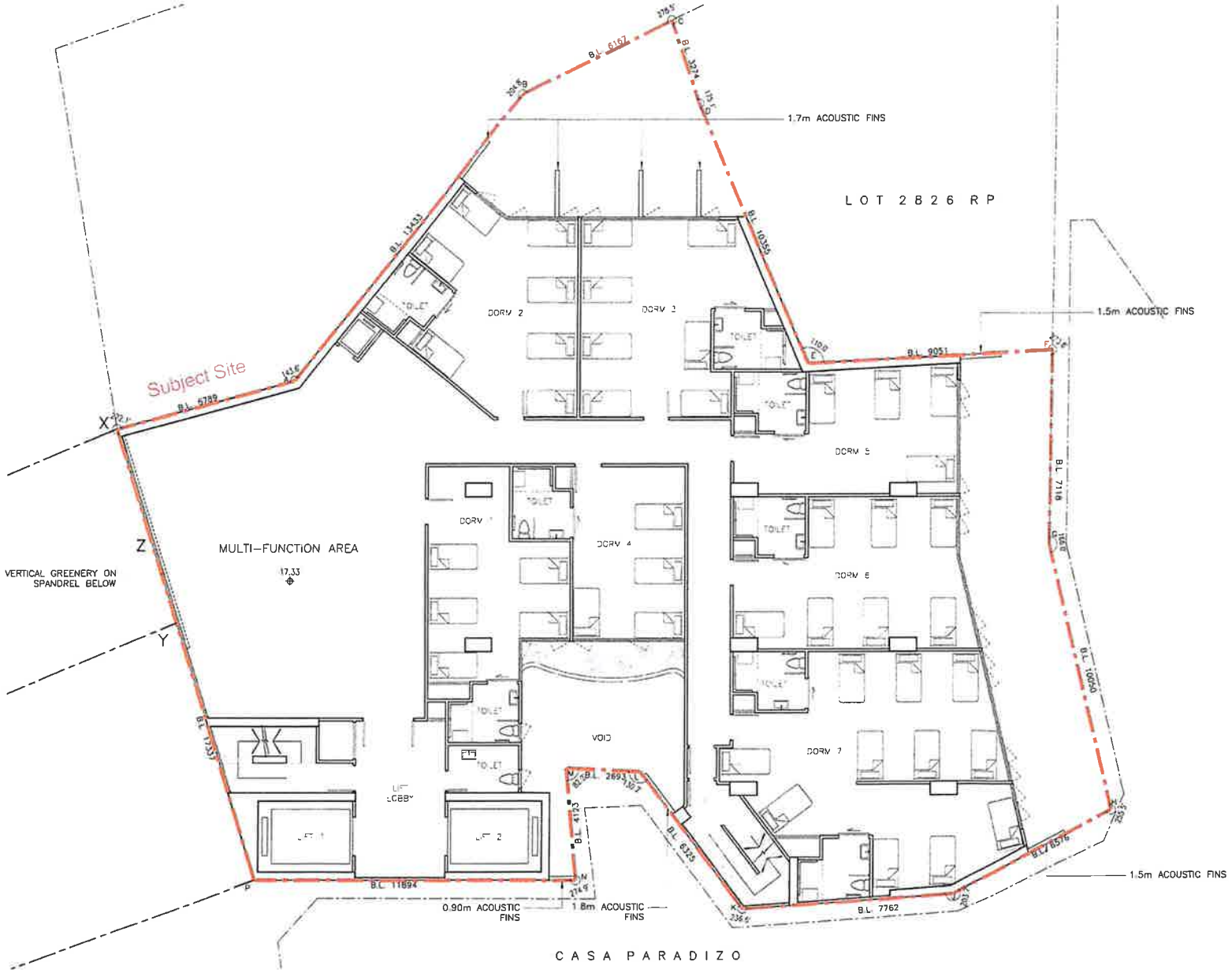
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

1/F PLAN
WELLNESS CENTRE & SKY GARDEN

G-04 1:150 (A3)

B OCT. 2022
A JULY 2022

RLEE



1 / G-05 2/F PLAN

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE

2202

PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

2/F PLAN
RCHE

G-05 1:150 (A3)

B OCT. 2022
A JULY. 2022

RLEE

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202

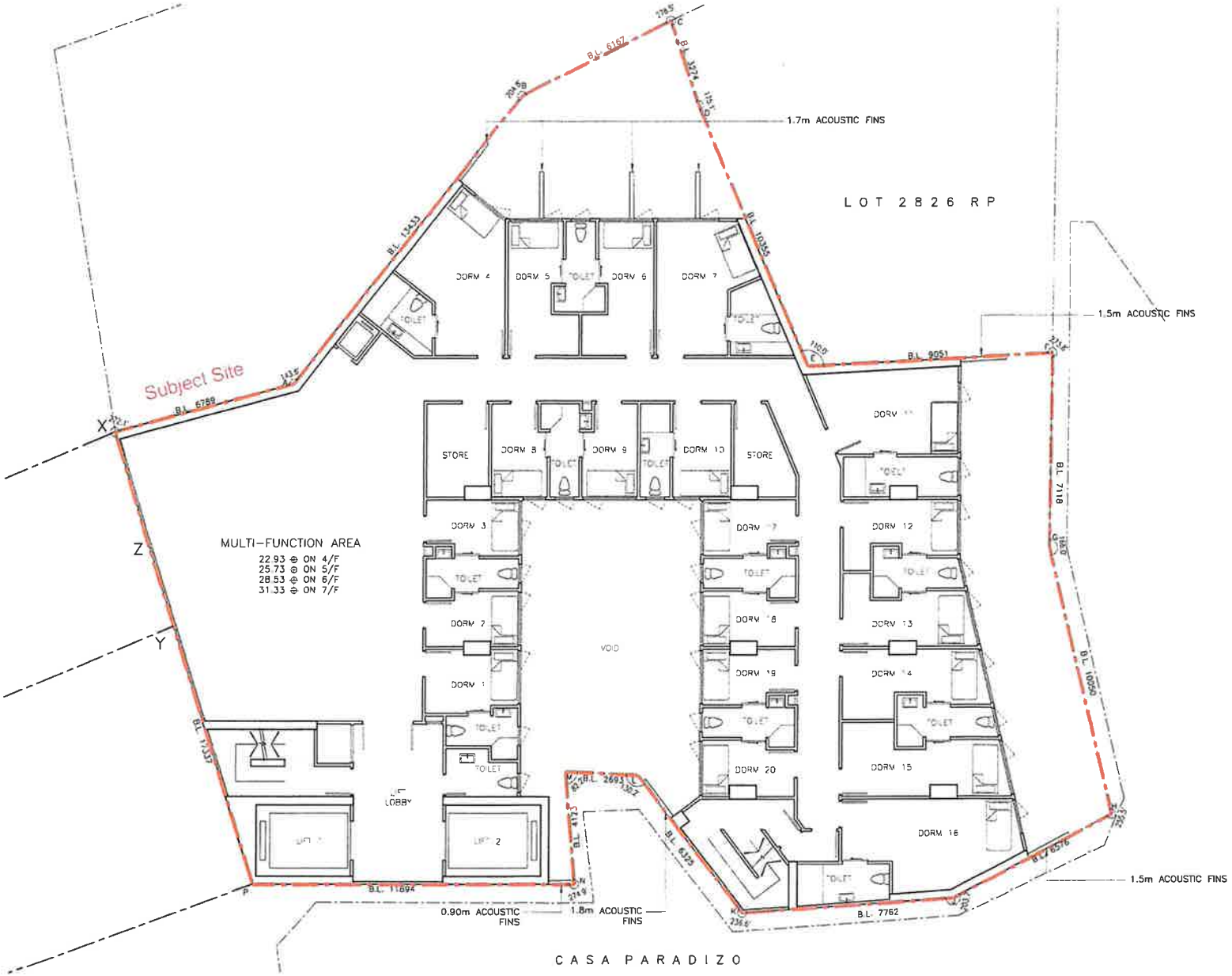
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

3/F PLAN
RCHE

G-06 1:150 (A3)

B OCT 2022
A JULY 2022

RLEE



1 / G-07 TYPICAL FLOOR PLAN PLAN

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202

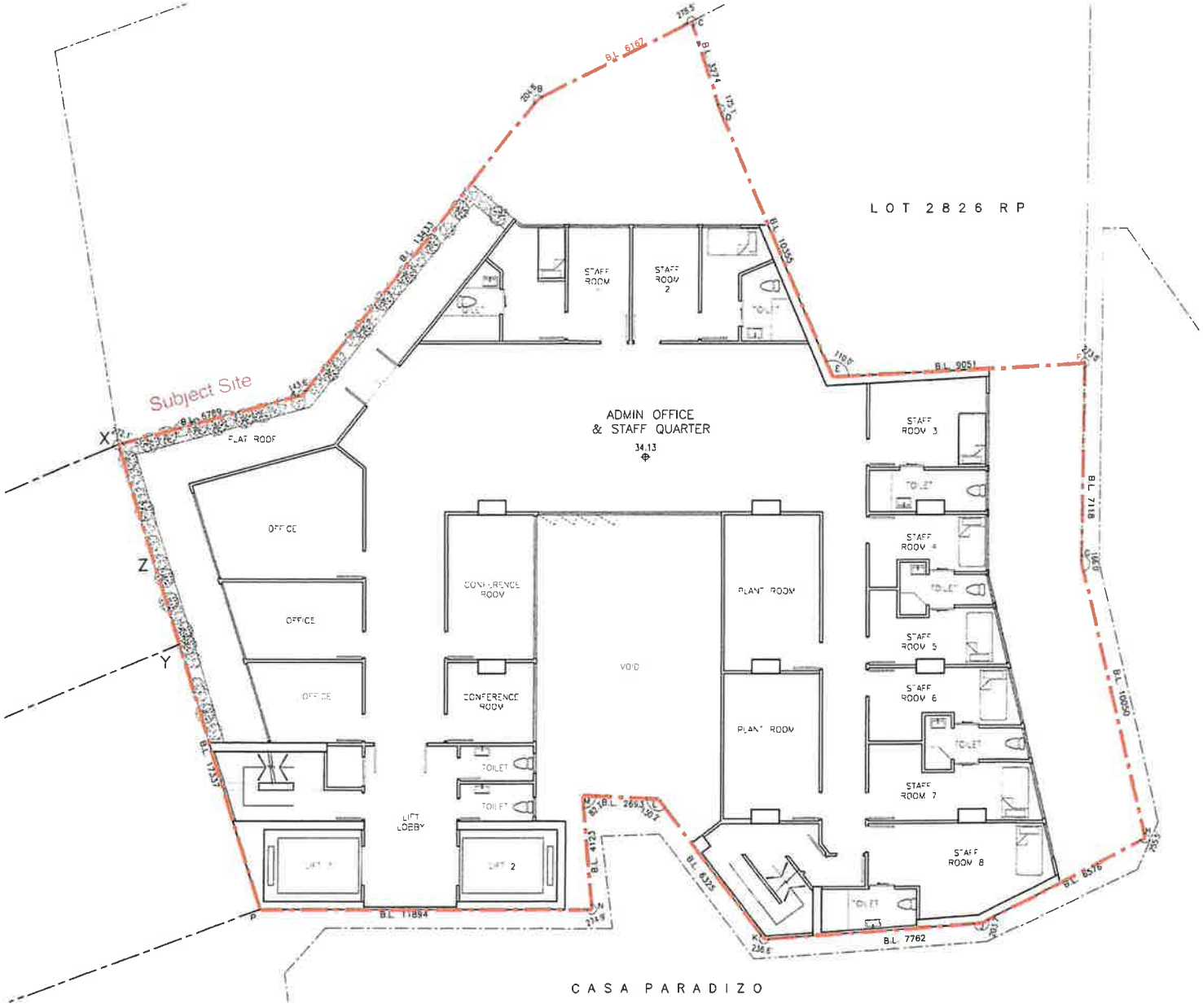
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

TYPICAL FLOOR PLAN PLAN
RCHE

G-07 1:150 (A3)

B	OCT. 2022
A	JULY. 2022

RLEE



1 G-08 8/F PLAN

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE

2202

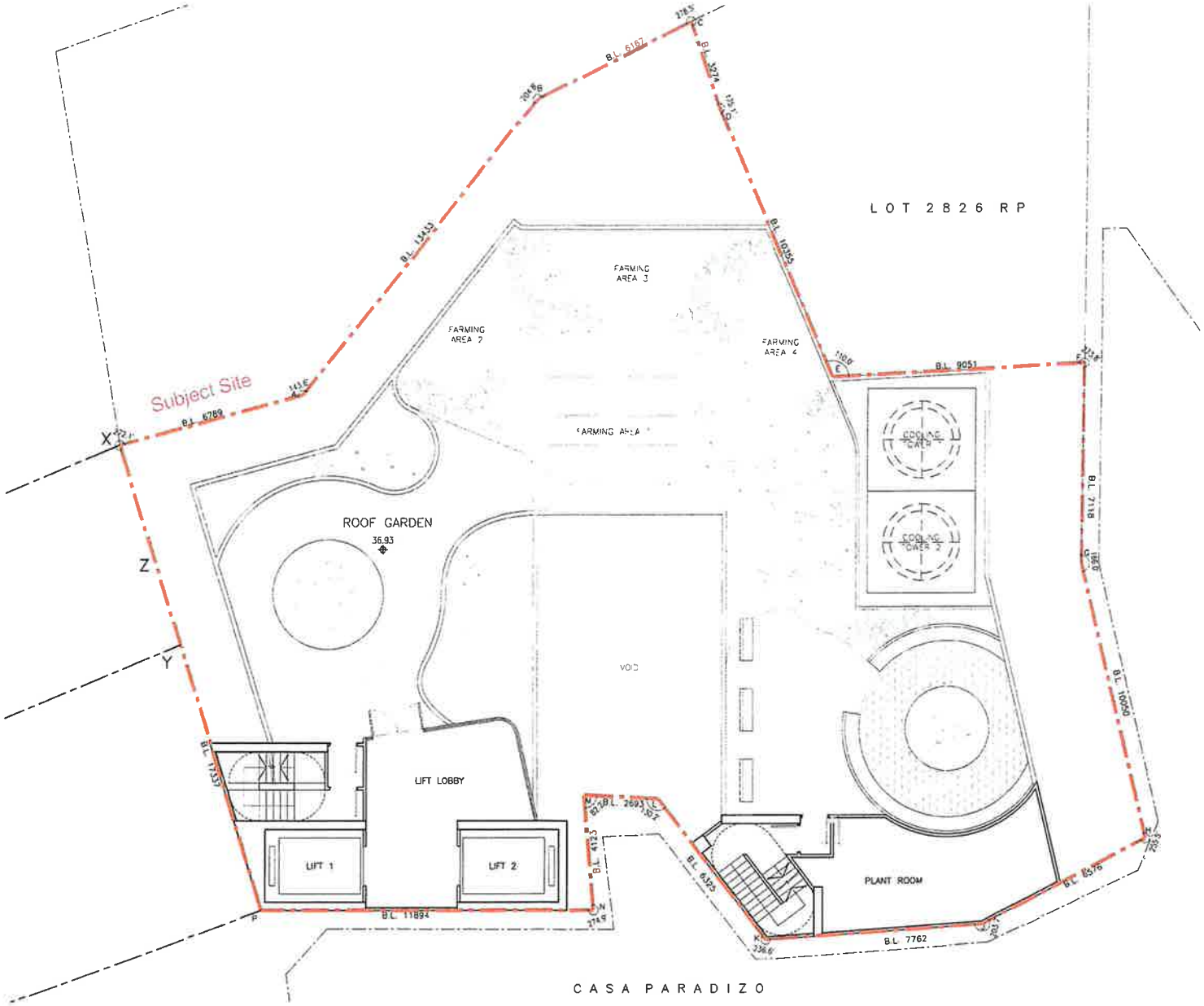
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

8/F PLAN
ADMIN OFFICE & STAFF QUARTER

G-08 | 1:150 (A3)

B	OCT. 2022
A	JULY. 2022

RISE



1 / G-09 ROOF GARDEN PLAN

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202

PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

ROOF GARDEN PLAN

G-09 1:150 (A3)

B	OCT 2022	
A	JULY 2022	

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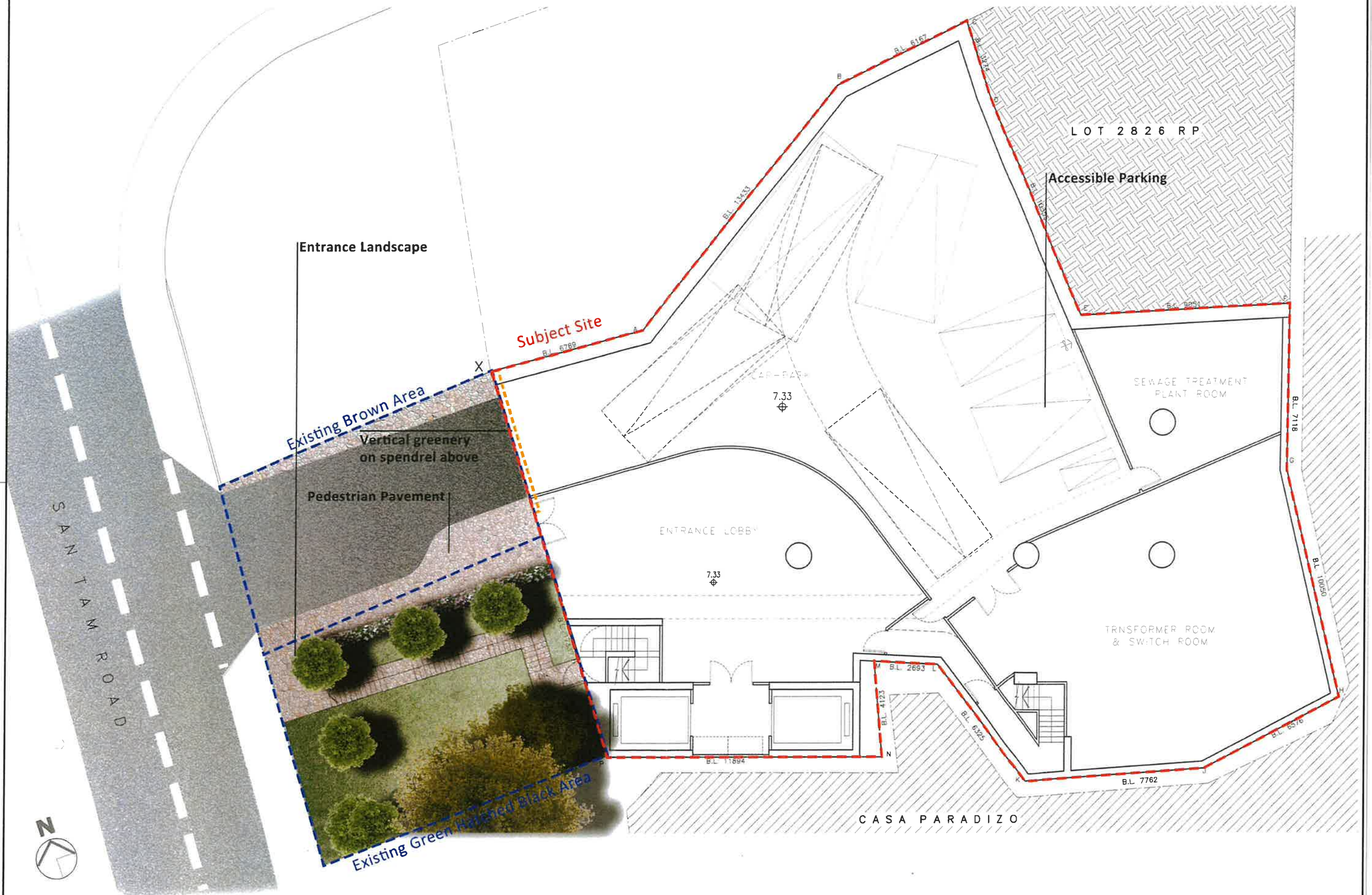
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

LANDSCAPE MASTER PLAN

FIGURE 2 1:150

B	OCT 2022
A	JUL 2022
-	MAY 2022

RLEE



2202 PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.	LG/F LANDSCAPE	FIGURE 3	1:150	B OCT 2022 A JUL 2022 - MAY 2022	*Do not scale drawing.* *Contractors are required to verify exact dimensions on site.* *The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate.* *The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified.* *This drawing is not for construction purposes unless expressedly certified.*

RLEE

2202 PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.	1/F LANDSCAPE	FIGURE 4 1:150	B A -	OCT 2022 JUL 2022 MAY.2022	Do not scale drawing. Contractors are required to verify exact dimensions on site. The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate. The design remains to be the property of "R-ee Architects (HK) Ltd" unless otherwise specified. This drawing is not for construction purposes unless expressedly certified.

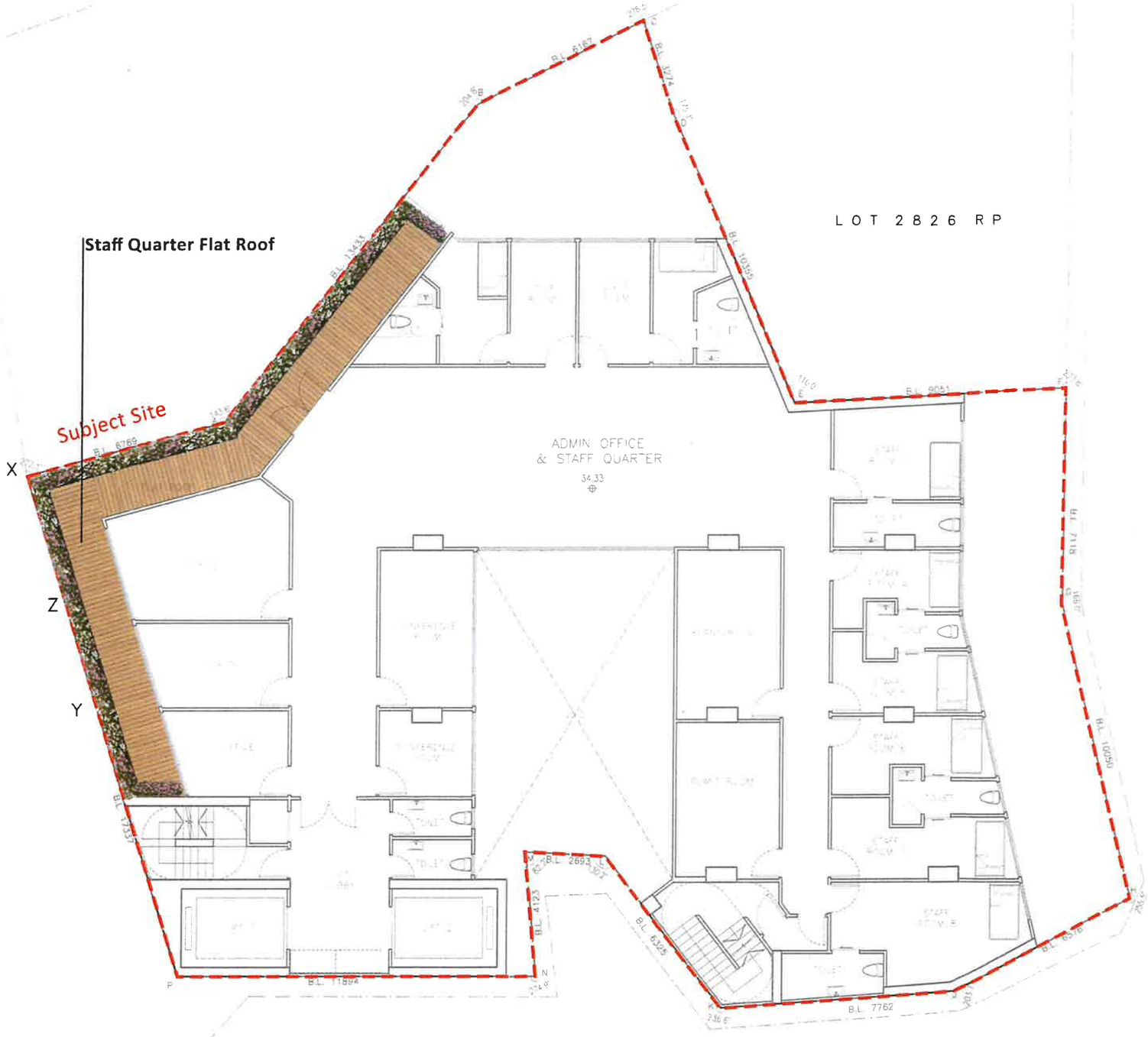
RLEE

2202 **PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.**	**2/F LANDSCAPE**	**FIGURE 5** 1:150	B OCT 2022 A JUL 2022 - MAY 2022	*Do not scale drawing.* *Contractors are required to verify exact dimensions on site.* *The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate.* *The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified.* *This drawing is not for construction purposes unless expressedly certified.*

RLEE

2202 **PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.**	**3/F LANDSCAPE**	**FIGURE 6**	**1:150**	B OCT 2022 A JUL 2022 - MAY 2022	*Do not scale drawing.* *Contractors are required to verify exact dimensions on site.* *The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate.* *The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified.* *This drawing is not for construction purposes unless expressedly certified.*

RLEE



2202 **PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.**	**8/F LANDSCAPE**	**FIGURE 7** **1:150**	B OCT 2022 A JUL 2022 - MAY 2022	*Do not scale drawing.* *Contractors are required to verify exact dimensions on site.* *The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate.* *The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified.* *This drawing is not for construction purposes unless expressedly certified.*

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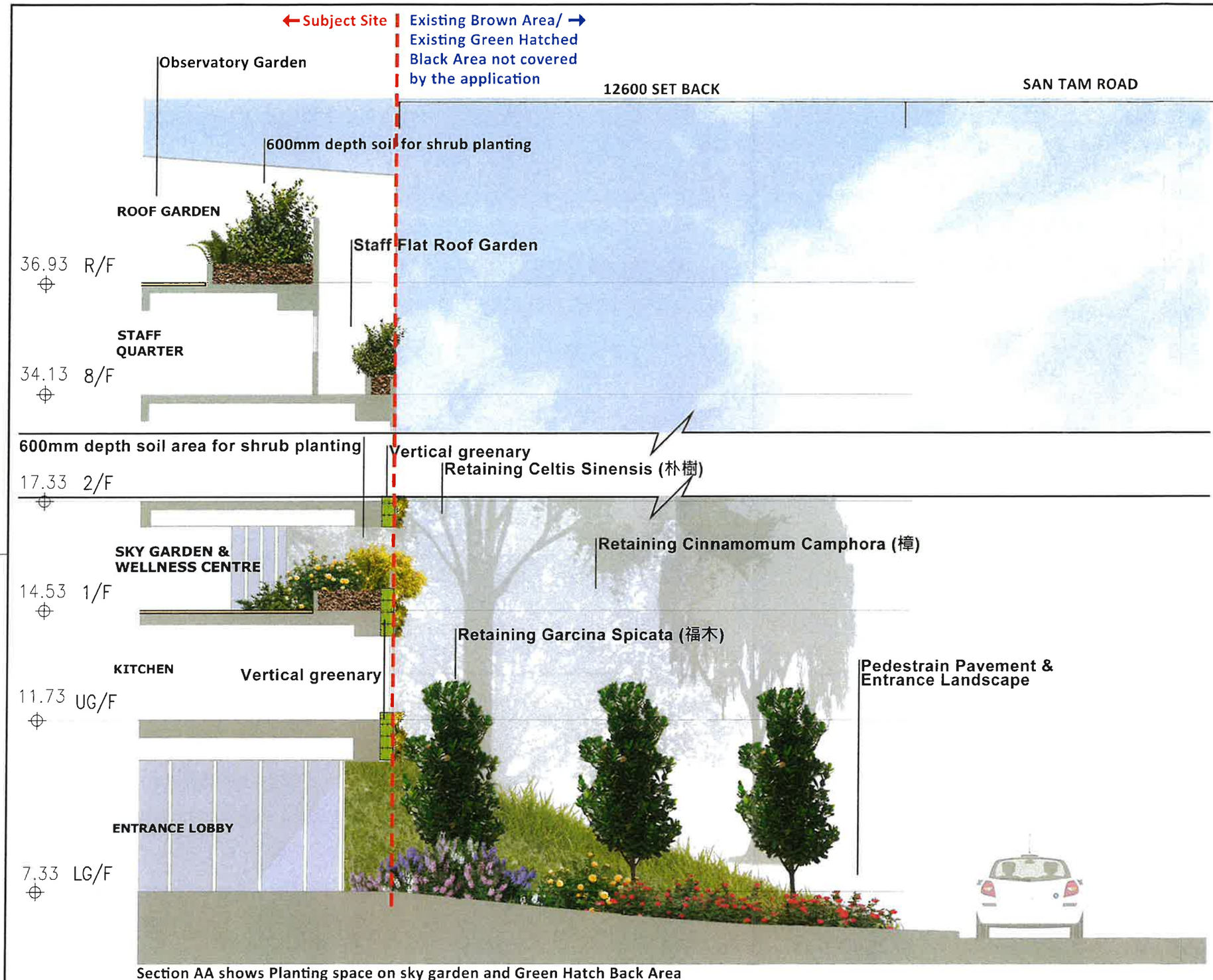
N

2202 PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.	R/F LANDSCAPE	FIGURE 8	1:150	B OCT 2022 A JUL 2022 - MAY 2022	Do not scale drawing. Contractors are required to verify exact dimensions on site. The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate. The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified. This drawing is not for construction purposes unless expressedly certified.

RLEE



Section AA shows Planting space on sky garden and Green Hatch Back Area

- Section Line
- Boundary Line
- Building Outline
- Level Mark
- Planting Soil
- Concrete Structure

2202

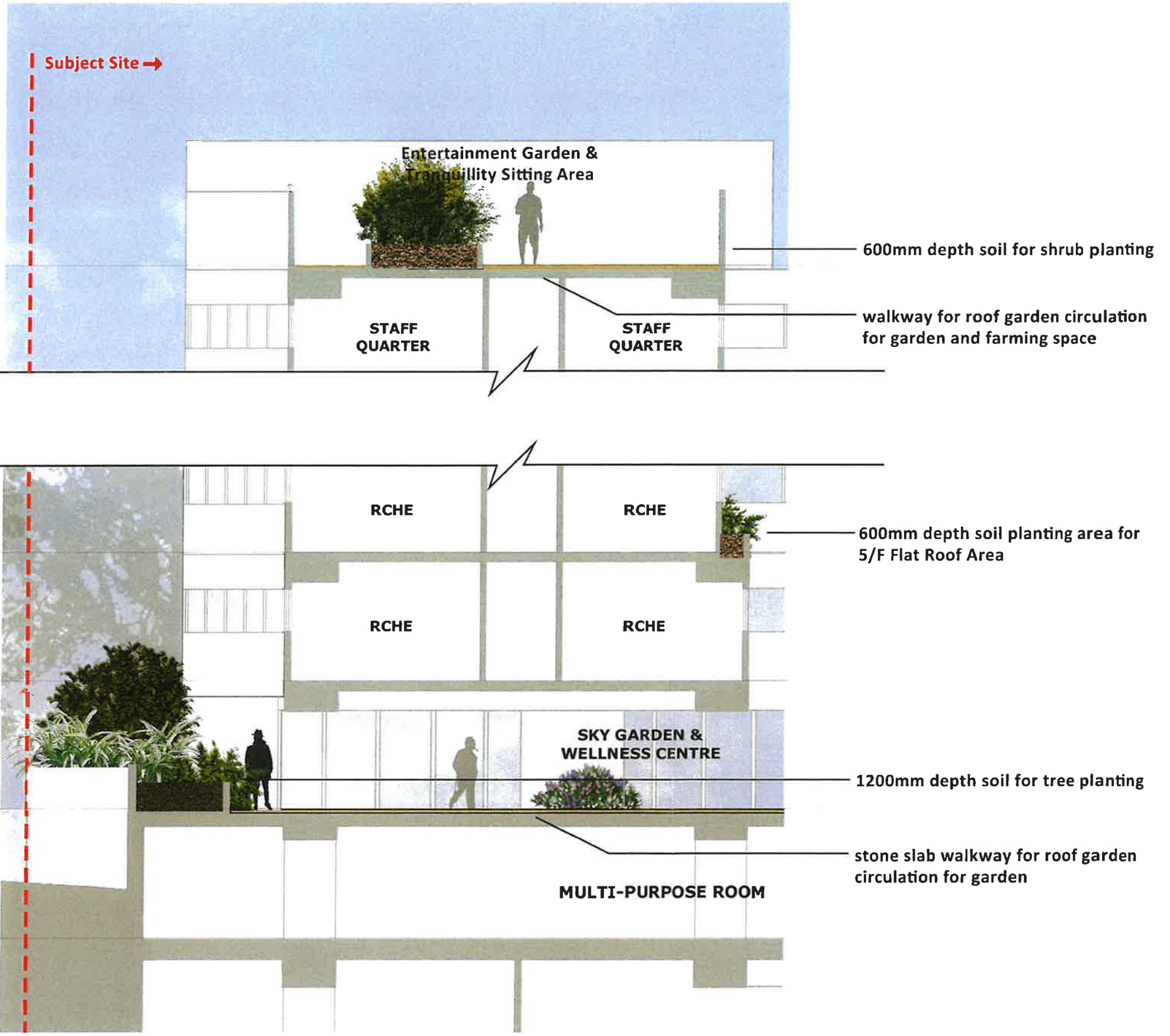
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

SECTION AA DIAGRAM

FIGURE 9 1:100

B	OCT 2022
A	JUL 2022
-	MAY 2022

RLEE



Section BB shows Planting space on sky garden

A — A Section Line

Boundary Line

Building Outline

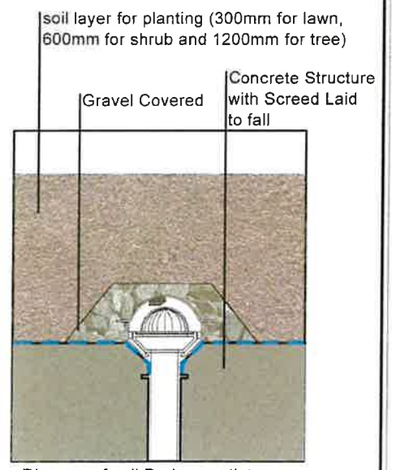
Level Mark

Planting Soil

Concrete Structure

Note:

- All soil depths stated exclude drainage layer.
-Yellow Granite finished for the planter walls and coping



- Diagram of soil Drainge outlet

2202

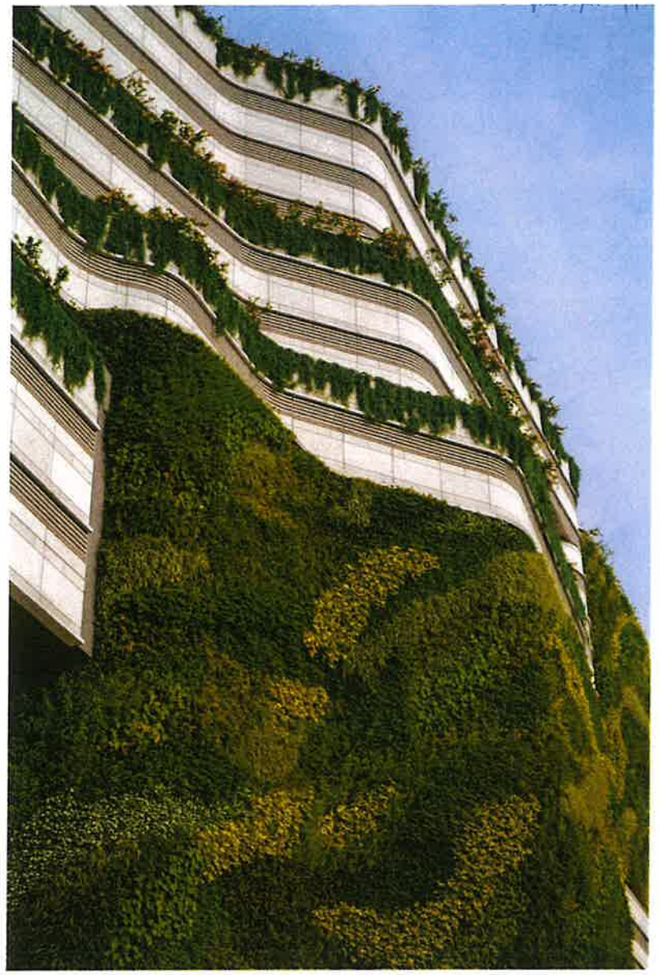
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

SECTION BB DIAGRAM

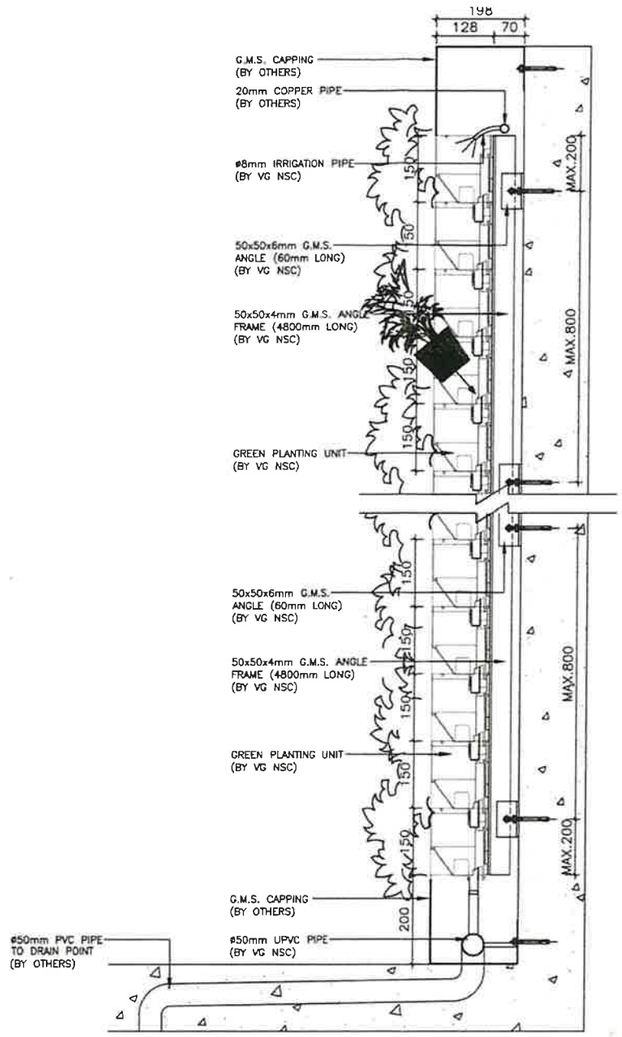
FIGURE 10 1:100

B	OCT 2022	
A	JUL 2022	
-	MAY 2022	

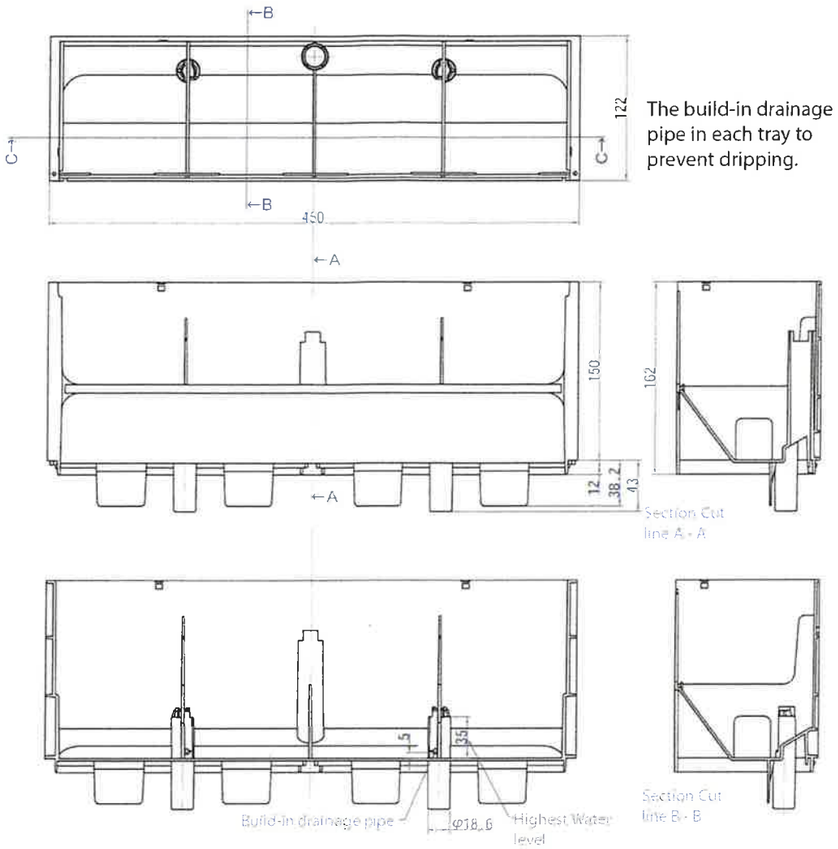
R-LEE



Example of Vertical Greenary

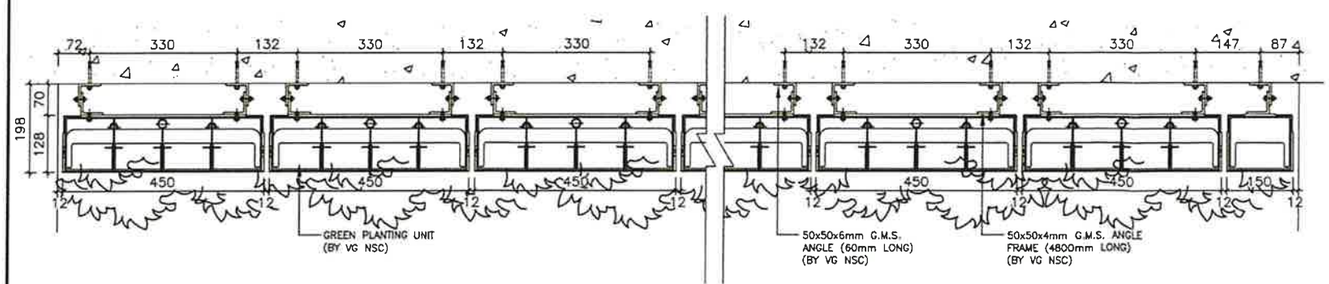


Section detail - 1:65

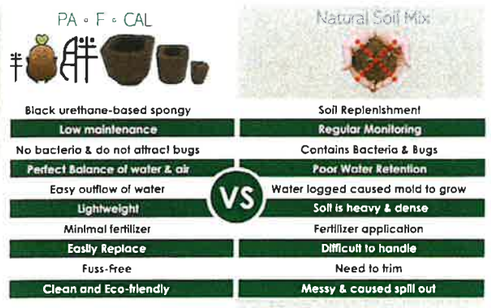


The build-in drainage pipe in each tray to prevent dripping.

Modular design - 1:5



Detail plans - 1:12.5



Filling material

2202 PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.	VERTICAL GREENING - MODULAR SYSTEM	FIGURE 11 -	A -	JUL 2022 MAY 2022	Do not scale drawing. Contractors are required to verify exact dimensions on site. The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate. The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified. This drawing is not for construction purposes unless expressedly certified.

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PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

PERSPECTIVE VIEW THROUGH SKYGARDEN

Figure 12 NTS (A3)

A	JUL. 2022
-	MAY. 2022

R.LEE

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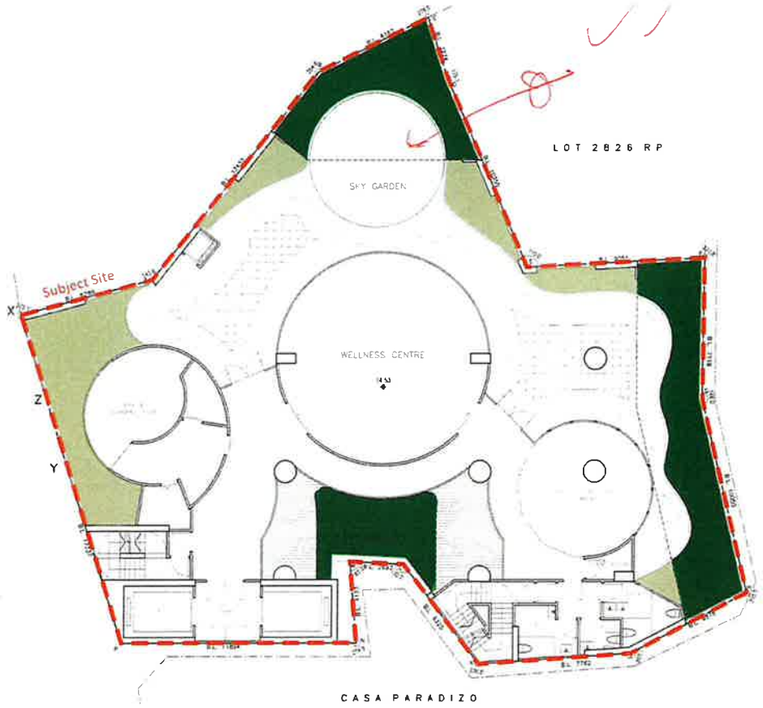
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

FRONT VIEW SHOWING GREENERY

Figure 13 NTS (A3)

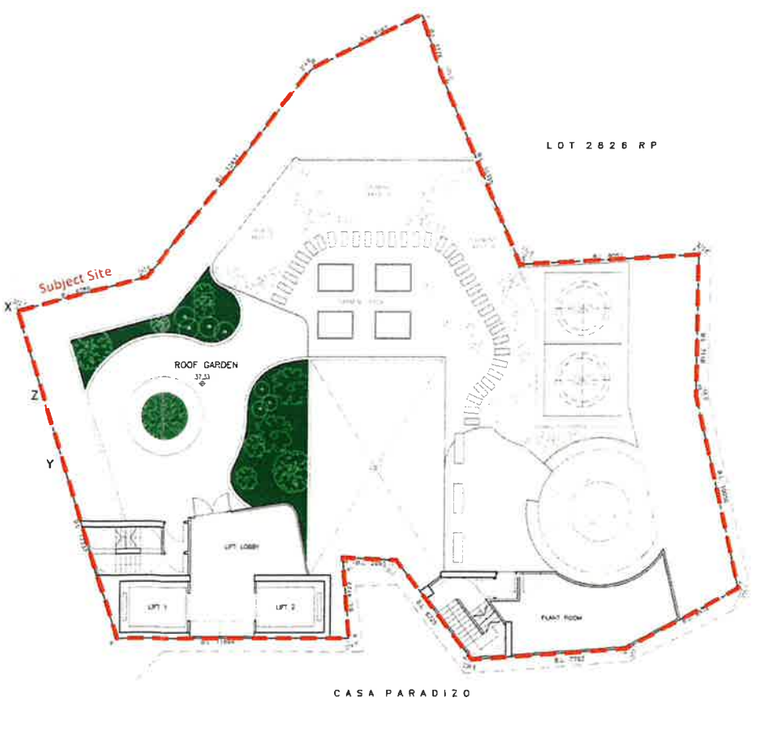
A	JUL. 2022
-	MAY. 2022

R.LEE



Covered green Area

Uncovered green Area



Green Coverage:
Primary Zone (15m above mean street level):

1/F uncovered area: 96.655m²
covered area:57.266m²

2/F uncovered area:6.844m²

3/F uncovered area:2.883m²

Total: 96.655 + 6.844 + 2.883 = 106.382m²
(14.442% > 10%)

Non-primary Zone:

R/F uncovered area: 42.062m²

Total: 42.062m² (5.713%)

Total Green Coverage:

106.382 + 42.062
=148.444m² (20.161% > 20%)

2202

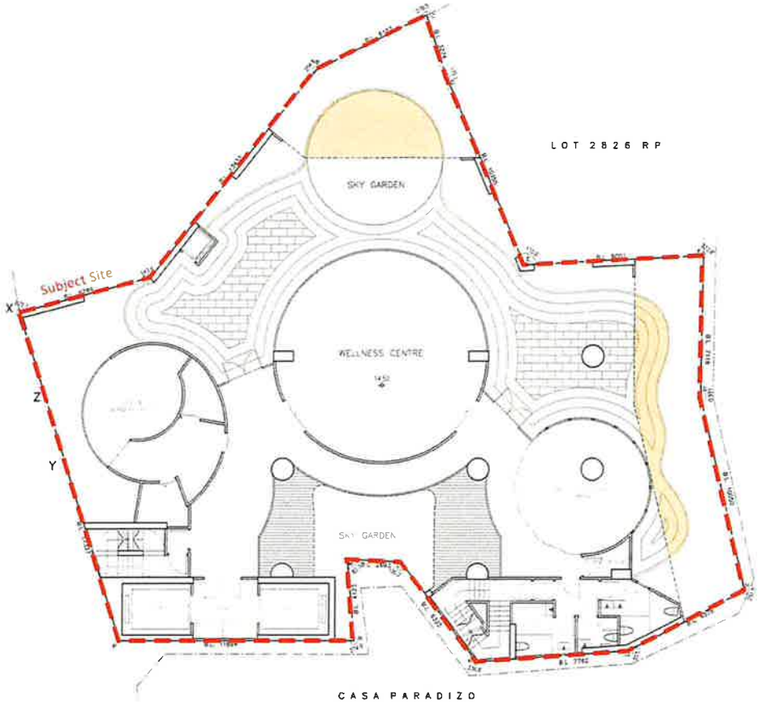
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.

GREEN COVERAGE CALCULATION

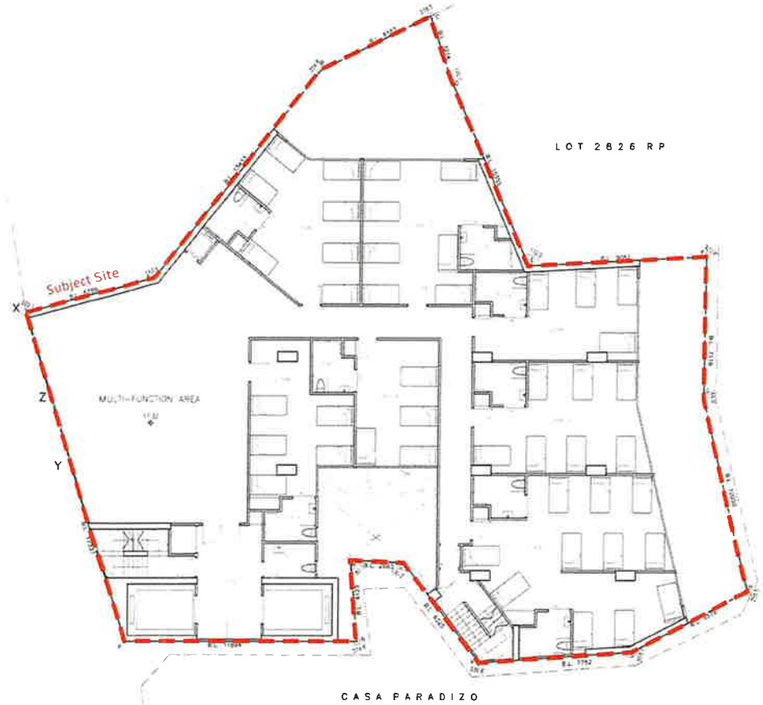
FIGURE 14 **1:300**

B	OCT 2022
A	JUL 2022
-	MAY 2022

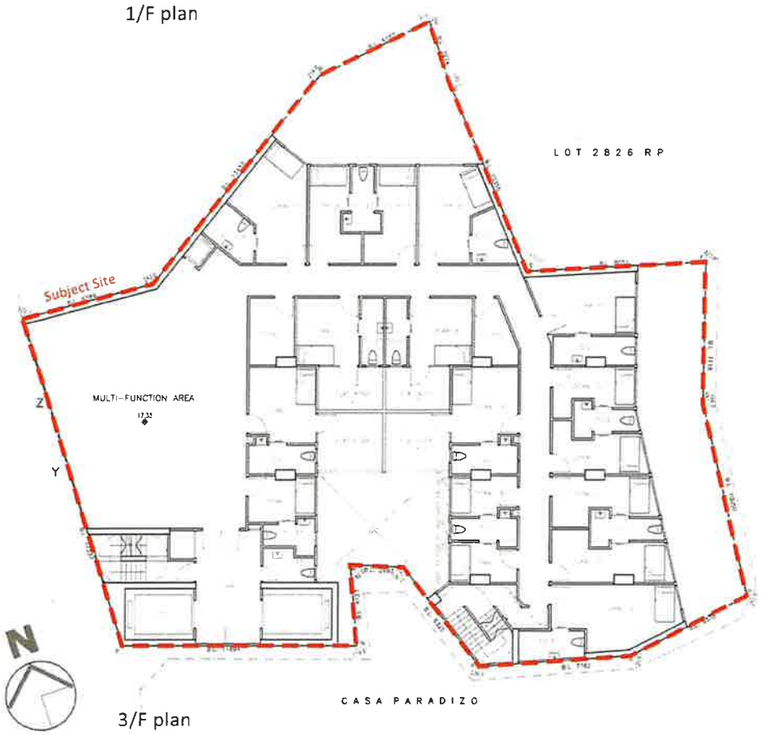
RLEE



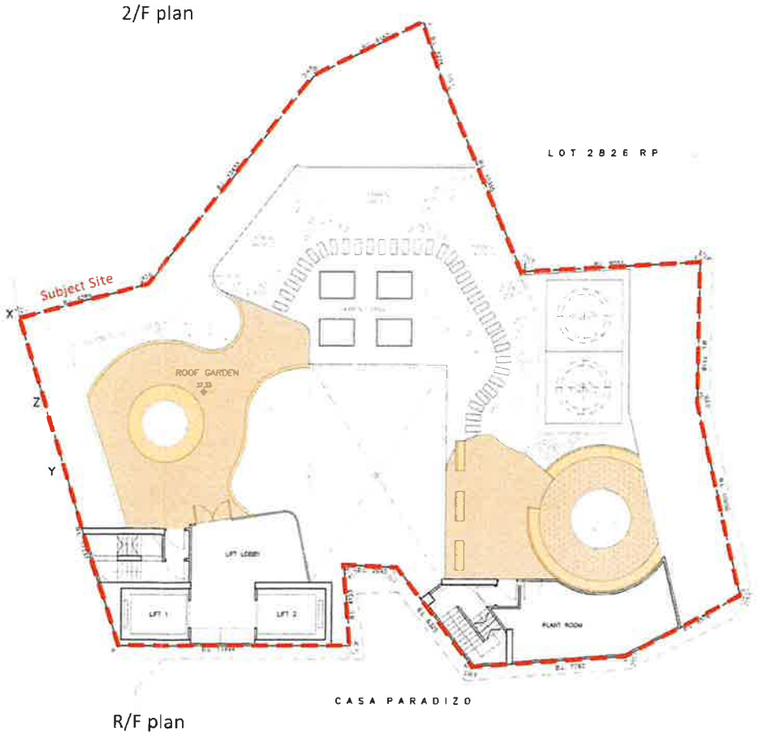
1/F plan



2/F plan



3/F plan



R/F plan

Open Space:

1/F uncovered area: 35.467m²
covered area: 157.516m²

R/F uncovered area: 148.153m²

Total: uncovered area:35.467 + 148.153 = 183.620m²
covered area: 157.516m2

Total Open Space Area: 183.620 + 157.516 =341.136m²

2202

PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.

OPEN SPACE CALCULATION

FIGURE 15 **1:300**

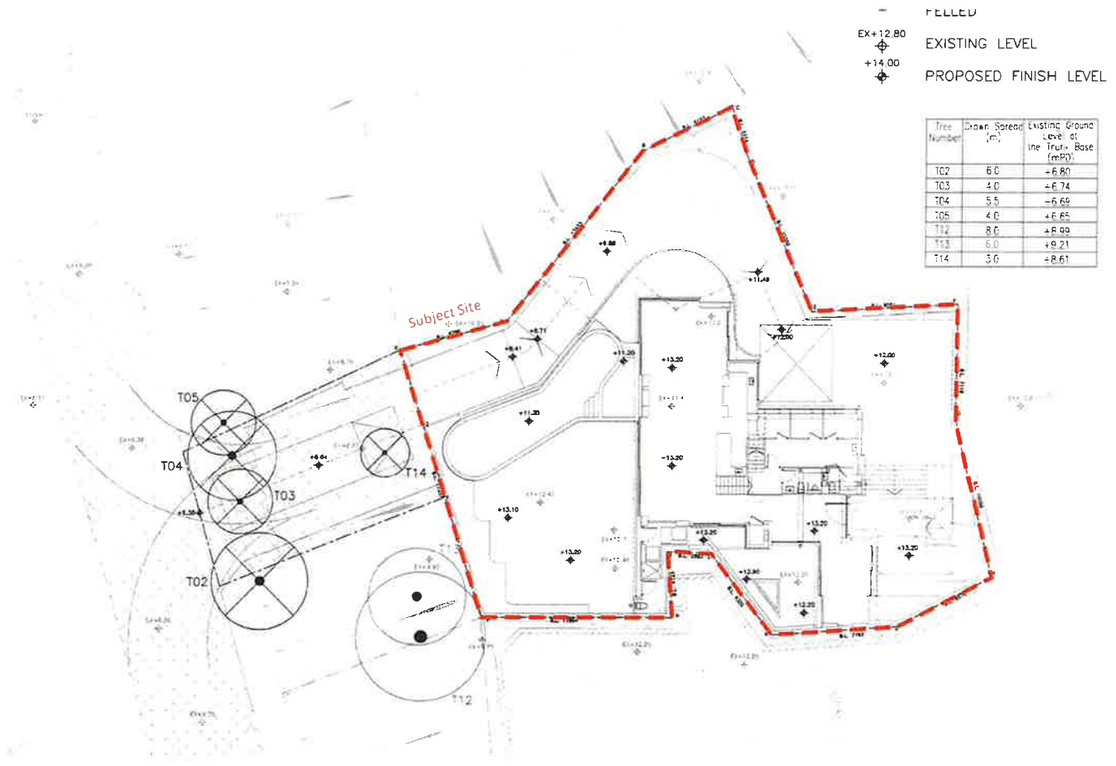
B	OCY 2022	
A	JUL 2022	
-	MAY 2022	

RLEE

Tree Assessment Schedule at
PROPOSED RESIDENTIAL DEVELOPMENT AT LOT NO. 4823 IN D.D.104, YUEN LONG, NEW TERRITORIES
Prepared by Ted Lam (R.L.A. NO. R-073) on 18 FEBRUARY 2014
To be read in conjunction with drawing nos. C1418/TS01

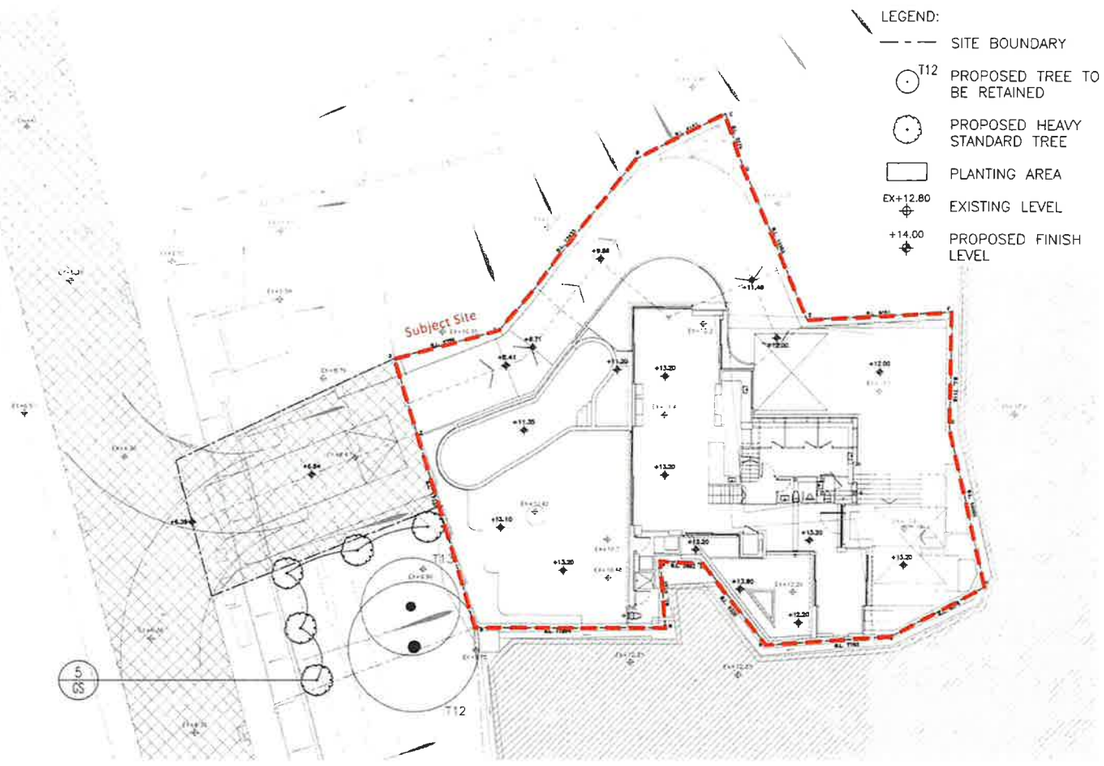
Tree No.	Species		Measurements			Amenity value	Form	Health condition	Structural Condition	Suitability for transplanting		OVT or Important Tree (IM)	Conservation status (**)	Recommendation	Department to provide expert advice to LandsD	Justification for Tree Felling
	Scientific name	Chinese name	Height (m)	DBH (mm)	Crown Spread (m)	(good/fair/poor)				(high/medium/low)	Remarks			(retain/transplant/fell)	(HyD, AFCD, LCSD, LandsD)	
T02	*Ficus microcarpa*	細葉榕	8.0	0.45	6.0	Low	Poor	Poor	Poor	Low	codominant trunk, unbalanced form	-	-	Fell	LCSD	1,2,7
T03	*Bombax ceiba*	木棉	8.0	0.15	4.0	Med	Fair	Poor	Fair	Low	Root embedded by concrete	-	-	Fell	LCSD	1, 2
T04	*Bombax ceiba*	木棉	10.0	0.23	5.5	Med	Fair	Poor	Fair	Low	Root embedded by concrete	-	-	Fell	LCSD	1,2
T05	*Bombax ceiba*	木棉	8.0	0.16	4.0	Med	Fair	Poor	Fair	Low	Root embedded by concrete	-	-	Fell	LCSD	1,2
T12	*Cinnamomum camphora*	樟	12.0	0.60	8.0	Med	Fair	Fair	Fair	Low	-	-	-	Retain	LCSD	-
T13	*Celtis sinensis*	朴樹	12.0	0.65	6.0	Med	Fair	Fair	Fair	Low	-	-	-	Retain	LCSD	-
T14	*Dead Tree*	死樹	4.0	0.18	3.0	-	-	Dead	Poor	-	Wilted branches and unbalanced form	-	-	Fell	LCSD	-

Tree Assessment before the Existing House development at Lot No. 4823 in 2014



Tree Number	Crown Spread (m)	Existing Ground Level at the Trunk Base (mPD)
T02	6.0	+6.80
T03	4.0	+6.74
T04	5.5	+6.69
T05	4.0	+6.65
T12	8.0	+8.99
T13	6.0	+9.21
T14	3.0	+8.61

Tree Survey Plan before Existing House Development



Tree Compensatory Plan for the Existing House Developement

Quantity	Code	Chinese Name	Botanical Name	Location	Height (mm)	Spread (mm)	DBH (mm)	Spacing (mm)	Remark
TREE									
5	GS	福木	Garcina spicata	Green Hatched Black Area	3000	1500	100	4000	straight trunk and balanced form

Compensatory Planting for Existing House Development

2202
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

TREE FELLING PROPOSAL &
RETAINED TREE LOCATION

FIGURE 16 1:350

B	OCT 2022	
A	JUL 2022	
-	MAY 2022	

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S12A AMENDMENT OF PLAN APPLICATION
APPROVED NGAU TAM MEI
OUTLINE ZONING PLAN NO. S/YL-NTM/12

PROPOSED REZONING FROM "R(C)" TO "G/IC"
FOR A PROPOSED "SOCIAL WELFARE FACILITIES"
(RESIDENTIAL CARE HOMES FOR THE ELDERLY)
(RCHE)

AT LOT 4823 IN D.D.104, 81 SAN TAM ROAD,
SAN TIN, N.T.

APPENDIX 5

GEOTECHNICAL PLANNING REVIEW REPORT
FOR PLANNING APPLICATION

RLEE

RLEE Architects (HK) Ltd

CONTENTS

1.0	Introduction
2.0	The Site
3.0	Existing and Proposed Design
4.0	Existing Geotechnical Features
5.0	Desk Study and Background Information Search
6.0	Geotechnical Investigation Work
7.0	Proposed Sequence of Construction
8.0	Conclusion

Appendices

Appendix 1	Slope Information Record of Features
Appendix 2	Existing Ground Investigation Works Data

1.0 INTRODUCTION

This report is to present geotechnical assessments to support the planning application for a proposed rezoning from "R(C)" to G/IC" for a proposed "Social Welfare Facilities" (Residential Care Homes for the Elderly) (RCHE)

The following geotechnical aspects are covered on this appraisal report:

1. Desk study and background information search of existing structures and geotechnical features located in the vicinity of the site.

2. A review of the site conditions and findings of the geotechnical investigation.

3. Brief assessment of the geotechnical feasibility of this planning application.

4. A proposed sequence of construction and / or mitigation measures which are likely to be carried out in connection with this planning application.

2.0 THE SITE

The Application Site locates at **No.81 San Tam Road, Lot no. 4823 in D.D. 104**, with a site area of about 736.3 m^2. The Site is accessible from San Tam Road at level +7.33 mPd from the West. It adjoins an access road to "Crescendo" to the North and a low-rise residential development "Casa Paradiso" to the South. To the East is a small mountain full of greenery.

Please refer to ***Figure 1*** for the Location Plan of the Application Site.

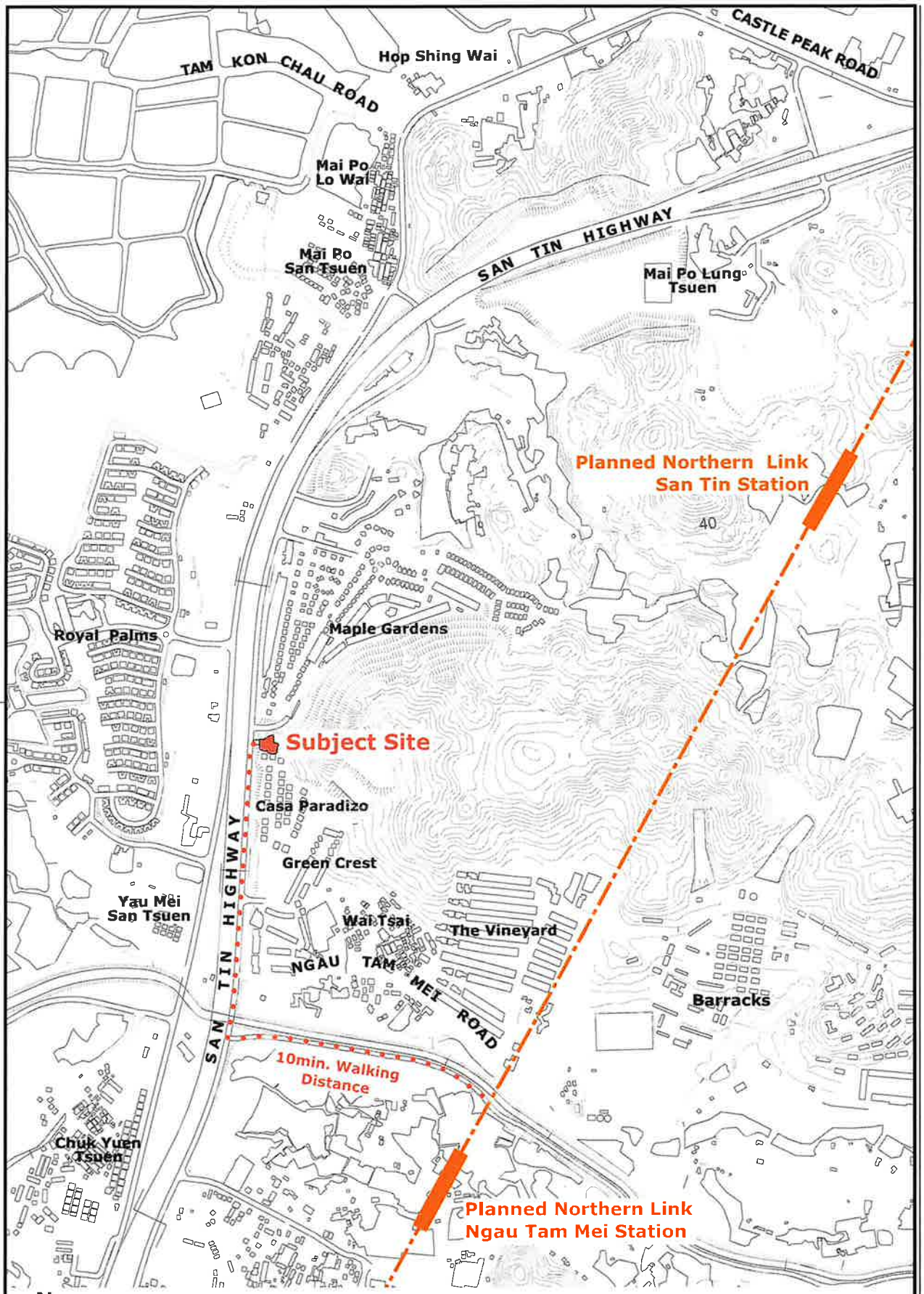


FIGURE NO.	TITLE	SCALE	
1	LOCATION PLAN	1:10000	
		DATE	JUL 2022

RLEE

3.0 EXISTING & PROPOSED DESIGN

There is an existing House of 3 storeys high from carpark, the main roof level is +21.00 mPd. It situates on a platform of level +12.0 mPd with a car ramp leading from the existing Brown area of level +7.33 mPd, which gain access from San Tam Road to the West.

The existing House is proposed to be demolished and re-developed into a RCHE by first of all, lowering of the access point to a level of +7.33 mPd, then follow up a 10-storeys building with main roof at level of + 36.93 mPd.

4.0 EXISTING GEOTECHNICAL FEATURES

According to the information obtained from the Hong Kong Slope Safety (HKSS) website, there are four registered features of 2SE – C/C 312, 2SE – C/F 94, 2SE – C/R 113 and 2SE – C/R 114 located in the vicinity of the proposed application site.

For ease of reference, the registered slope plan downloaded from HKSS website is shown in Figure 2.

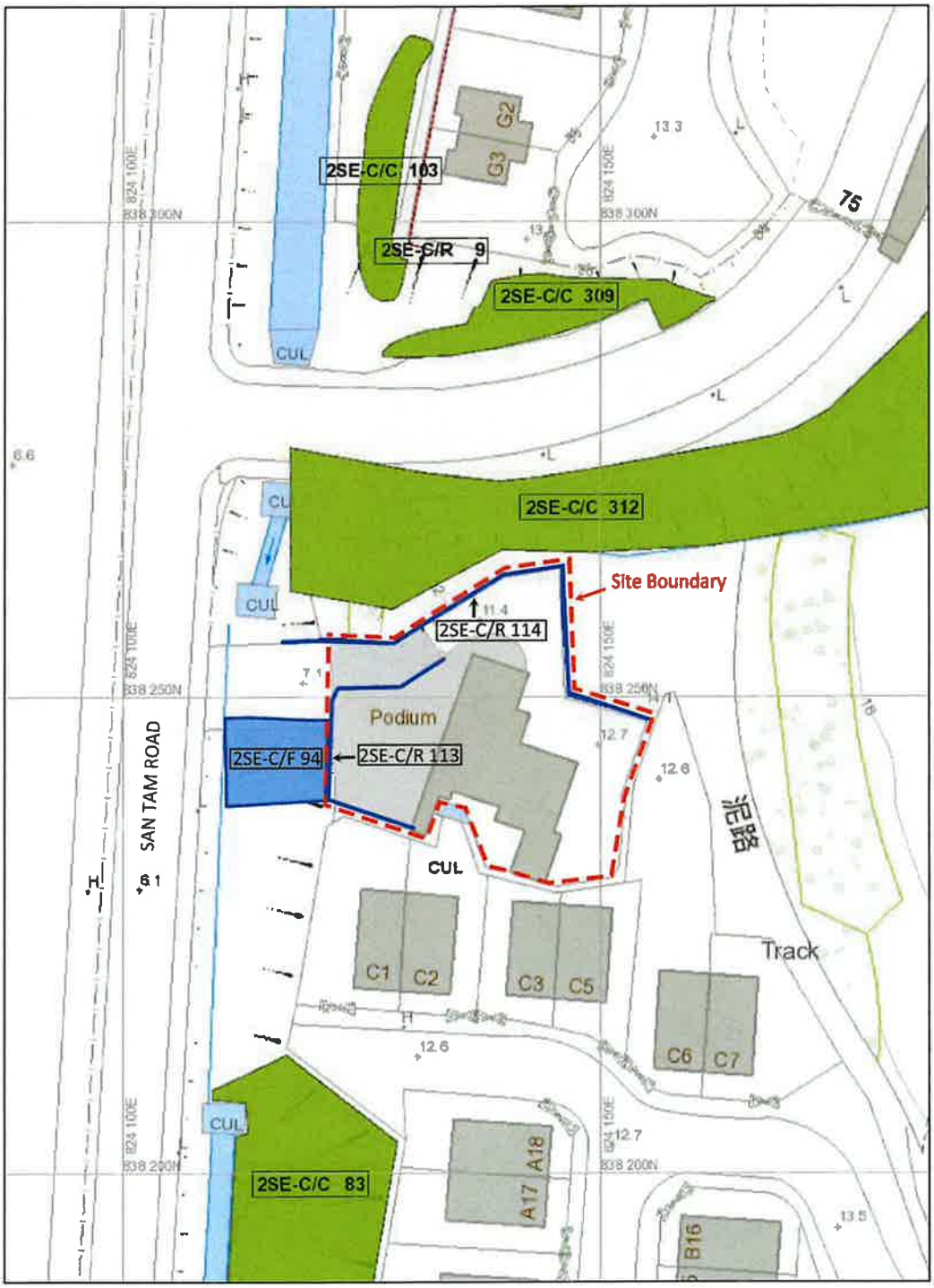

2SE-C/C 103
2SE-C/R 9
2SE-C/C 309
2SE-C/C 312
Site Boundary
2SE-C/R 114
Podium
2SE-C/F 94
2SE-C/R 113
SAN TAM ROAD
CUL
C1
C2
C3
C5
C6
C7
Track
2SE-C/C 83
A17
A18
B16
G2
G3
75

Figure 2

A brief description on these geotechnical features is given below and the detail information is attached in Appendix 1.

Feature No. 2SE – C/C 312

Feature No. 2SE – C/C 312 adjoins the proposed site to the North. The feature consists of a slope of Max. 18 m high, 85 m long and with an average angle of 26 deg. There are existing 400 mm surface channels located at the berm & crest and a 900 mm channel at the toe of the feature. The consequence-to-life category is 1, according to HKSS website of the GEO. The maintenance responsibility of the feature belongs to Lot 2086 in DD 105.

Feature No. 2SE – C/F 94

Feature No. 2SE – C/F 94 adjoins the proposed site at the West. The feature consists of a slope of Max. 3.5 m high, 9m long and with an average angle of 20 deg. There is an existing 225 mm surface channel located at the toe of the feature. The consequence-to-life category is 1, according to HKSS website of the GEO. The maintenance responsibility of the feature belongs to Lot 4823 in DD 104.

Feature No. 2SE – C/R 113

Feature No. 2SE – C/R 113 is a R.C. Retaining Wall to the West & North of the site. It is app. 6.2 m high, 34.5m long and with a face angle of 90 deg. The consequence-to-life category is 1, according to HKSS website of the GEO. The maintenance responsibility of the feature belongs to Lot 4823 in DD 104.

Feature No. 2SE – C/R 114

Feature No. 2SE – C/R 114 is a R.C. Retaining Wall to the North of the site. It is app. 2.2 m high, 53.5 m long and with a face angle of 90 deg. The consequence-to-life category is 1, according to HKSS website of the GEO. The maintenance responsibility of the feature belongs to Lot 4823 in DD 104.

5.0 DESK STUDY AND BACKGROUND INFORMATION SEARCH

We have searched record files in the Buildings Department & the Geotechnical Engineering Office concerning this site and there are corresponding records for the existing House on the site. The information would be helpful and be utilized in the Detail Design of the new RCHE Development.

6.0 GEOTECHNICAL INVESTIGATION WORK

6.1 Outline of Site Geology

According to the Geological Map of San Tin (Sheet 2), the site is generally underlain by coarse ash crystal TUFF, which is consistent with the findings from the completed boreholes of the adjacent lot.

6.2 Information Retrieval

According to record, the site has carried out Geotechnical Investigation Works in year 2013. The works consist of 5 boreholes and a number of trial pits within the site.

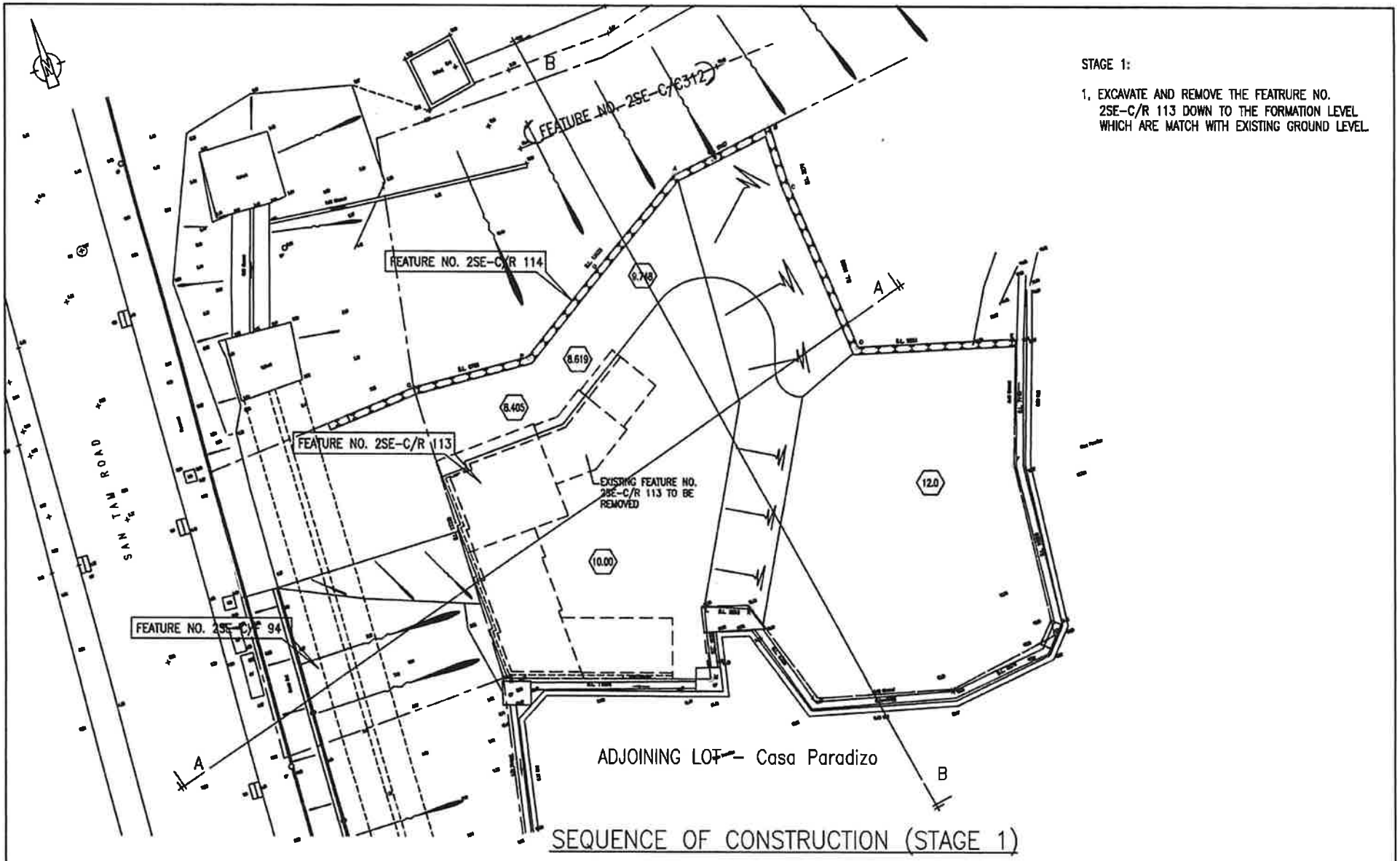
The borehole records are shown in Appendix 2. The information would be utilized in the Detail Design of the new RCHE Development.

7.0 PROPOSED SEQUENCE OF CONSTRUCTION

In order to suit the new RCHE design, The Soldier Pile Retaining Wall (2SE – C/R 114) would be abandoned while the R.C. Retaining Wall (2SE – C/R 113) would be removed during construction. The stability of the feature 2SE-C/C 312 & 2SE-C/F94 will be reviewed in the design of the proposed development. If it is found not to be up to the required standard, those can be propped by a new supplementary retaining wall inside the proposed development. The supplementary wall will be integrated with the proposed building structure so that it is strong enough to lend support to those features.

The sequence of construction (Drawing GA-1 to GA-7) involves basically the following steps:

1. After existing buildings are demolished, excavate and remove the feature No. 2SE-C/R 113 down to the formation level which are match with existing ground level.
2. Install foundation socketed h-piles and pipe pile / sheet pile cofferdam.
3. Carry out ELS works sequentially down to the final excavation level at the western half of the site.
4. Construct the pile caps and structure with the cofferdam.
5. Employing the completed structure as stiff support, carry out ELS works for the remaining part of the site sequentially down to the final excavation level.
6. Construct the remaining pile cap and other related retaining structures.
7. Construct the superstructure above ground floor in the usual manner.

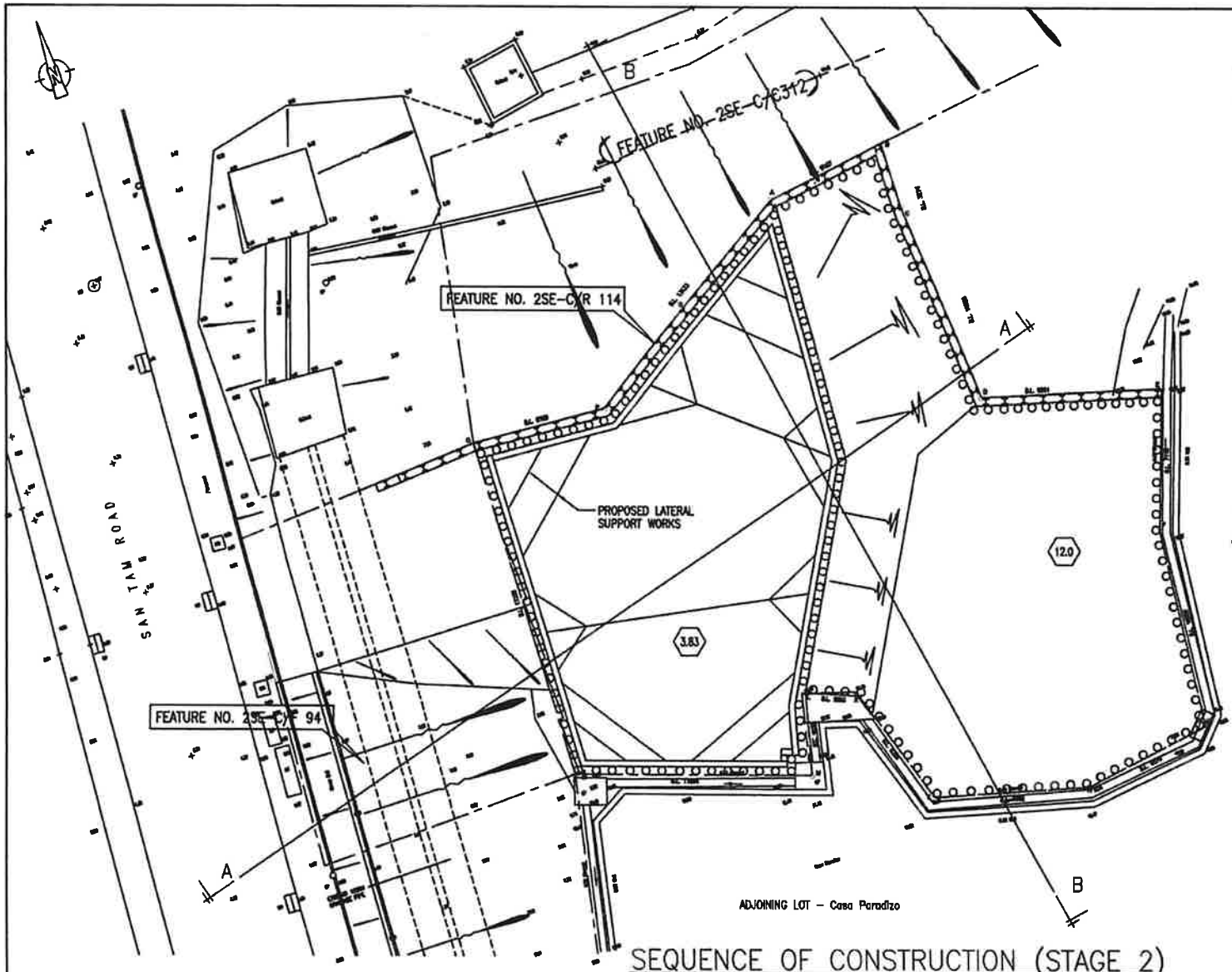


STAGE 1:

1, EXCAVATE AND REMOVE THE FEATRURE NO. 2SE-C/R 113 DOWN TO THE FORMATION LEVEL WHICH ARE MATCH WITH EXISTING GROUND LEVEL.

SEQUENCE OF CONSTRUCTION (STAGE 1)

Project: LOT NO. 4823 IN D.D. 104, YUEN LONG, NEW TERRITORIES	Drawing Title: SEQUENCE OF CONSTURCTION – STAGE 1	Drn. E.C.	Chd. R.L.	ARCHITECT: RLEE
		Scale 1:300	Date 1/2023	
		Drawing No. GA-1	Rev.	

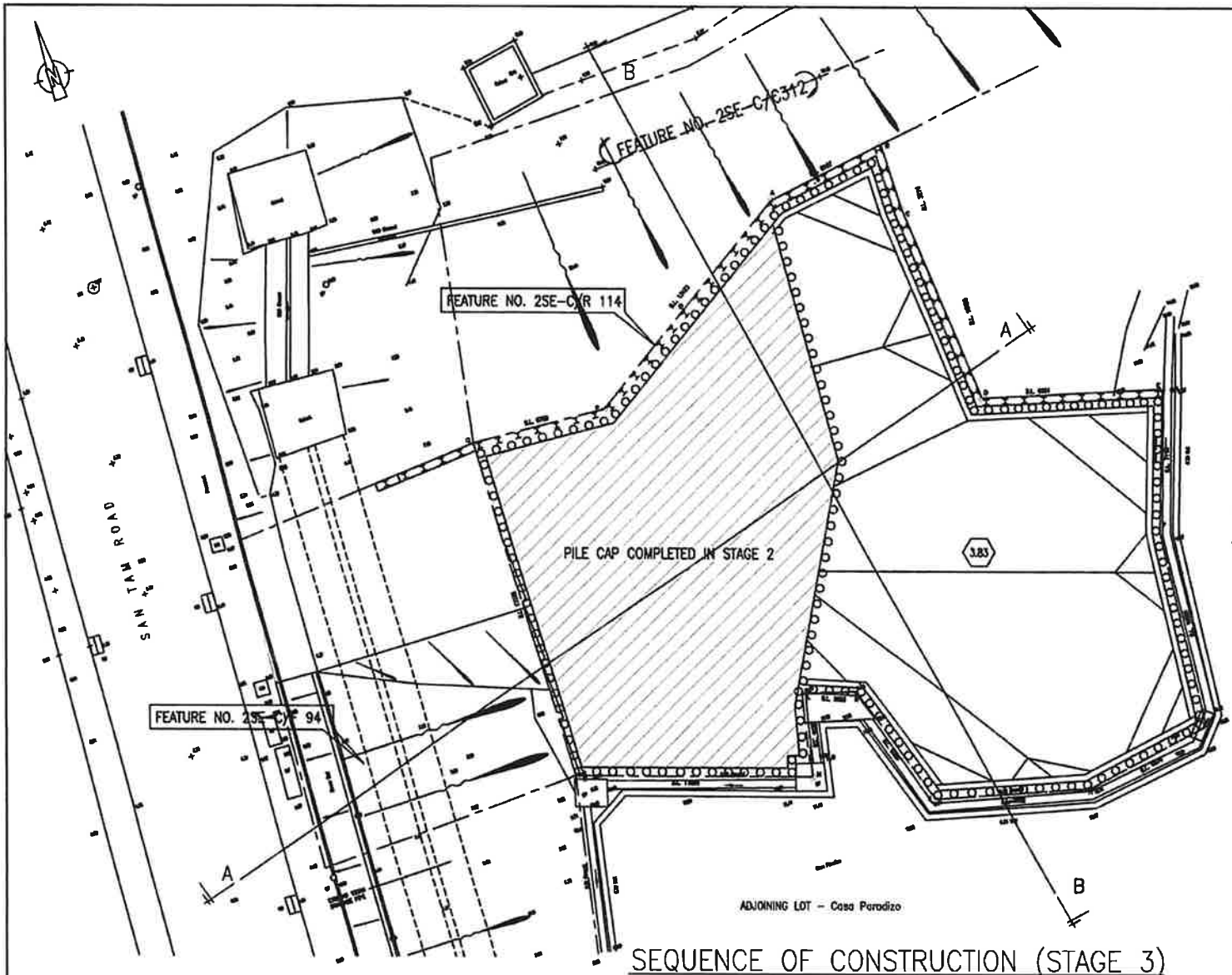


STAGE 2:

1. INSTALL FOUNDATION SOCKETED H-PILES AND PIPE PILE / SHEET PILE COFFERDAM.
2. CARRY OUT ELS WORKS SEQUENTIALLY DOWN TO THE FINAL EXCAVATION LEVEL AT THE WESTERN HALF OF THE SITE.
3. CONSTRUCT THE PILE CAPS AND STRUCTURE WITH THE COFFERDAM.

SEQUENCE OF CONSTRUCTION (STAGE 2)

Project: LOT NO. 4823 IN D.D. 104, YUEN LONG, NEW TERRITORIES	Drawing Title: SEQUENCE OF CONSTURCTION – STAGE 2	Drn. E.C. / Chd. R.L.	ARCHITECT: RLEE
		Scale 1:300 / Date 1/2023	
		Drawing No. GA-2 / Rev.	

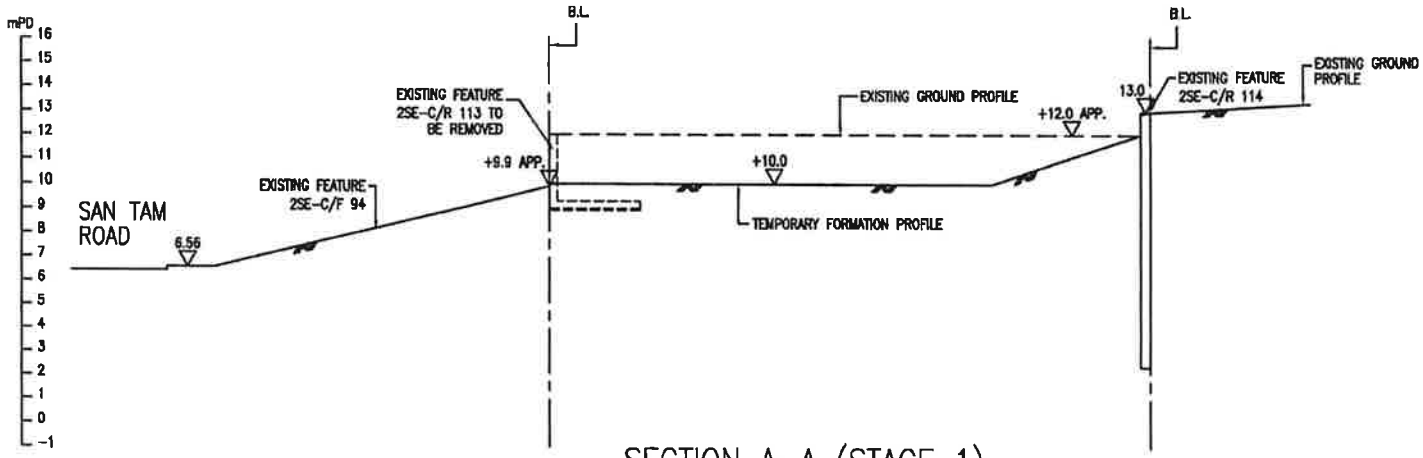


STAGE 3:

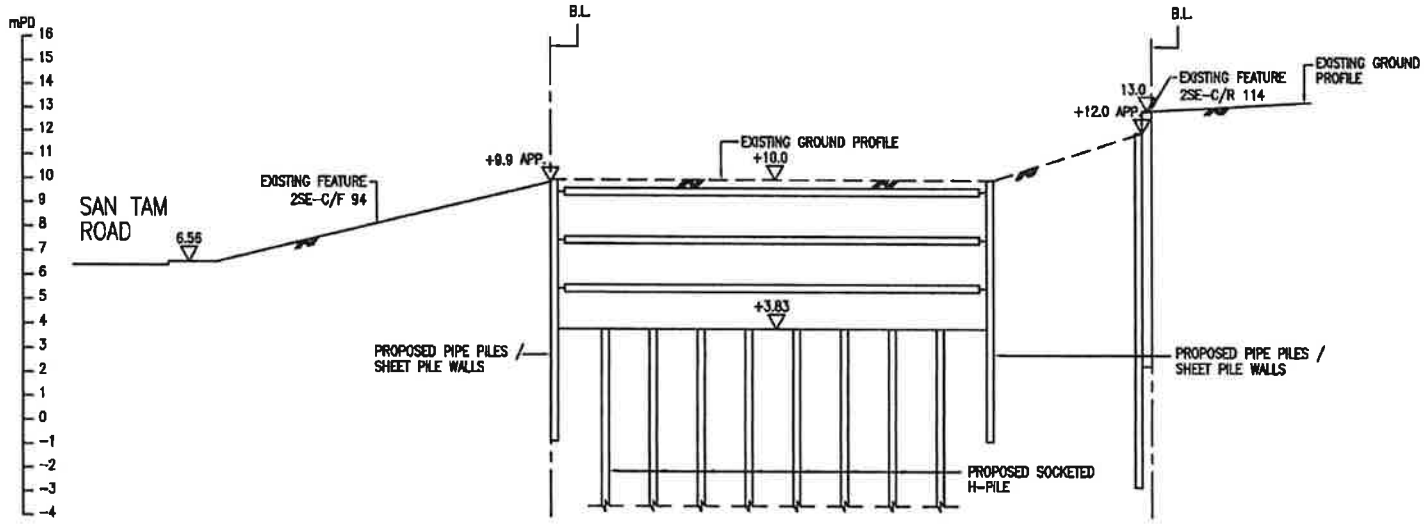
1. EMPLOYING THE COMPLETED STRUCTURE AS STIFF SUPPORT, CARRY OUT ELS WORKS FOR THE REMAINING PART OF THE SITE SEQUENTIALLY DOWN TO THE FINAL EXCAVATION LEVEL.
2. CONSTRUCT THE REMAINING PILE CAP AND OTHER RELATED RETAINING STRUCTURES.
3. CONSTRUCT THE SUPERSTRUCTURE ABOVE GROUND FLOOR IN THE USUAL MANNER.

SEQUENCE OF CONSTRUCTION (STAGE 3)

Project	Drawing Title	Drn.	Chd.	ARCHITECT
LOT NO. 4823 IN D.D. 104, YUEN LONG, NEW TERRITORIES	SEQUENCE OF CONSTURCTION – STAGE 3	E.C.	R.L.	RLEE
		Scale 1:300	Date 1/2023	
		Drawing No. GA-3	Rev.	

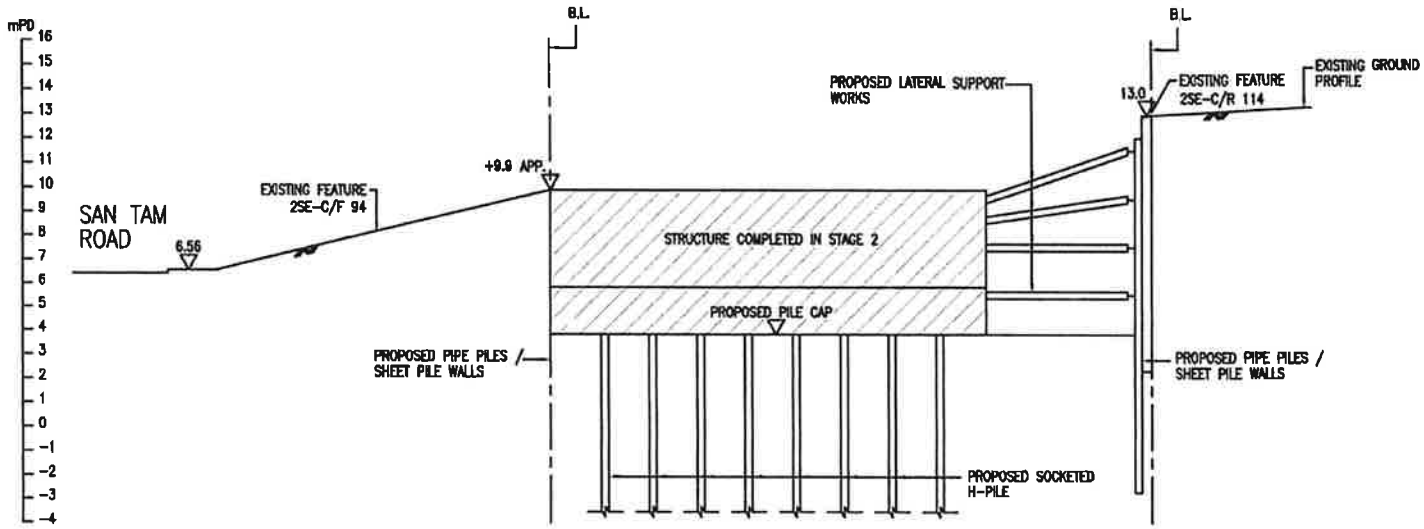


SECTION A-A (STAGE 1)



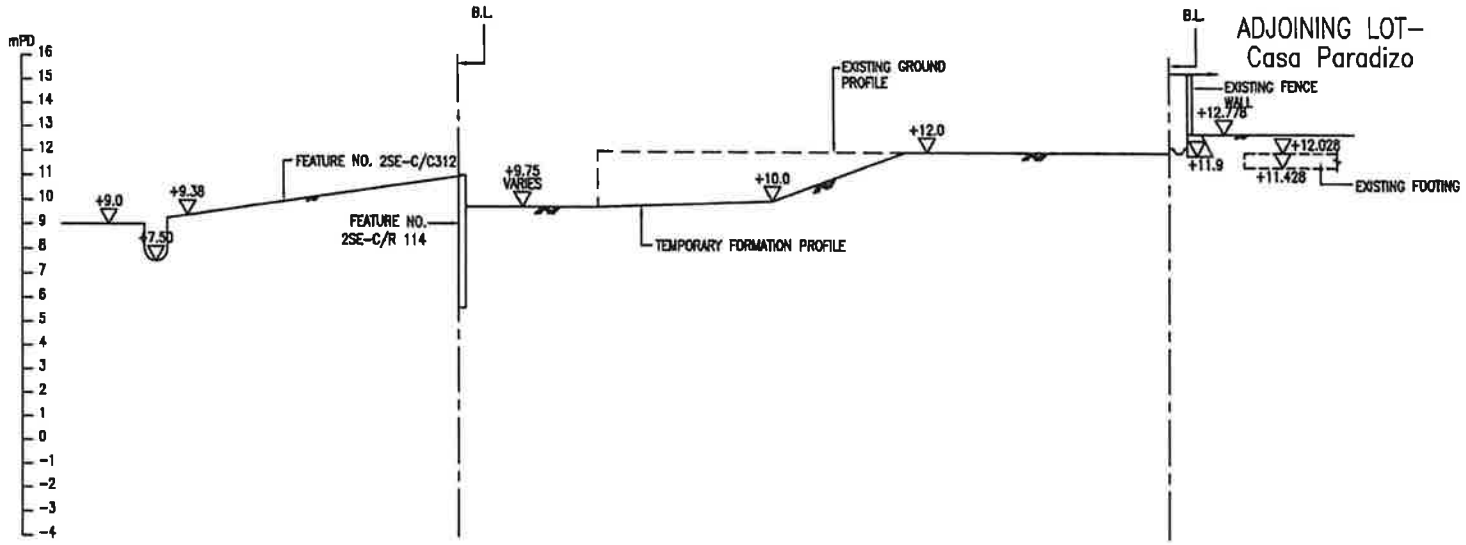
SECTION A-A (STAGE 2)

Project: LOT NO. 4823 IN D.D. 104, YUEN LONG, NEW TERRITORIES	Drawing Title: SEQUENCE OF CONSTURCTION – SECTION A-A (STAGE 1 AND STAGE 2)	Drn. E.C. / Chd. R.L.	ARCHITECT: RLEE
		Scale 1:300 / Date 1/2023	
		Drawing No. GA-4 / Rev.	

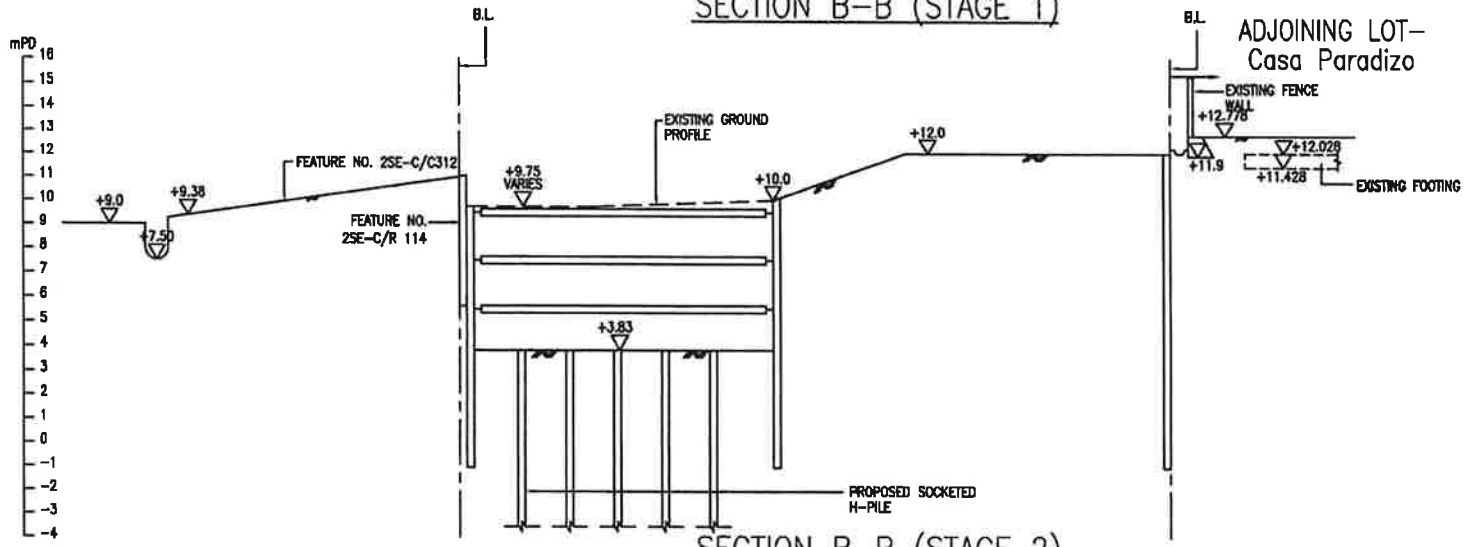


SECTION A-A (STAGE 3)

Project: LOT NO. 4823 IN D.D. 104, YUEN LONG, NEW TERRITORIES	Drawing Title: SEQUENCE OF CONSTURCTION – SECTION A-A (STAGE 3)	Drn. E.C.	Chd. R.L.	ARCHITECT: RLBE www.rlbe.com.hk
		Scale 1:300	Date 1/2023	
		Drawing No. GA-5	Rev.	



SECTION B-B (STAGE 1)



SECTION B-B (STAGE 2)

Project

LOT NO. 4823 IN D.D. 104, YUEN LONG, NEW TERRITORIES

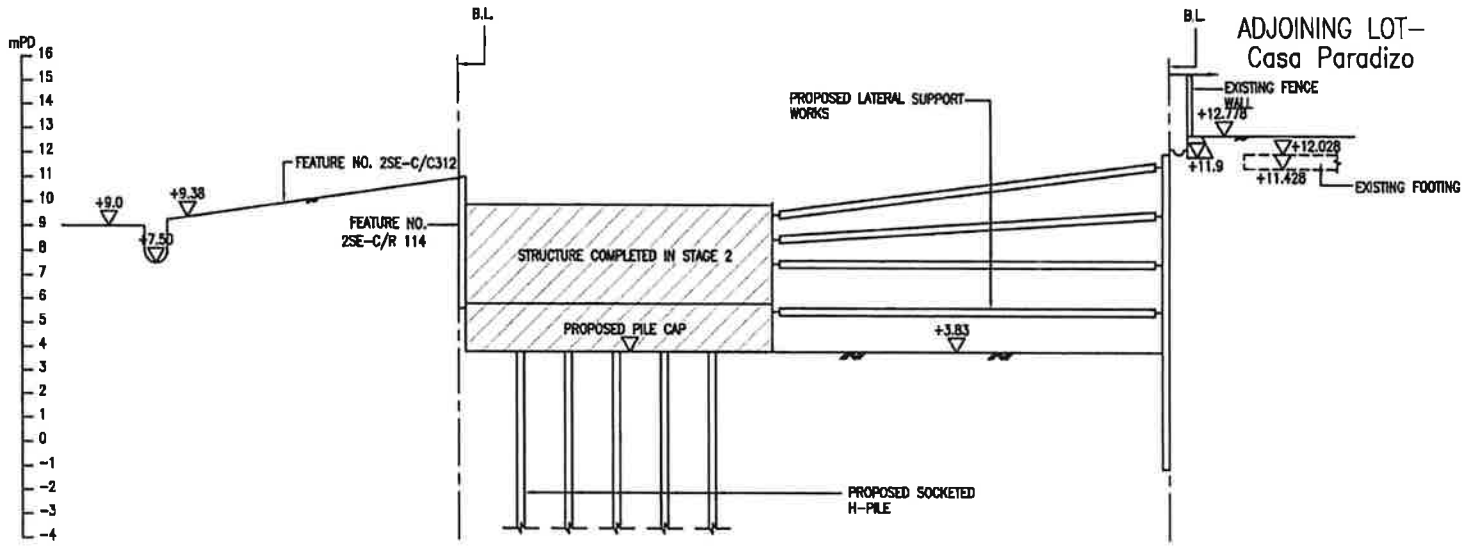
Drawing Title

SEQUENCE OF CONSTURCTION - SECTION B-B(STAGE 1 AND STAGE 2)

Drn.	Chd.
E.C.	R.L.
Scale: 1:300	Date: 1/2023
Drawing No.: GA-6	Rev.

ARCHITECT

RLEE



SECTION B-B (STAGE 3)

Project: LOT NO. 4823 IN D.D. 104, YUEN LONG, NEW TERRITORIES	Drawing Title: SEQUENCE OF CONSTURCTION - SECTION B-B (STAGE 3)	Drn. E.C.	Chd. R.L.	ARCHITECT: RLEE
		Scale 1:300	Date 1/2023	
		Drawing No. GA-7	Rev.	

8.0 CONCLUSION

A review of the site conditions and the geotechnical works likely to be carried out for the proposed planning application has been carried out and the following conclusion can be made.

1. It is envisaged that the proposed planning application is geotechnically feasible. Since the existing retaining walls (2SE – C/R 113 & 2SE – C/R 114) would be modified & be buttressed by the new permanent basement structures. The stability of the feature 2SE-C/C 312 & 2SE-C/F94 will be reviewed in the design of the proposed development. If it is found not to be up to the required standard, those can be propped by a new supplementary retaining wall inside the proposed development. The supplementary wall will be integrated with the proposed building structure so that it is strong enough to lend support to those features. No additional adverse effect will be induced on the adjacent ground and geotechnical features.

2. A detailed investigation and assessment of all existing slopes located in the vicinity to the site such as 2SE – C/C 312, 2SE – C/F 94, 2SE – C/R 113 and 2SE – C/R 114 will be carried out to ensure that the stability of the existing geotechnical features is complying with current geotechnical standards and will not induce any adverse effect on the proposed development. If necessary, appropriate measures including recommendation and implementation of any stabilization / upgrading / preventive works in order to acquire a safe geotechnical environment will be employed in detail in future studies.

S12A AMENDMENT OF PLAN APPLICATION
APPROVED NGAU TAM MEI
OUTLINE ZONING PLAN NO. S/YL-NTM/12

PROPOSED REZONING FROM "R(C)" TO "G/IC"
FOR A PROPOSED "SOCIAL WELFARE FACILITIES"
(RESIDENTIAL CARE HOMES FOR THE ELDERLY)
(RCHE)

AT LOT 4823 IN D.D.104, 81 SAN TAM ROAD,
SAN TIN, N.T.

APPENDIX 1

Slope Information Record of Features

BASIC INFORMATION

Location: Lot No. 4823 in DD104, Yuen Long, New Territories

Date of Formation: post-1977

Date of Construction/ Modification: 30-06-2017

Approximate Coordinates: Easting : 824116 Northing : 838243

CONSEQUENCE-TO-LIFE CATEGORY

Facility at Crest: Residential building

Distance of Facility from Crest (m): 0

Facility at Toe: Road/footpath with moderate traffic density

Distance of Facility from Toe (m): 2

Consequence-to-life Category: 1

Remarks: N/A

SLOPE PART

(1) Max. Height (m): 3.5 Length (m): 9 Average Angle (deg): 20

WALL PART

N/A

MAINTENANCE RESPONSIBILITY

Private Feature Party: DD104 LOT 4823 Agent: N/A

DETAILS OF SLOPE / RETAINING WALL

Date of Inspection: 16-01-2018
Data Source: AP
Slope Part Drainage: (1) Position: Toe Size(mm): 225

Wall Part Drainage: N/A

SLOPE PART

Slope Part (1)
Surface Protection (%): Bare: 0 Vegetated: 100 Chunam: 0 Shotcrete: 0 Other Cover: 0
Material Description: Material type: Soil Geology: N/A
Berm: No. of Berms: N/A Min. Berm Width (m): N/A
Weepholes: Size (mm): N/A Spacing (m): N/A

WALL PART

N/A

SERVICES

(1) Utilities Type: Water Main Size(mm): 1500 Location: Crest Remark: N/A

STAGE 1 STUDY REPORT

Inspected On:
Weather:
District: N/A

Section No: 1-1
Height(m):
Type of Toe Facility: Road/footpath with moderate traffic density

Distance from Toe(m): 2
Type of Crest Facility: Residential building

Distance from Crest(m): 0
Consequence Category:
Engineering Judgement:

Section No: 2-2
Type of Toe Facility:

Distance from Toe(m):
Type of Crest Facility:

Distance from Crest(m):
Consequence Category:
Engineering Judgement:

Sign of Seepage:

Criterion A satisfied:
Sign of Distress:

Criterion D satisfied:
Non-routine maintenance required:
Note:

Masonry wall/Masonry facing:
Note:

Consequence category (for critical section):
Observations: N/A
Emergency Action Required:
Action By: N/A

ACTION TO INITIATE PREVENTIVE WORKS

Criterion A/Criterion D: N/A
Action By: N/A
Further Study:
Action By: N/A

OTHER EXTERNAL ACTION

Check / repair Services:
Action By: N/A
Non-routine Maintenance:
Action By: N/A

PHOTO

BASIC INFORMATION

Location: Lot No. 4823 in DD104, Yuen Long, New Territories

Date of Formation: post-1977

Date of Construction/ Modification: 30-06-2017

Approximate Coordinates: Easting : 824125 Northing : 838238

CONSEQUENCE-TO-LIFE CATEGORY

Facility at Crest: Residential building

Distance of Facility from Crest (m): 0

Facility at Toe: Road/footpath with moderate traffic density

Distance of Facility from Toe (m): 2

Consequence-to-life Category: 1

Remarks: N/A

SLOPE PART

N/A

WALL PART

(1) Max. Height (m): 6.2 Length (m): 34.5 Face Angle (deg): 90

MAINTENANCE RESPONSIBILITY

Private Feature Party: DD104 LOT 4823 Agent: N/A

DETAILS OF SLOPE / RETAINING WALL

Date of Inspection: 16-01-2018
Data Source: AP
Slope Part Drainage: N/A

Wall Part Drainage: N/A

SLOPE PART

N/A

WALL PART

Wall Part (1)
Type of Wall: Wall Material: Concrete Wall Location: Retaining wall with level platform
Berm: No. of Berms: N/A Min. Berm Width (m): N/A
Weepholes: Size (mm): 75 Spacing (m): 2

SERVICES

N/A

STAGE 1 STUDY REPORT

Inspected On:
Weather:
District: N/A

Section No: 1-1
Height(m):
Type of Toe Facility: Road/footpath with moderate traffic density

Distance from Toe(m): 2
Type of Crest Facility: Residential building

Distance from Crest(m): 0
Consequence Category:
Engineering Judgement:

Section No: 2-2
Type of Toe Facility:

Distance from Toe(m):
Type of Crest Facility:

Distance from Crest(m):
Consequence Category:
Engineering Judgement:

Sign of Seepage:	
Criterion A satisfied:	
Sign of Distress:	
Criterion D satisfied:	
Non-routine maintenance required:	
Note:	
Masonry wall/Masonry facing:	
Note:	
Consequence category (for critical section):	
Observations:	N/A
Emergency Action Required:	
Action By:	N/A

ACTION TO INITIATE PREVENTIVE WORKS

Criterion A/Criterion D:	N/A
Action By:	N/A
Further Study:	
Action By:	N/A

OTHER EXTERNAL ACTION

Check / repair Services:	
Action By:	N/A
Non-routine Maintenance:	
Action By:	N/A

PHOTO

BASIC INFORMATION

Location: Lot No. 4823 in DD104, Yuen Long, New Territories

Date of Formation: post-1977

Date of Construction/ Modification: 30-06-2017

Approximate Coordinates: Easting : 824136 Northing : 838260

CONSEQUENCE-TO-LIFE CATEGORY

Facility at Crest: Residential building

Distance of Facility from Crest (m): 0

Facility at Toe: Road/footpath with moderate traffic density

Distance of Facility from Toe (m): 2

Consequence-to-life Category: 1

Remarks: N/A

SLOPE PART

N/A

WALL PART

(1) Max. Height (m): 2.2 Length (m): 53.5 Face Angle (deg): 90

MAINTENANCE RESPONSIBILITY

Private Feature Party: DD104 LOT 4823 Agent: N/A

DETAILS OF SLOPE / RETAINING WALL

Date of Inspection: 09-05-2019
Data Source: AP
Slope Part Drainage: N/A

Wall Part Drainage: N/A

SLOPE PART

N/A

WALL PART

Wall Part (1)
Type of Wall: Wall Material: Concrete Wall Location: Wall at toe
Berm: No. of Berms: N/A Min. Berm Width (m): N/A
Weepholes: Size (mm): N/A Spacing (m): N/A

SERVICES

N/A

STAGE 1 STUDY REPORT

Inspected On:
Weather:
District: N/A

Section No: 1-1
Height(m):
Type of Toe Facility: Road/footpath with moderate traffic density

Distance from Toe(m): 2
Type of Crest Facility: Residential building

Distance from Crest(m): 0
Consequence Category:
Engineering Judgement:

Section No: 2-2
Type of Toe Facility:

Distance from Toe(m):
Type of Crest Facility:

Distance from Crest(m):
Consequence Category:
Engineering Judgement:

Sign of Seepage:

Criterion A satisfied:
Sign of Distress:

Criterion D satisfied:
Non-routine maintenance required:
Note:

Masonry wall/Masonry facing:
Note:

Consequence category (for critical section):
Observations: N/A
Emergency Action Required:
Action By: N/A

ACTION TO INITIATE PREVENTIVE WORKS

Criterion A/Criterion D: N/A
Action By: N/A
Further Study:
Action By: N/A

OTHER EXTERNAL ACTION

Check / repair Services:
Action By: N/A
Non-routine Maintenance:
Action By: N/A

PHOTO

S12A AMENDMENT OF PLAN APPLICATION
APPROVED NGAU TAM MEI
OUTLINE ZONING PLAN NO. S/YL-NTM/12

PROPOSED REZONING FROM "R(C)" TO "G/IC"
FOR A PROPOSED "SOCIAL WELFARE FACILITIES"
(RESIDENTIAL CARE HOMES FOR THE ELDERLY)
(RCHE)

AT LOT 4823 IN D.D.104, 81 SAN TAM ROAD,
SAN TIN, N.T.

Additional Pages to

APPENDIX 1

BASIC INFORMATION

Location: D.D.105 Lot 2086, Ngau Tam Mei, Yuen Long

Date of Formation: post-1977

Date of Construction/ Modification: 01-12-2013

Approximate Coordinates: Easting : 824196 Northing : 838284

CONSEQUENCE-TO-LIFE CATEGORY

Facility at Crest: Undeveloped green belt

Distance of Facility from Crest (m): 0

Facility at Toe: Residential building

Distance of Facility from Toe (m): 0

Consequence-to-life Category: 1

Remarks: N/A

SLOPE PART

(1) Max. Height (m): 18 Length (m): 85 Average Angle (deg): 26

WALL PART

N/A

MAINTENANCE RESPONSIBILITY

Private Feature Party: DD105 LOT 2086 Agent: N/A

DETAILS OF SLOPE / RETAINING WALL

Date of Inspection: 07-09-2016

Data Source: AP

Slope Part Drainage: (1) Position: Berm Size(mm): 400
(2) Position: Crest Size(mm): 400
(3) Position: Toe Size(mm): 900

Wall Part Drainage: N/A

SLOPE PART

Slope Part (1)
Surface Protection (%): Bare: 0 Vegetated: 100 Chunam: 0 Shotcrete: 0 Other Cover: 0
Material Description: Material type: Soil Geology: N/A
Berm: No. of Berms: 3 Min. Berm Width (m): 0.6
Weepholes: Size (mm): N/A Spacing (m): N/A

WALL PART

N/A

SERVICES

N/A

STAGE 1 STUDY REPORT

Inspected On:
Weather:
District: N/A

Section No: 1-1
Height(m):
Type of Toe Facility: Residential building

Distance from Toe(m): 0
Type of Crest Facility: Undeveloped green belt

Distance from Crest(m): 0
Consequence Category:
Engineering Judgement:

Section No: 2-2
Type of Toe Facility:

Distance from Toe(m):
Type of Crest Facility:

Distance from Crest(m):
Consequence Category:
Engineering Judgement:

Sign of Seepage:

Criterion A satisfied:
Sign of Distress:

Criterion D satisfied:
Non-routine maintenance required:
Note:

Masonry wall/Masonry facing:
Note:

Consequence category (for critical section):
Observations: N/A
Emergency Action Required:
Action By: N/A

ACTION TO INITIATE PREVENTIVE WORKS

Criterion A/Criterion D: N/A
Action By: N/A
Further Study:
Action By: N/A

OTHER EXTERNAL ACTION

Check / repair Services:
Action By: N/A
Non-routine Maintenance:
Action By: N/A

PHOTO

S12A AMENDMENT OF PLAN APPLICATION
APPROVED NGAU TAM MEI
OUTLINE ZONING PLAN NO. S/YL-NTM/12

PROPOSED REZONING FROM "R(C)" TO "G/IC"
FOR A PROPOSED "SOCIAL WELFARE FACILITIES"
(RESIDENTIAL CARE HOMES FOR THE ELDERLY)
(RCHE)

AT LOT 4823 IN D.D.104, 81 SAN TAM ROAD,
SAN TIN, N.T.

APPENDIX 2

Existing Ground Investigation Works Data

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 1
	CONTRACT NO.	SHEET 1 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES E 824,144.44 N 838,262.20	W.O. No
MACHINE & No. XY2B		DATE: 18/01/2013 to 21/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +12.02 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
18.1.13	HX							A 0.50 B 1.00	+11.02	1.00			Firm, greyish yellow, sandy SILT with some gravels and roots. (FILL)
			100				(1, 1, 2, 2, 3, 5) N = 12	1 2.00 2.10 2.20 2 2.50 2.55 3 3.00					Firm, yellowish brown, fine sandy SILT. (COLLUVIUM)
			100				(1, 3, 3, 3, 4, 4) N = 14	4 4.00 4.10 4.20 5 4.50 4.55 6 5.00					
			100				(2, 3, 3, 4, 6, 9) N = 21	7 6.00 6.10 6.20 8 6.50 6.55 9 7.00	+5.02	7.00			
			63				(3, 4, 4, 5, 7, 7) N = 23	10 8.00 8.10 8.20 11 8.50 8.55 12 9.00	+3.02	9.00			Firm to stiff, yellowish brown with reddish brown, fine sandy SILT. (RESIDUAL SOIL)
9 18.1.13 19.1.13		7.30m at 18:00 8.00m at 08:00	80					13 10.00	+2.02	10.00		V	Extremely weak, yellowish grey, completely decomposed fine ash TUFF. (Stiff, fine sandy SILT)
10													

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- In-situ Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

LOGGED P.S. Wong

DATE 22/01/2013

CHECKED K.M. Lam

DATE 23/01/2013

REMARKS

1. Prior to drilling an inspection pit was excavated by hand to 1.00m depth.
2. Constant head permeability tests were carried out at 6.00-7.00m and 8.00-9.00m depth.

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 1
	CONTRACT NO.	SHEET 2 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES	W.O. No
MACHINE & No. XY2B	E 824,144.44 N 838,262.20	DATE: 18/01/2013 to 21/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +12.02 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
10							(3, 3, 4, 6, 7, 8) N = 25	19 10.10 10.20 20 10.50 10.55				V	As sheet 1 of 4.
11			73					21 11.00					
12							(3, 4, 5, 6, 9, 12) N = 32	22 12.00 12.10 23 12.20 24 12.50 12.55					
13			85					25 13.00					
14							(2, 6, 6, 9, 13, 15) N = 43	26 14.00 14.10 27 14.20 28 14.50 14.55					
15			100					29 15.00					
16							(3, 4, 9, 9, 15, 20) N = 53	30 16.00 16.10 31 16.20 32 16.50 16.55					
17		7.80m at 18:00						33 17.00					
18		8.00m at 08:00	100				(4, 7, 7, 9, 9, 14) N = 39	34 18.00 18.10 35 18.20 36 18.50 18.55					
19			0					19.00	-6.98	19.00		V/IV	Extremely weak to very weak, brownish grey, completely to highly decomposed fine ash TUFF. (Hard to stiff, sandy silty GRAVEL sized rock fragments)
20								20.00	-7.98	20.00			

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- V In-situ Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

LOGGED P.S. Wong

DATE 22/01/2013

CHECKED K.M. Lam

DATE 23/01/2013

REMARKS

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 1
	CONTRACT NO.	SHEET 3 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES E 824,144.44 N 838,262.20	W.O. No
MACHINE & No. XY2B		DATE: 18/01/2013 to 21/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +12.02 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
							50/40mm 200/40mm	38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 T2-101 T2-101 T2-101				V/IV	As sheet 2 of 4.
			95				(5, 7, 12, 14, 20, 24) N = 70						
			70										
							(3, 6, 21, 20, 30, 34) N = 105						
			100										
							(3, 6, 19, 22, 35, 37) N = 103						
			47										
			95	0	0	NI			-15.73	-27.75		III	Moderately strong, greyish yellow, moderately decomposed fine ash TUFF with closely spaced joints and iron stained.
			100	67	46	7.5							
			100	24	24	NI			-17.47	-29.49		V/IV	Extremely weak to very weak, greyish brown, completely to highly decomposed fine ash TUFF. (Very dense, silty sandy
									-17.98	-30.00			

Small Disturbed Sample
Piston Sample
U76 Undisturbed Sample
U100 Undisturbed Sample
Mazier Sample
SPT Liner Sample
Water Sample
Standard Penetration Test
In-situ Vane Shear Test
Permeability Test
Impression Packer Test
Packer Test
Piezometer Tip
Standpipe Tip

LOGGED P.S. Wong
DATE 22/01/2013
CHECKED K.M. Lam
DATE 23/01/2013

REMARKS

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 1
	CONTRACT NO.	SHEET 4 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

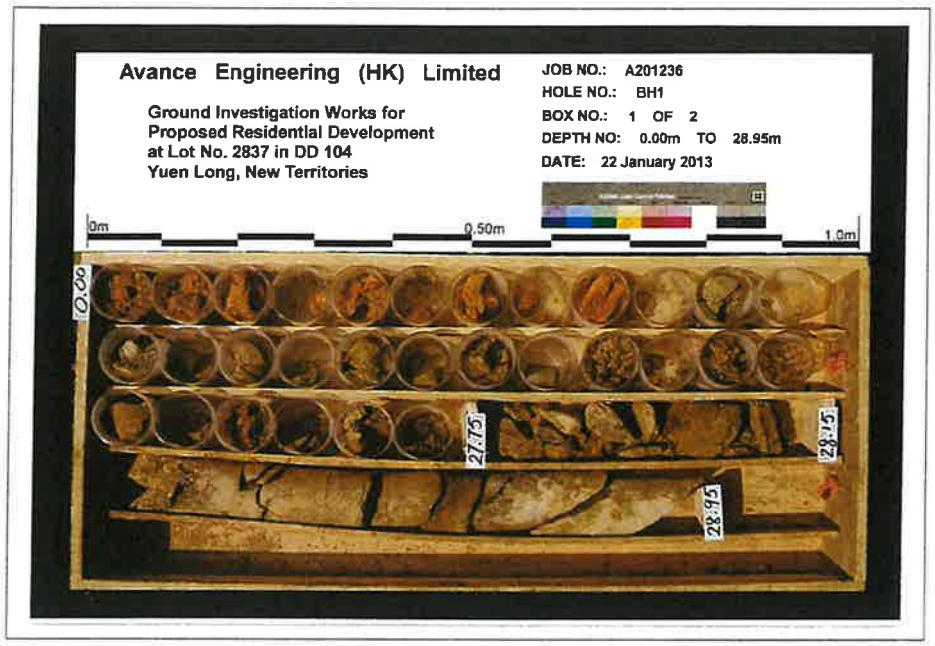
METHOD RC	CO-ORDINATES E 824,144.44 N 838,262.20	W.O. No
MACHINE & No. XY2B		DATE: 18/01/2013 to 21/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +12.02 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
30													
31							50/43mm 200/40mm	53 30.50 54 30.60 30.63 30.65 31.00				V/IV	coarse GRAVEL sized rock fragments)
32			0				50/30mm 200/30mm	55 32.00 56 32.10 32.11 32.16 32.50					
33			0				50/20mm 200/20mm	57 33.50 58 33.60 33.64 34.00					
34			0				50/20mm 200/10mm	59 35.00 60 35.10 35.13 35.50					
35													
36	HX 36.65		0				50/30mm	61 36.50 62 36.60	-24.63	36.65			
37													End of Investigation hole at 36.65m.
38													
39													
40													

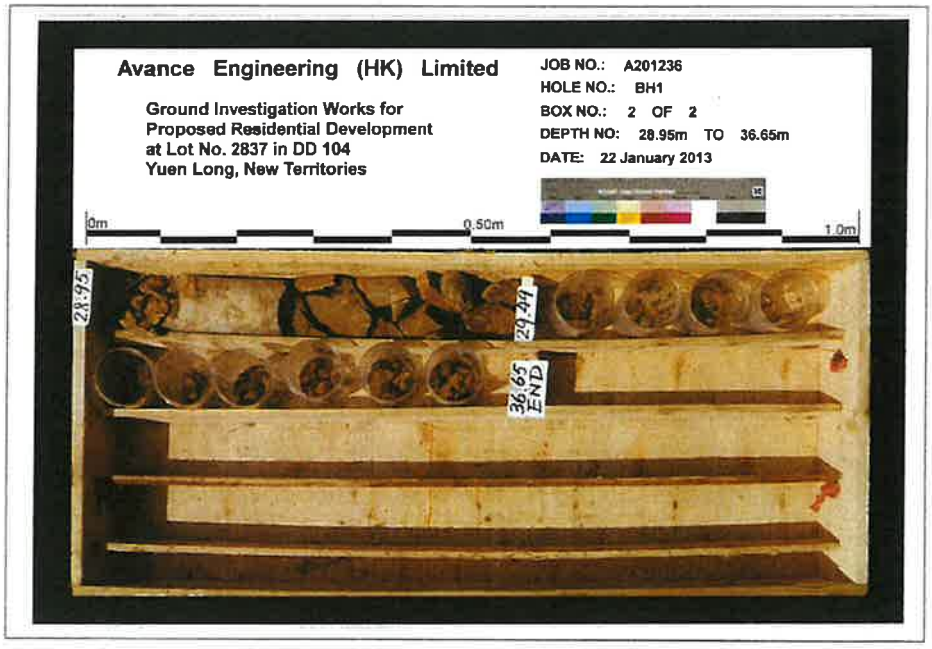
Small Disturbed Sample
Piston Sample
U76 Undisturbed Sample
U100 Undisturbed Sample
Mazier Sample
SPT Liner Sample
Water Sample
Standard Penetration Test
In-situ Vane Shear Test
Permeability Test
Impression Packer Test
Packer Test
Piezometer Tip
Standpipe Tip

LOGGED P.S. Wong
DATE 22/01/2013
CHECKED K.M. Lam
DATE 23/01/2013

REMARKS



BH1 – 1 OF 2



BH1 – 2 OF 2

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 2
	CONTRACT NO.	SHEET 1 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES E 824,124.52 N 838,244.82	W.O. No
MACHINE & No. XY2B		DATE: 10/01/2013 to 12/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +10.32 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
10.1.13	HX												Soft, greyish brown, sandy SILT with roots. (FILL)
			100				(1, 1, 2, 2, 3, 3) N = 10						
									+7.32	3.00			Firm, greyish brown, slightly fine sandy SILT. (COLLUVIUM)
			100				(1, 2, 2, 3, 4, 5) N = 15						
									+5.32	5.00			Stiff, reddish brown, slightly sandy SILT. (RESIDUAL SOIL)
			100				(2, 5, 7, 13, 13, 15) N = 48						
									+3.32	7.00		V/IV	Extremely weak to weak, greyish brown with greyish yellow, completely to highly decomposed fine ash TUFF. (Hard, sandy SILT with some gravel sized rock fragments)
			0				50/10mm 200/10mm		+2.12	8.20		IV/III	Weak to moderately strong, dark brown, highly to moderately decomposed fine ash TUFF with fractured. (CORESTONE)
			50					T2-101					
		5.70m at 18:00							+0.82	9.50		V	Extremely weak, brownish grey, completely decomposed fine ash TUFF. (Hard, slightly fine sandy SILT)
11.1.13		8.00m at 08:00							+0.32	10.00			

Small Disturbed Sample
Piston Sample
U76 Undisturbed Sample
U100 Undisturbed Sample
Mazier Sample
SPT Liner Sample
Water Sample
Standard Penetration Test
Insitu Vane Shear Test
Permeability Test
Impression Packer Test
Packer Test
Piezometer Tip
Standpipe Tip

LOGGED P.S. Wong
DATE 17/01/2013
CHECKED K.M. Lam
DATE 18/01/2013

REMARKS
1. Prior to drilling an inspection pit was excavated by hand to 1.00m depth.
2. A standpipe installed to 10.00m depth.
3. Constant head permeability tests were carried out at 3.00-4.00m and 7.00-8.00m depth.

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 2
	CONTRACT NO.	SHEET 2 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES E 824,124.52 N 838,244.82	W.O. No
MACHINE & No. XY2B		DATE: 10/01/2013 to 12/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +10.32 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
												V	As Sheet 1 of 4.
			100				326 65,139 200/130mm	15 11.00 16 11.10 17 11.35 18 11.40 11.50	-1.18	11.50		IV/III	Weak to moderately strong, dark brown, highly to moderately decomposed fine ash TUFF with fractured. (CORESTONE)
			100					T2-101 19 13.00	-2.68	13.00		V	Extremely weak, greyish brown, completely decomposed fine ash TUFF. (Hard, fine sandy SILT)
			100					20 14.00 14.10	-3.78	14.10		IV/III	Weak to moderately strong, greyish brown, highly to moderately decomposed fine ash TUFF. (CORESTONE) From 14.30-14.70m : Quartz vein.
			80					T2-101 15.35	-3.98	14.30			
									-4.38	14.70			
									-4.93	15.25			From 15.25-15.60m : Quartz vein.
		5.80m at 18:00	87					T2-101 16.10	-5.28	15.60			
		8.00m at 08:00	0						-5.78	16.10		V	Extremely weak, greyish brown, completely decomposed fine ash TUFF. (Stiff to very stiff, fine sandy SILT)
							(27, 57, 100, 100) N = 200	21 17.10 22 17.20 23 17.45 24 17.50					
			100					25 18.50 18.60 26 18.70					
							(4, 4, 8, 10, 11, 19) N = 48	27 19.00 19.05					
									-9.68	20.00			

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- Insitu Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

LOGGED P.S. Wong
DATE 17/01/2013
CHECKED K.M. Lam
DATE 18/01/2013

REMARKS

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 2
	CONTRACT NO.	SHEET 3 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES E 824,124.52 N 838,244.82	W.O. No
MACHINE & No. XY2B		DATE: 10/01/2013 to 12/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +10.32 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
20												V	As Sheet 2 of 4.
21			100				(3, 5, 9, 13, 14, 19) N = 55	28 20.50 29 21.50 21.60 21.70 30 31 22.00 22.05					
22													
23								32 23.50					
24			100					33 24.50 24.60 24.70 34					
25							(11, 13, 22, 31, 50, 100) N = 203	35 25.00 25.05					
26			70					36 25.50					
27	HX 27.00						20.46 100/100mm 200/30mm	37 26.50 38 26.60 39 26.70 26.83 27.00	-16.68	27.00		III	Moderately strong, yellowish grey, moderately decomposed fine ash TUFF. Joints are closely and very closely spaced, smooth planar and undulating, iron stained, dipping at 25°, 40°, 60° and 75°.
28			100	12	12	9.1		T2-101 28.10					
29			83	38	33	8.6 NI		T2-101 29.30					
30			100	18	0	11.4		T2-101	-19.68	30.00			

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- V Insitu Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

LOGGED P.S. Wong

DATE 17/01/2013

CHECKED K.M. Lam

DATE 18/01/2013

REMARKS

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 2
	CONTRACT NO.	SHEET 4 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

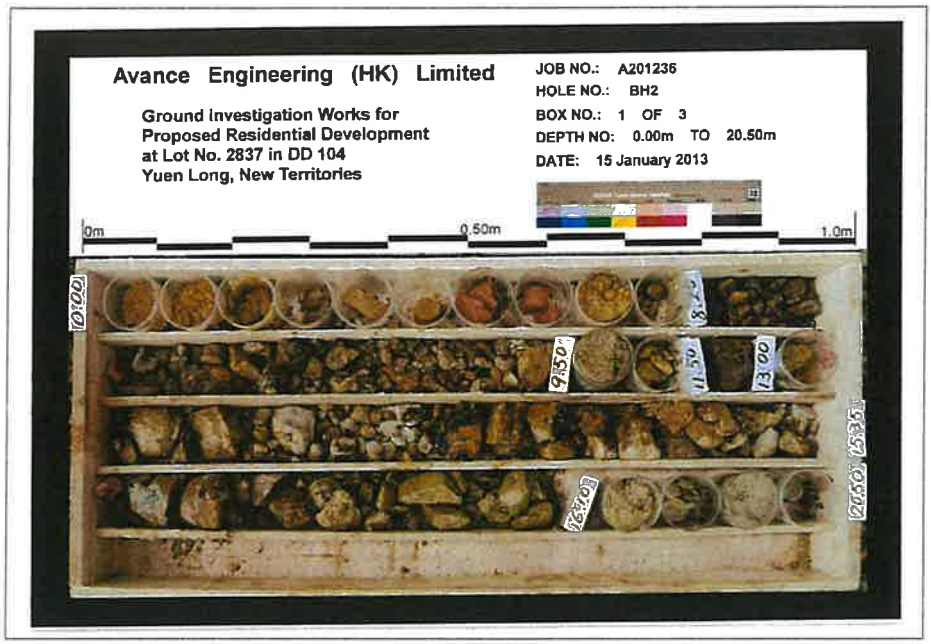
METHOD RC	CO-ORDINATES E 824,124.52 N 838,244.82	W.O. No
MACHINE & No. XY2B		DATE: 10/01/2013 to 12/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +10.32 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
30			100	18	0	11.4		T2-101 30.30				III	As Sheet 3 of 4.
			100	0	0	NI		T2-101 30.75					
31						20.0							
			98	38	17	NI		T2-101					
32						9.5		32.08	-21.76	32.08			
													End of Investigation hole at 32.08m.
33													
34													
35													
36													
37													
38													
39													
40													

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- Insitu Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

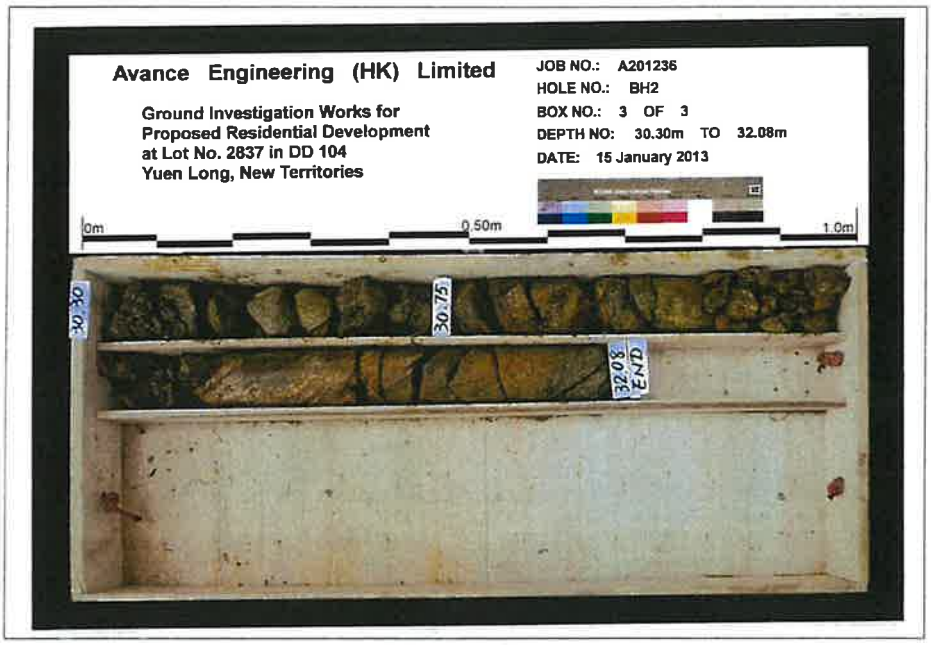
LOGGED P.S. Wong
DATE 17/01/2013
CHECKED K.M. Lam
DATE 18/01/2013

REMARKS



BH2 – 1 OF 3

BH2 – 2 OF 3


Avance Engineering (HK) Limited
Ground Investigation Works for
Proposed Residential Development
at Lot No. 2837 in DD 104
Yuen Long, New Territories
JOB NO.: A201236
HOLE NO.: BH2
BOX NO.: 3 OF 3
DEPTH NO: 30.30m TO 32.08m
DATE: 15 January 2013
0m
0.50m
1.0m
30.30
30.75
32.08
END

BH2 – 3 OF 3

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 3
	CONTRACT NO.	SHEET 1 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES E 824,136.08 N 838,247.23	W.O. No
MACHINE & No. XY2B		DATE: 16/01/2013 to 18/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +11.15 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
15.1.13	PX												Firm, greyish brown, very sandy gravelly SILT with roots. (FILL)
	PX 1.00							A D 0.50					
	HX							B 1 1.00	+10.15	1.00			Firm, yellowish brown, sandy SILT with some gravels. (COLLUVIUM)
			100					2 2.00					
							(2, 2, 3, 3, 3, 4) N = 13	3 2.10 2.20					
								4 2.50 2.55					
			100					5 3.00					
								6 4.00					
							(3, 4, 4, 4, 5, 6) N = 19	7 4.10 4.20					
								8 4.50 4.55					
			100					9 5.00	+6.15	5.00		VI	Stiff, reddish brown with white, fine sandy SILT. (RESIDUAL SOIL)
								10 6.00					
							(5, 5, 7, 9, 13, 13) N = 42	11 6.10 6.20					
								12 6.50 6.55					
			100					13 7.00	+4.15	7.00		V	Extremely weak, yellowish grey, completely decomposed fine ash TUFF. (Stiff, fine sandy SILT)
								14 8.00					
							(7, 7, 9, 11, 14, 17) N = 51	15 8.10 8.20					
								16 8.50 8.55					
			100					17 9.00					
								18 10.00	+1.15	10.00			

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- V In-situ Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

LOGGED P.S. Wong
DATE 19/01/2013
CHECKED K.M. Lam
DATE 21/01/2013

REMARKS
1. Prior to drilling an inspection pit was excavated by hand to 1.00m depth.
2. A standpipe installed to 10.00m depth.

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 3
	CONTRACT NO.	SHEET 2 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES E 824,136.08 N 838,247.23	W.O. No
MACHINE & No. XY2B		DATE: 16/01/2013 to 18/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +11.15 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
10							(5, 7, 11, 11, 13, 15) N = 50	19 18.10 18.20 20 10.50 10.55				V	As sheet 1 of 4.
11			100					21 11.00					
12							(5, 8, 11, 12, 16, 25) N = 64	22 12.00 12.10 23 12.20 24 12.50 12.55					
13		6.30m at 08:00						25 13.00					
14			100					26 14.00 14.10 27 14.20 28 14.50 14.55					
15							(7, 11, 14, 15, 21, 27) N = 77	29 15.00					
16			80					30 16.00 16.10 31 16.20 32 16.50 16.55					
17							(6, 13, 15, 15, 22, 29) N = 81	33 17.00					
18			100					34 18.00 18.10 35 18.20 36 18.50 18.55					
19							(5, 7, 11, 16, 19, 25) N = 71	37 19.00					
20			90					38 20.00	-8.85	20.00			

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- In-situ Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

LOGGED P.S. Wong
DATE 19/01/2013
CHECKED K.M. Lam
DATE 21/01/2013

REMARKS

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 3
	CONTRACT NO.	SHEET 3 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES E 824,136.08 N 838,247.23	W.O. No
MACHINE & No. XY2B		DATE: 16/01/2013 to 18/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +11.15 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
								39 20.10 40 20.28 20.33				V	As sheet 1 of 4.
21								41 21.00	-9.85	21.00		IV	Very weak, brownish grey, highly decomposed fine ash TUFF.
22			100					42 22.00 43 22.10 22.13	-11.00	22.15		III	Moderately strong, brownish grey, moderately decomposed fine ash TUFF. (CORESTONE)
23			93	13	13	NI		T2-101 23.15	-12.00	23.15		V/IV	Extremely weak to very weak, yellowish grey and grey, completely to highly decomposed fine ash TUFF. (Stiff to hard, fine sandy SILT with gravel sized rock fragments)
24			100					44 23.50 45 24.50 46 24.60 24.64					
25								25.00					
26			0					47 26.00 48 26.10 26.15					
27			0					26.50 49 27.50 50 27.60 27.63					
28		6.50m at 08:00	100					51 28.00					
29								52 29.00 53 29.10 29.13					
30									-18.85	30.00			

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- V In-situ Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

LOGGED P.S. Wong
DATE 19/01/2013
CHECKED K.M. Lam
DATE 21/01/2013

REMARKS

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 3
	CONTRACT NO.	SHEET 4 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

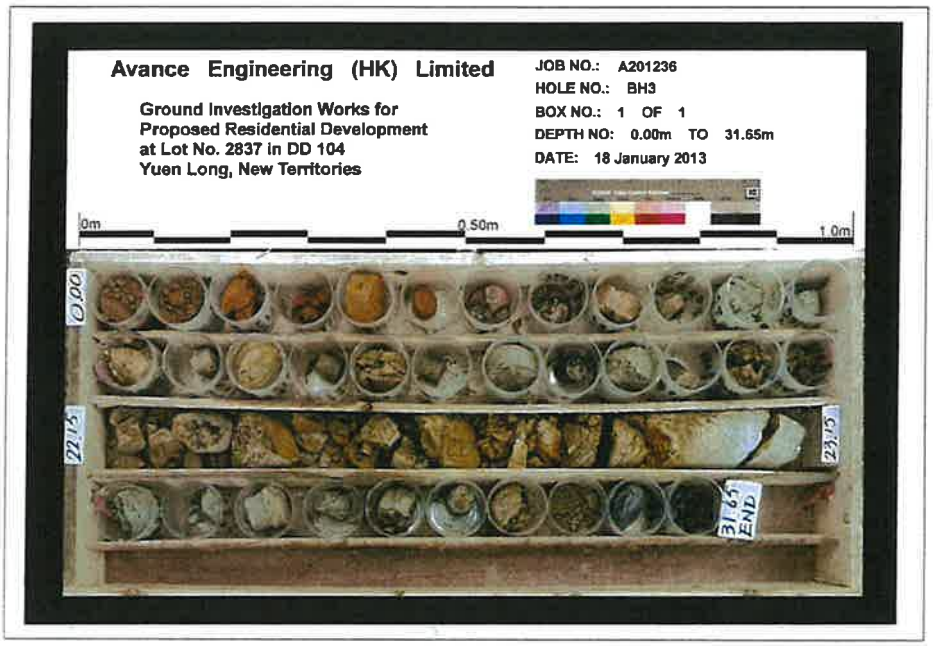
METHOD RC	CO-ORDINATES E 824,136.08 N 838,247.23	W.O. No
MACHINE & No. XY2B		DATE: 16/01/2013 to 18/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +11.15 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
30												V/IV	As sheet 3 of 4.
31	HX 31.65		100					54 30.50 55 31.50 56 31.60	-20.50	31.65			End of Investigation hole at 31.65m.
32													
33													
34													
35													
36													
37													
38													
39													
40													

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- In-situ Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

LOGGED P.S. Wong
DATE 19/01/2013
CHECKED K.M. Lam
DATE 21/01/2013

REMARKS


Avance Engineering (HK) Limited
Ground Investigation Works for
Proposed Residential Development
at Lot No. 2837 in DD 104
Yuen Long, New Territories
JOB NO.: A201236
HOLE NO.: BH3
BOX NO.: 1 OF 1
DEPTH NO: 0.00m TO 31.65m
DATE: 18 January 2013
0m
0.50m
1.0m
0.00
22.15
23.15
31.65
END

BH3 – 1 OF 1

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 4
	CONTRACT NO.	SHEET 1 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES E 824,153.27 N 838,247.14	W.O. No
MACHINE & No. XY2B		DATE: 12/01/2013 to 16/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +13.16 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
12.1.13	HX							A I.P. 0.50 B 1.00	+12.16	1.00			Firm, yellowish brown, sandy SILT with gravel and concrete fragments. (FILL)
			100				(1, 1, 3, 3, 3, 3) N = 12	2.00 2.10 2.20 2.50 2.55					Firm to stiff, yellowish brown, fine sandy SILT with gravels. (COLLUVIUM)
			100					3.00 4.00 4.10 4.20 4.50 4.55					
			100				(2, 3, 4, 4, 5, 6) N = 19	5.00	+8.16	5.00		VI	Stiff, yellowish brown and brownish yellow, fine sandy SILT. (RESIDUAL SOIL)
			100				(1, 3, 3, 3, 3, 8) N = 17	6.00 6.10 6.20 6.50 6.55					
			100					7.00 8.00 8.10 8.20 8.50 8.55					
			100				(2, 3, 5, 6, 8, 10) N = 29	9.00	+4.16	9.00		V	Extremely weak, yellowish grey, completely decomposed fine ash TUFF. (Stiff, fine sandy SILT)
								10.00	+3.16	10.00			

Small Disturbed Sample
Piston Sample
U76 Undisturbed Sample
U100 Undisturbed Sample
Mazier Sample
SPT Liner Sample
Water Sample

Standard Penetration Test
In-situ Vane Shear Test
Permeability Test
Impression Packer Test
Packer Test
Piezometer Tip
Standpipe Tip

LOGGED P.S. Wong
DATE 17/01/2013
CHECKED K.M. Lam
DATE 18/01/2013

REMARKS
1. Prior to drilling an inspection pit was excavated by hand to 1.00m depth.
2. A standpipe installed to 15.00m depth.
3. Constant head permeability tests were carried out at 4.00-5.00m and 9.00-10.00m depth.

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 4
	CONTRACT NO.	SHEET 2 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES E 824,153.27 N 838,247.14	W.O. No
MACHINE & No. XY2B		DATE: 12/01/2013 to 16/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +13.16 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
10							(3, 7, 7, 8, 10, 12) N = 37	19 10.10 10.20 20 10.50 10.55				V	As sheet 1 of 4.
11			100					21 11.00					
12							(1, 10, 12, 14, 14, 16) N = 55	22 12.00 23 12.10 12.20 24 12.50 12.55					
13			95					25 13.00					
14							(1, 11, 20, 24, 32, 34) N = 110	26 14.00 27 14.10 14.20 28 14.50 14.55					
15			100					29 15.00					
16		9.40m at 18:00					(10, 15, 24, 39, 56, 59) N = 178	30 16.00 31 16.10 16.20 32 16.50 16.55					
17		8.00m at 08:00	100					33 17.00					
18							(12, 20, 25, 40, 53, 58) N = 176	34 18.00 35 18.10 18.20 36 18.50 18.55					
19			100					37 19.00					
20								38 20.00	-6.84	20.00			

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- V In-situ Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

LOGGED P.S. Wong
DATE 17/01/2013
CHECKED K.M. Lam
DATE 18/01/2013

REMARKS

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 4
	CONTRACT NO.	SHEET 3 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES E 824,153.27 N 838,247.14	W.O. No
MACHINE & No. XY2B		DATE: 12/01/2013 to 16/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +13.16 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
		9.23m at 18:00					(10, 12, 15, 17, 22, 28) N = 00	39 20.10 20.20 40 20.50 20.55 41 21.00				V	As sheet 1 of 4.
			100					42 22.00 22.10 43 22.21 44 22.26					
		9.30m at 18:00	100					45 23.26 23.36 46 23.43 23.60	-10.44	23.60		III	Moderately strong, brownish grey, moderately decomposed fine ash TUFF. (CORESTONE)
			93					T2-101 24.00					
			97					T2-101 25.00	-11.84	25.00		V/IV	Extremely weak to very weak, brownish grey, completely to highly decomposed fine ash TUFF. (Hard, sandy SILT with some gravel sized rock fragments)
			0				50/30mm 200/20mm	47 26.00 48 26.10 26.11 26.16					
								26.50					
			0				50/20mm 200/20mm	49 27.50 50 27.60 27.65					
								28.00					
			0				50/20mm 200/20mm	51 29.00 52 29.10 29.14					
								53 29.50	-16.84	30.00			

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- V Insitu Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

LOGGED P.S. Wong
DATE 17/01/2013
CHECKED K.M. Lam
DATE 18/01/2013

REMARKS

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 4
	CONTRACT NO.	SHEET 4 of 4

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

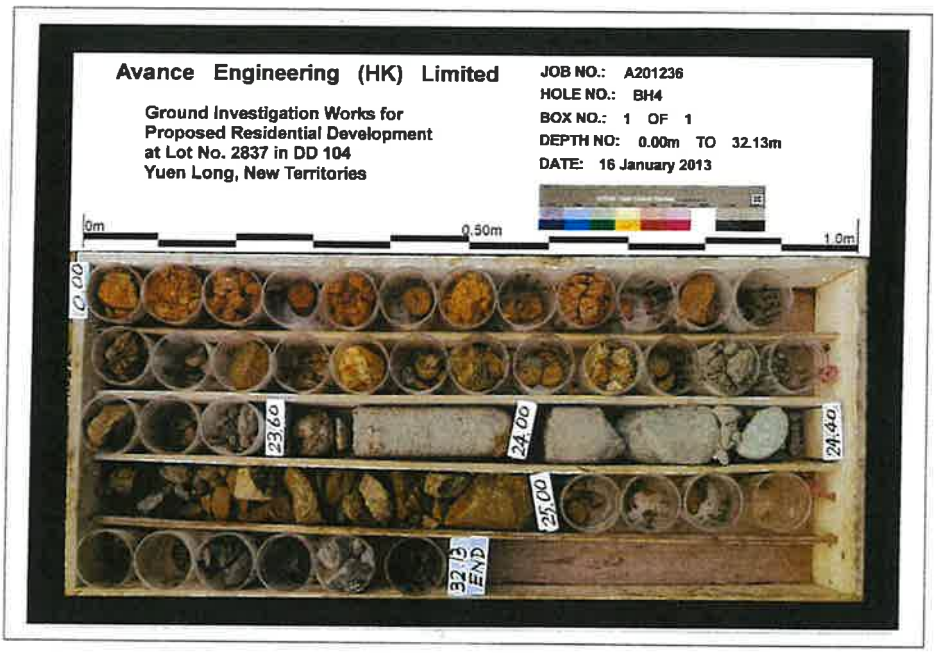
METHOD RC	CO-ORDINATES E 824,153.27 N 838,247.14	W.O. No
MACHINE & No. XY2B		DATE: 12/01/2013 to 16/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +13.16 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
30			95					54 30.50 55 30.60 30.64				V/IV	As sheet 3 of 4.
31							50/20mm 200/20mm	56 31.00					
32 16.1.13	HX 32.13		95				50/10mm	57 32.00 58 32.10 32.13	-18.97	32.13			End of investigation hole at 32.13m.
33													
34													
35													
36													
37													
38													
39													
40													

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- V In-situ Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

LOGGED P.S. Wong
DATE 17/01/2013
CHECKED K.M. Lam
DATE 18/01/2013

REMARKS


Avance Engineering (HK) Limited
Ground Investigation Works for
Proposed Residential Development
at Lot No. 2837 in DD 104
Yuen Long, New Territories
JOB NO.: A201236
HOLE NO.: BH4
BOX NO.: 1 OF 1
DEPTH NO: 0.00m TO 32.13m
DATE: 16 January 2013
0m
0.50m
1.0m
0.00
23.60
24.00
24.40
25.00
32.13
END

BH4 – 1 OF 1

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 5
	CONTRACT NO.	SHEET 1 of 3

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES E 824,143.98 N 838,236.29	W.O. No
MACHINE & No. XY2B		DATE: 10/01/2013 to 12/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +12.24 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
	PX												Firm, brownish grey, fine sandy SILT with gravels. (FILL)
	PX 1.00 HX		100				(23, 3, 4, 6, 8, 10) N = 28		+11.24	1.00			Firm to stiff, yellowish brown, slightly fine sandy SILT. (COLLUVIUM)
			100				(3, 4, 6, 9, 10, 12) N = 36		+7.24	5.00		VI	Stiff, yellowish brown and reddish brown, fine sandy SILT with gravel. (RESIDUAL SOIL)
			100				(4, 6, 8, 10, 12, 13) N = 43		+5.24	7.00		V	Extremely weak, greyish yellow, completely decomposed fine ash TUFF. (Stiff to hard, slightly sandy SILT)
			95				(3, 5, 7, 9, 11, 13) N = 40						
		7.20m at 18:00											
		8.00m at 08:00	100						+2.24	10.00			

Small Disturbed Sample
Piston Sample
U76 Undisturbed Sample
U100 Undisturbed Sample
Mazier Sample
SPT Liner Sample
Water Sample

Standard Penetration Test
In-situ Vane Shear Test
Permeability Test
Impression Packer Test
Packer Test
Piezometer Tip
Standpipe Tip

LOGGED P.S. Wong
DATE 15/01/2013
CHECKED K.M. Lam
DATE 16/01/2013

REMARKS
1. Prior to drilling an inspection pit was excavated by hand to 1.00m depth.

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 5
	CONTRACT NO.	SHEET 2 of 3

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

METHOD RC	CO-ORDINATES E 824,143.98 N 838,236.29	W.O. No
MACHINE & No. XY2B		DATE: 10/01/2013 to 12/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +12.24 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
							(5, 6, 8, 10, 12, 14) N = 44	19 18.10 18.20 20 10.50 10.55				V	As sheet 1 of 3.
								21 11.00	+1.24	11.00		V/IV	Extremely weak to weak, greyish yellow, completely to highly decomposed fine ash TUFF. (Hard, sandy SILT with some gravel sized rock fragments)
			100										
							(7, 14, 16, 26, 28, 30) N = 100	22 12.00 23 12.10 12.20 24 12.50 12.55					
								25 13.00					
			95										
								26 14.00 27 14.10 14.20 28 14.50 14.55					
							(10, 15, 21, 25, 29, 33) N = 105						
							(11, 17, 22, 28, 45, 48) N = 143	29 15.10 30 15.40 15.45 15.62	-3.38	15.62			
			70	29	18	7.2		T2-101				III	Moderately strong, greyish yellow, moderately decomposed fine ash TUFF. (CORESTONE)
								31 16.73 16.83	-4.49 -4.59	16.73 16.83		V	Extremely weak to weak, yellowish grey, completely to highly decomposed fine ash TUFF. (Hard, sandy SILT with some gravel sized rock fragments)
		7.50m at 18:00	25	0	0	NI		T2-101				IV/III	Moderately weak to weak, greyish brown, highly to moderately decomposed fine ash TUFF with fractured. (CORESTONE)
		8.00m at 08:00	95					32 18.19	-5.95	18.19		V	Extremely weak, greyish yellow, completely decomposed fine ash TUFF. (Hard to stiff, fine sandy SILT)
							(6, 8, 15, 40, 48, 59) N = 162	33 19.19 19.29 19.39 34 35 19.69 19.74					
								36 20.09	-7.76	20.00			

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- Insitu Vane Shear Test
- Permeabilty Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

LOGGED P.S. Wong
DATE 15/01/2013
CHECKED K.M. Lam
DATE 16/01/2013

REMARKS

AVANCE ENGINEERING (HK) LIMITED	DRILLHOLE RECORD	HOLE NO. BH 5
	CONTRACT NO.	SHEET 3 of 3

PROJECT Ground Investigation Works for Proposed Residential Development at Lot No. 2837 in DD 104, Yuen Long, New Territories

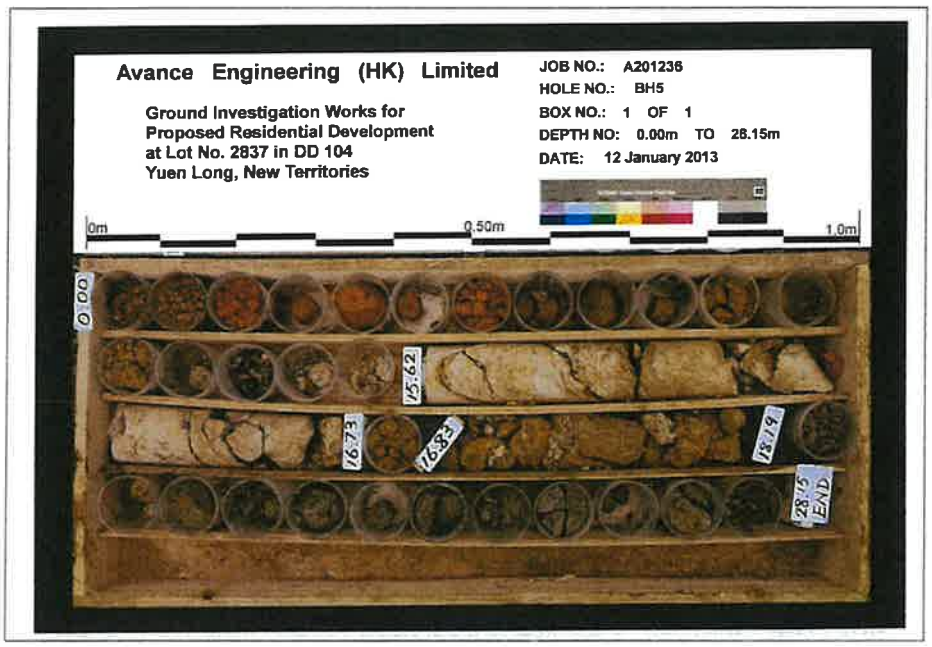
METHOD RC	CO-ORDINATES E 824,143.98 N 838,236.29	W.O. No
MACHINE & No. XY2B		DATE: 10/01/2013 to 12/01/2013
FLUSHING MEDIUM WATER	ORIENTATION VERTICAL	GROUND LEVEL +12.24 mPD

Drilling Progress	Casing size	Water level (m) Shift start/ end	T.C.R.(%)	S.C.R.(%)	R.Q.D.(%)	F.I.	Tests	Samples	Reduced Level	Depth (m)	Legend	Grade	Description
20													
21			100				(25, 35, 45, 46, 50 59) N = 200	37 21.00 21.10 38 21.20 39 21.50 21.55				V/IV	Extremely weak to very weak, yellowish grey, completely to highly decomposed fine ash TUFF. (Hard, fine sandy SILT with gravel sized rock fragments)As sheet 2 of 3.
22								40 22.00					
23			100				(27, 29, 40, 48, 52, 60) N = 200	41 23.00 42 23.10 23.20 43 23.50 44 23.68					
24			100					45 24.00 24.70 46 24.30					
25							(15, 33, 38, 46, 53, 64) N = 200	47 25.10 48 25.15					
26			100					49 26.15 26.25 50 26.35					
27			95				(22, 50, 42, 48, 51, 59) N = 200	51 26.65 52 26.70					
28 12.1.13	HX 28.15						50/10mm 200/20mm	53 27.70 54 27.80 27.83	-15.91	28.15			
29													End of Investigation hole at 28.15m.
30													

- Small Disturbed Sample
- Piston Sample
- U76 Undisturbed Sample
- U100 Undisturbed Sample
- Mazier Sample
- SPT Liner Sample
- Water Sample
- Standard Penetration Test
- In-situ Vane Shear Test
- Permeability Test
- Impression Packer Test
- Packer Test
- Piezometer Tip
- Standpipe Tip

LOGGED P.S. Wong
DATE 15/01/2013
CHECKED K.M. Lam
DATE 16/01/2013

REMARKS


Avance Engineering (HK) Limited
Ground Investigation Works for
Proposed Residential Development
at Lot No. 2837 in DD 104
Yuen Long, New Territories
JOB NO.: A201236
HOLE NO.: BH5
BOX NO.: 1 OF 1
DEPTH NO: 0.00m TO 28.15m
DATE: 12 January 2013
0m
0.50m
1.0m
0.00
15.62
16.73
16.83
18.19
28.15
END

BH5 – 1 OF 1

S12A AMENDMENT OF PLAN APPLICATION
APPROVED NGAU TAM MEI
OUTLINE ZONING PLAN NO. S/YL-NTM/12

PROPOSED REZONING FROM "R(C)" TO "G/IC"
FOR A PROPOSED "SOCIAL WELFARE FACILITIES"
(RESIDENTIAL CARE HOMES FOR THE ELDERLY)
(RCHE)

AT LOT 4823 IN D.D.104, 81 SAN TAM ROAD,
SAN TIN, N.T.

APPENDIX 6

QUANTITATIVE RISK ASSESSMENT REPORT FOR
HIGH PRESSURE TOWN GAS PIPELINE

RLEE

RLEE Architects (HK) Ltd

Quantitative Risk Assessment for Section 12A Planning Application of a proposed RCHE at 81 San Tam Road, Yuen Long

February 2023

Submitted to

R Lee Architects (HK) Ltd

Prepared By

Meinhardt Infrastructure and Environment Ltd

Date	Revision	Prepared By	Checked By	Approved By
15 February 2023	0			
		Wilson PAU	Amy HO	Claudine LEE

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1.2 Scope of Work 1
1.3 Risk Criteria 1
1.4 Methodology 2
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1 INTRODUCTION

1.1 Background

A S12A planning application, Planning Application No. Y/YL-NTM/9, was submitted to the Town Planning Board (TPB) to seek permission for amendments to rezone the application site at Lot 4823 in D.D.104, Ngau Tam Mei, Yuen Long (hereinafter referred as the "Project Site") from "Residential (Group C)" to "Government, Institution or Community". The Project Site has an area of 736.3 m^2, abutting San Tam Road, Yuen Long. It is planned to be developed for a Residential Care Home for the Elderly in 2027.

There is an underground high pressure town gas pipeline (HPTGP) running along San Tam Road near the Project Site. The HPTGP is classified as Notifiable Gas Installation (NGI) under the Gas Safety Ordinance Cap. 51. The locations of the Project Site and HPTGP are illustrated in **Figure 1**.

Meinhardt Infrastructure and Environment Limited (MIEL) was commissioned by R Lee Architects (HK) Limited (the Client) to undertake this Quantitative Risk Assessment (QRA) to determine the risk level posed by the HPTGP to the surrounding, including the proposed development, and to determine the compliance with the Hong Kong Risk Guidelines (HKRG) outlined in Chapter 12 of the Hong Kong Planning Standards and Guidelines (HKPSG), for the comments of DEMS.

1.2 Scope of Work

The objective of this study is to assess the potential risks associated with the underground HPTGP to the population in the vicinity including the future occupants of the proposed development in year 2027, and to determine whether any additional risk mitigation measures are required in the design of the proposed development.

The scope of the work of the QRA is set out as follows:

a) To identify all potential hazardous scenarios associated with the 1.6km section of underground HPTGP of 600mm diameter laid along San Tam Road, operated by The Hong Kong and China Gas Company (HKCG) and determine a set of relevant scenarios for the QRA;

b) execute a QRA and express the off-site risks in terms of individual risk (IR) contours, and societal risk (SR) FN curves;

c) compare the QRA results with the HKRG in future years; and

d) where the HKRG cannot be met, identify and assess practicable and cost-effective risk mitigation measures.

1.3 Risk Criteria

1.3.1 Hong Kong Risk Guidelines (HKRG)

Chapter 12.4 of the HKPSG [1] stipulates the risk guidelines to determine the acceptability of Potentially Hazardous Installation (PHI) in terms of individual and societal risks. These risk guidelines are also adopted to ascertain whether the risk levels posed by the NGIs are acceptable.

The individual and societal risk criteria for the risk assessment are described below:

i. **Individual Risk**: a measure of the frequency at which an individual at a specified distance from the hazardous installations is expected to sustain a specified level of harm from the realization of hazardous incident(s). The maximum level of off-site individual risk causing fatality of a person located 24 hours a day outside the facility of concern should not exceed 1×10^{-5} / year, i.e. 1 in 100,000 per year.

ii. **Societal Risk**: a measure of the relationship between the frequency of an incident and the number of fatalities that will result. It is typically expressed graphically by an F-N curve showing the cumulative frequency (F) of incidents causing N or more fatalities. The societal risk criteria are presented graphically as in **Figure 2**. There are three regions as described below:

- *Acceptable*: where the risk is low enough that no action is necessary;
- *Unacceptable*: where the risk is very high that it should be reduced regardless of the cost or else the project of concern should not proceed; and
- *ALARP (As Low As Reasonably Practicable)*: where the risk associated with the facility of concern should be reduced to a level "as low as reasonably practicable", in which the priority of measures is established on the basis of practicality and cost to implement versus the risk reduction achieved.

1.4 Methodology

1.4.1 Overall QRA Approach

The methodology of this study follows the HKRG stipulated in Section 4 of Chapter 12 of the HKPSG [1] and the guideline published by EMSD in 2021 - Quantitative Risk Assessment Study for High Pressure Town Gas Installations in Hong Kong [2]. The overall QRA methodology is shown schematically in **Figure 3**.

The major phases in QRA includes:

i. **Hazard Identification**: Identify hazard scenarios associated with the HPTGP, and then determine a set of relevant scenarios to be included in a QRA.

ii. **Frequency Assessment**: Assess the likelihood of occurrence of the identified hazard scenarios.

iii. **Consequence Assessment**: Assess the consequences and impact to the surrounding population.

iv. **Risk Summation and Assessment**: Evaluate the risk level, in terms of individual risk and societal risk. The risks will be compared with the criteria outlined in HKRG to determine their acceptability.

v. **Identification of Mitigation Measures**: Identify and assess practicable and cost-effective risk mitigation measures if necessary. The risks of mitigated cases will then be reassessed to determine the level of risk reduction.

1.4.2 Case Considered

This QRA will consider two scenarios in future year, 2027, including:

- Case 1 – Base Case in Year 2027: evaluating the risk level in year 2027 without proposed development;
- Case 2 – Operation Case in Year 2027: elevating the risk level in year 2027 with proposed development.

2 PROJECT DATA

2.1 The Project

The Project Site is located on San Tam Road, Yuen Long. The site area is approximately 736.3m^2 and is zoned as "Residential (Group C)" under the "R(C)" Zone on the approved Ngau Tam Mei Outline Zoning Plan (OZP) No. S/YL-NTM/12. An S12A application is submitted to the TPB to rezone the Site to "Government, Institution or Community" on the OZP for Proposed Residential Care Home for the Elderly (hereinafter referred as the "Proposed Development").

The Proposed Development involves one Residential Care Home for Elderly (RCHE) of a 10-storeys building comprising 142 beds, administration offices and recreational facilities. The proposed RCHE will accommodate a maximum of 142 elderlies and have 50 staffs who are divided in 2 shifts.

The layout plan of the Proposed Development is given in **Appendix A**.

2.2 Hazardous Facilities

2.2.1 Underground Town Gas Pipelines

Information of the underground HPTGP along San Tam Road in the vicinity of the Project Site had been obtained from HKCG.

The alignment of an 1.6km section of HPTGP is buried underground along San Tam Road as shown in **Figure 1**. The HPTGP has a diameter of 600mm with operating pressure of 35 bar(g) and can be isolated by 2 manual isolation valves 6.2km apart. It has a nominal wall thickness of 12.7 mm and is buried at a minimum depth of 1.1m.

The information of the pipeline is summarized in **Appendix B**.

2.2.2 Property of Town Gas

Town gas is colourless and buoyant under ambient conditions. Odorant is added to make it smell distinctive for easy detection of gas leakage. The main components of town gas are hydrogen and methane which are flammable. It also contains carbon dioxide and a small amount of carbon monoxide which are toxic and asphyxiating. **Table 1** lists its composition and physical properties.

Table 1 Gas Composition and its Physical Properties

Component	Percentage (%)	Physical Properties	Values
Hydrogen (H_2)	49	Calorific Value (MJ/m^3)	17.27
Methane (CH_4)	28.5	Specific Gravity	0.52
Carbon Dioxide (CO_2)	19.5	Wobbe Index (MJ/Nm^3)	24
Carbon Monoxide (CO)	3.0	Weaver Flame Speed (Dimensionless)	35
Total	**100**	Lower Flammable Limit (LFL) (%)	5.5

3 BACKGROUND INFORMATION OF STUDY

3.1 Study Zone

The Proposed Development at Project Site is subject to the risk of underground high pressure town gas pipeline. According to EMSD's guidance note [2], the highest risk 1.6 km section of underground HPTGP is studied in this QRA. The study zone is taken as the area covering 200m from section of the underground HPTGP concerned. The study zone is illustrated in **Figure 4**.

3.2 Population

3.2.1 Population in the Vicinity

The surrounding populations will be directly impacted by hazardous events arising from the loss of containment of town gas in the HPTGP. According to the Outline Zoning Plan (OZP), areas within the study zone are mainly Residential, Village type development, Open Space and Open Storage.

Population information were collected from desktop research and site survey conducted on 26th January, 2023. Pending and approved Planning Applications in the vicinity of the Project Site had been reviewed and there is no planned development falls into the study zone.

The future population within the study zone is estimated based on site observation and up-to-date data published by the Government Departments. The following information and assumptions were adopted in the estimation:

- Average residential household size estimated as shown in **Table 2** as per 2021 Population Census [3]; and
- Conservative assumption of annual residential population growth rate estimated as shown in **Table 2** as per population statistics in from 2021 Population By-Census [3] and the Projections of Population Distribution 2021 – 2029 [4]

Table 2 TPU Population information and assumptions

	TPU			
	541	**542**	**543 and 546**	**544**
Average residential household size	3.2	2.8	3.6	2.9
Annual residential population growth rate	0%	0.9%	2.1%	0.2%

The population groups considered within the study zone are illustrated in **Figure 5**. The population data are summarized in **Table 4**.

3.2.2 Transient Population

Transient population includes passengers of road transport (traffic population) as well as pedestrians along road sections.

The traffic population is estimated from the flow data of Annual Traffic Census 2021 [5] using the following formula:

$$\text{Traffic Population (ppl)} = \frac{\text{Traffic Flow } (^{veh}/_{hr}) \times {}^{ppl}/_{veh}}{\text{Speed } (^{km}/_{hr})} \times \text{Road length (km)}$$

The detailed transient population calculations are provided in **Appendix C**.

3.2.3 Temporal Variation of Population

To reflect the temporal changes in population within a week, the corresponding population proportion of the time periods are assumed based on observation from site survey and with reference to the approved EIA reports [6] .

Day time is defined as 07:00 to 19:00 and night time from 19:00 to 07:00 next day. The temporal changes of different population category are provided in **Table 3**.

Table 3 Temporal Change of Population within a Week

Category	Weekday Day (WDD)	Weekday Night (WDN)	Weekend Day (WED)	Weekend Night (WEN)
Agricultural (1)	100%	10%	100%	10%
Drug Rehab Centre (1)	100%	100%	100%	100%
Industrial (2)	100%	10%	40%	5%
Kindergarten (1)	100%	0%	0%	0%
Residential (2)	30%	100%	70%	100%
Restaurant (1)	50%	50%	100%	100%
Retail (1)	35%	20%	100%	35%
Road (3)	100%	37%	100%	37%
RCHE (1)	100%	100%	100%	100%
Residential Care Homes for Persons with Disabilities (RCHD) (1)	100%	100%	100%	100%
Storage (1)	100%	5%	100%	5%

Notes:
(1) Based on site survey and judgement
(2) Reference to HATS Stage 2A EIA [6]
(3) Annual Traffic Census 2021 [5]

3.2.4 Indoor and Outdoor Ratio

Building structures can offer some protection from fires for the occupants inside. An indoor ratio of 95% is applied to the population in residential, drug rehab centre, kindergarten, RCHE/RCHD, retail, restaurant and industrial buildings, while the remaining 5% of population is assumed to be outdoor, accounting for outdoor activities and walking on pathways.

At the proposed development, a total of 660 m^2 of communal space is available. To factor in the residents and staffs using outdoor facilities including sky garden and roof garden, the indoor ratio of ID PD01 in **Table 4** is reduced from 95% to 85% conservatively.

Population group of agricultural are considered 100% outdoor although greenhouse in farms may provide certain protection. Passengers in vehicles are considered as 100% outdoors population although vehicles may provide certain protection. Population group of storage is considered as 90% outdoor. Large steel container cargos and temporary admin office may provide protection to a certain extent.

Table 4 **Population Data Within Study Zone**

ID	Population Name	Population Category	Population in Year 2027	Temporal Population Change				Indoor Ratio	TPU	Remarks
				WDD	WDN	WED	WEN			
1	Scenic Heights	Residential	132	30%	100%	70%	100%	95%	543 & 546	Total of 33 blocks, providing 33 residential units. Assume average household size of 3.6 with 2.1% annual residential growth.
2	Maple Garden	Residential	639	30%	100%	70%	100%	95%	543 & 546	Total of 3 phases, 160 blocks, providing 160 residential units. Assume average household size of 3.6 with 2.1% annual residential growth.
3	Rolling Hills I	Residential	65	30%	100%	70%	100%	95%	543 & 546	Total of 2 phases, 70 blocks, 3 storeys per block, providing 70 residential units. Assume average household size of 3.6 with 2.1% annual residential growth.
4	Crescendo Milano	Residential	269	30%	100%	70%	100%	95%	543 & 546	Total of 67 blocks, with 3 storeys per block, providing 67 residential units. Assume average household size of 3.6 with 2.1% annual residential growth.
5	Casa Paradizo	Residential	232	30%	100%	70%	100%	95%	543 & 546	Total of 58 blocks, 2 storeys per block, providing 58 residential units. Assume average household size of 3.6 with 2.1% annual residential growth.
6	Green Crest	Residential	252	30%	100%	70%	100%	95%	543 & 546	Total of 63 blocks, 2 storeys per block, providing 63 residential units. Assume average household size of 3.6 with 2.1% annual residential growth.
7	La Maison Vineyard	Residential	105	30%	100%	70%	100%	95%	543 & 546	Total of 26 blocks, 2 storeys per block, providing 26 residential units. Assume average household size of 3.6 with 2.1% annual residential growth.

ID	Population Name	Population Category	Population in Year 2027	Temporal Population Change				Indoor Ratio	TPU	Remarks
				WDD	WDN	WED	WEN			
8	Motor vehicle dealer	Industrial	5	100%	10%	40%	5%	95%	543 & 546	Conservative assumption of 5 workers based on site survey.
9	Green Lion Farm	Agricultural	20	100%	10%	100%	10%	0%	544	Conservative assumption of 20 workers based on site survey.
10A	Yau Tam Mei Tsuen (Storage)	Storage	15	100%	5%	100%	5%	10%	544	From site survey, there are 3 village houses, each with large open storage area nearby. Assume 5 workers for each storage conservatively based on site survey.
10B	Yau Tam Mei Tsuen (Residential)	Residential	9	30%	100%	70%	100%	95%	544	From site survey, there are 3 village houses, each with large open storage area nearby. Assume average household size of 2.9 with 0.2% annual residential growth.
11	Sheung Chuk Yuen	Residential	80	30%	100%	70%	100%	95%	544	Total of 27 blocks, 3 storeys, providing 27 residential units. Assume average household size of 2.9 with 0.2% annual residential growth.
12	Kadoorie Villas	Residential	220	30%	100%	70%	100%	95%	544	Total of 73 blocks, 3 storeys per block, providing 75 residential units. Assume average household size of 2.9 with 0.2% annual residential growth.
13	San Wai Tsuen	Residential	30	30%	100%	70%	100%	95%	544	Total of 10 blocks, 3 storeys per block, providing 10 residential units. Assume average household size of 2.9 with 0.2% annual residential growth.
14	Ian court	Residential	337	30%	100%	70%	100%	95%	544	Total of 40 blocks, 2 storeys for blocks 1-5, 3 storeys for remaining 35 blocks, providing 115 residential units. Assume average household size of 2.9 with 0.2% annual residential growth.

ID	Population Name	Population Category	Population in Year 2027	Temporal Population Change				Indoor Ratio	TPU	Remarks
				WDD	WDN	WED	WEN			
15	Village type Development (Chuk Yuen Tsuen, Fortune Village, Tai Yuen Villa)	Residential	1444	30%	100%	70%	100%	95%	541	OZP village type development. A total of approximately 216 blocks, providing 451 residential units. Assume average household size of 3.2 with 0% annual residential growth.
16	EIS International Pre-school	Kindergarten	120	100%	0%	0%	0%	95%	541	Maximum capacity of 110 students and 10 teachers.
17	RCHE/RCHD	RCHE/RCHD	570	100%	100%	100%	100%	95%	541	According to info from Social Welfare Department. Total bed numbers and number of staffs of 4 RCHEs and 1 RCHD.
18	Restaurant	Restaurant	80	50%	50%	100%	100%	95%	541, 542	2 restaurants, assuming 40 customers and staff each based on site survey observation.
19	Yau Mei San Tsuen	Residential	72	30%	100%	70%	100%	95%	542	Total of 12 blocks, 2 storeys per block, providing 24 residential units. Assume average household size of 2.8 with 0.9% annual residential growth.
20	Christian New Life Association Mission Ark Yuen Long Centre	Drug Rehab Centre	30	100%	100%	100%	100%	95%	542	Residential Drug Treatment and Rehabilitation Centre of approximately 20 candidates and staffs. Conservatively assume as 30 people.
21	Village Houses (Geranium Path)	Residential	7	30%	100%	70%	100%	95%	542	2 village houses. Assume average household size of 2.8 with 0.9% annual residential growth.
22	Royal Palms	Residential	1243	30%	100%	70%	100%	95%	542	Total of 2 phases, 424 blocks, providing 424 residential units. Assume average household size of 2.8 with 0.9% annual residential growth.

ID	Population Name	Population Category	Population in Year 2027	Temporal Population Change				Indoor Ratio	TPU	Remarks
				WDD	WDN	WED	WEN			
23A	Ko Hang (Retail)	Retail	50	35%	20%	100%	35%	95%	542	5 retail stores in total, assume 10 workers each store conservatively.
23B	Ko Hang (residential)	Residential	13	30%	100%	70%	100%	95%	542	4 village houses. Assume average household size of 2.8 with 0.9% annual residential growth.
24	Royal Palms Sewage Treatment Plant	Industrial	5	100%	10%	40%	5%	95%	542	Conservative assumption of 5 workers.
25	Village Houses (Ko Hang)	Residential	18	30%	100%	70%	100%	95%	542	Total of 6 blocks, 3 storeys per block, providing 6 residential units. Assume average household size of 2.8 with 0.9% annual residential growth.
PD01	Proposed Development	RCHE	167	100%	100%	100%	100%	85%	543 & 546	Assumed no population in base case of year 2027. For operation case, 142 beds and 50 staffs working in 2 shifts. Project Info.
R01	San Tam Road	Road	74	100%	37%	100%	37%	0%	-	Refer Appendix C.
R02	San Tin Highway	Road	222	100%	37%	100%	37%	0%	-	Refer Appendix C.
R03	Castle Peak Rd - Tam Mi, Mai Po & San Tin	Road	71	100%	37%	100%	37%	0%	-	Refer Appendix C.

Note: In **Figure 5**, 10A and 10B shares the same area with label ID10; 23A and 23B shares the same area with label ID23 .

3.3 Source of Ignition

Flammable gas cloud from an accidental release can be ignited and led to fire or explosion if there are ignition sources present in the close proximity or along the dispersion path of the cloud. If the gas cloud is diluted outside flammable concentration range (i.e. below Lower Flammable Limit), or in the absent of ignition source, no fire hazard is expected. The energy level, timing, location and ignition effectiveness of ignition sources in the vicinity of hazardous installations affect the extent of gas cloud dispersion and its potential impacts.

Three types of ignition sources are defined in the SAFETI model:

- **Population sources:** account for human activities such as smoking, cooking, and using electrical appliances and are assigned implicitly to all population group by SAFETI v8.6.
- **Line source – transportation route segments**: account for the moving vehicles on roads. The ignition probabilities are calculated from traffic density, average vehicle speed, vehicle ignition efficiency and total length of the roads. Vehicle ignition efficiency is taken as 0.4 per 60 seconds [7].

3.4 Meteorological Information

Meteorological conditions affect the consequences of gas release, in particular wind direction, speed and stability which influences the direction and degree of turbulence of gas dispersion. Meteorological data from Wetland Park Weather Station (Year 2021) was collected from the Hong Kong Observatory and adopted in the consequence model to determine the various gas dispersion, fire and explosion effects [8]. In accordance with TNO Purple Book [7], all data collected will be rationalized into a set of weather classes. The meteorological data can be expressed in combination of wind speed and Pasquill stability classes. Pasquill classes (A to F) represent the atmospheric turbulence with class A being the most turbulent class while class F being the least turbulent class.

The six most dominant sets of wind speed-stability classes combination for both day-time and night-time are summarized in **Table 5** and **Table 6** respectively, and in **Appendix D**. The average ambient temperature adopted in the analysis is 25°C and the relative humidity is 78%.

Table 5 Day Time Wind Direction Frequency at Wetland Park Weather Station (Year 2021)

Direction	WEATHER CLASS						Total
	2.0B	1.5D	3.5D	6.0D	2.5E	1.5F	
0 – 30	4.54	1.82	0.05	0.00	0.23	3.58	10.22
30 – 60	6.69	1.97	0.56	0.00	0.25	1.44	10.90
60 – 90	14.26	3.36	0.63	0.00	0.43	1.61	20.29
90 – 120	4.90	2.32	0.63	0.00	0.35	1.82	10.02
120 – 150	3.05	0.88	0.38	0.00	0.18	0.93	5.43
150 – 180	6.66	1.84	0.98	0.00	0.20	1.56	11.25
180 – 210	7.22	1.24	0.86	0.00	0.28	0.93	10.52
210 – 240	3.99	0.25	0.10	0.00	0.03	0.20	4.57
240 – 270	2.09	0.35	0.00	0.00	0.00	0.15	2.60
270 – 300	2.70	0.63	0.00	0.00	0.00	0.25	3.58
300 – 330	4.11	0.40	0.03	0.00	0.00	0.23	4.77

Direction	WEATHER CLASS						Total
	2.0B	1.5D	3.5D	6.0D	2.5E	1.5F	
330 – 360	4.21	0.83	0.05	0.00	0.00	0.76	5.85
All	**64.42**	**15.90**	**4.26**	**0.00**	**1.94**	**13.47**	**100.00**

Table 6 Night Time Wind Direction Frequency at Wetland Park Weather Station (Year 2021)

Direction	WEATHER CLASS						Total
	2.0B	1.5D	3.5D	6.0D	2.5E	1.5F	
0 – 30	0.00	0.97	0.08	0.00	0.59	21.98	23.62
30 – 60	0.00	1.15	0.78	0.00	1.39	5.74	9.06
60 – 90	0.00	0.67	0.19	0.00	1.05	5.50	7.40
90 – 120	0.00	0.46	1.02	0.00	2.31	10.19	13.97
120 – 150	0.00	0.08	0.27	0.00	0.43	6.19	6.97
150 – 180	0.00	0.16	0.03	0.00	2.28	17.10	19.57
180 – 210	0.00	0.13	0.21	0.00	1.85	10.08	12.28
210 – 240	0.00	0.05	0.05	0.00	0.24	0.54	0.88
240 – 270	0.00	0.03	0.00	0.00	0.00	0.29	0.32
270 – 300	0.00	0.00	0.00	0.00	0.03	0.29	0.32
300 – 330	0.00	0.11	0.00	0.00	0.00	0.75	0.86
330 – 360	0.00	0.64	0.05	0.00	0.13	3.91	4.75
All	**0.00**	**4.45**	**2.68**	**0.00**	**10.29**	**82.57**	**100.00**

4 HAZARD IDENTIFICATION

The possible causes that lead to pipeline failure are discussed in the following sections for consideration in the risk assessment.

4.1 Internal Causes

4.1.1 Corrosion

Corrosion is one of the main contributors for pipeline failure. External corrosion of buried HPTGP may be due to the contact of stray DC electric earth current or contaminated ground. Internal corrosion occurs due to the presence of moistures and contaminants in the gas. The underground HPTGP carries dry town gas which is not expected to have any moisture and it is coated with epoxy internally to avoid corrosion. Nevertheless, loss of containment incident due to corrosion is still a credible scenario.

4.1.2 Material Defects

Material defect of HPTGP including welding failure and mechanical strength failure, etc., could occur for various reasons. HKCG adopted non-destructive testing (NDT) by X-ray for each butt weld and magnetic particle inspection (MPI)/ ultrasonic test for fillet welds of the underground pipeline according to IGEM/TD/1 [11]. Historical data showed that material failure leading to loss of containment is credible and such scenario is included in this QRA.

4.2 External Causes

4.2.1 Natural Hazards

Natural hazards such as earthquakes, storms, typhoons, subsidence and tsunamis may cause damages to the gas facilities and lead to loss of containment. This section will discuss the credibility of loss of containment due to these natural hazards with respect to Hong Kong's geographical location.

Earthquakes

Hong Kong is not located within the seismic belt. According to the Hong Kong Observatory, earthquakes occurring in the circum-Pacific seismic belt which passes through Taiwan and Philippines are too far away to affect Hong Kong significantly. Although there has not been any reported case of destructive earthquake tremor in Hong Kong, loss of containment incident due to earthquake is still considered credible to cause rupture of underground pipeline.

Subsidence/ Landslides

Excessive subsidence may lead to failure of the structure and ultimately loss of containment scenario. Subsidence is usually slow in movement and such movement can be observed and remedial action can be taken in time.

Considering that pipeline failures due to landslide have been reported by the EGIG, it is reviewed in frequency assessment of the underground HPTGP along San Tam Road (refer **Section 5.2 to 5.4**).

Lightning

Lightning sparks could ignite the combustible gas in air. In regards of the pipeline, lightning is considered by the EGIG and thus, is studied (refer **Section 5.2 to 5.4**).

Major Leakages of Underground Water Mains

Major leakage of underground water mains could be another concern to underground pipeline. In case if the water ejects towards the gas main, it carries the surrounding soil and sand and impacts on the surface of the pipes, resulting in damage on pipe wall and loss of containment.

Third Party Damages

Third party damage on gas pipeline includes the damage to pipes due to drilling, hammering, excavation works, etc. In fact, the potential of third party damage to the gas piping depends on the surrounding environment. Pipe wall thickness, buried depth, concrete cover and design factor have influence on whether third party damage would result in pipe damage.

In Hong Kong, excavation/ trenching works are well controlled. As per EMSD's Code of Practice on "Avoidance of Damage to Gas Pipes, 2nd Edition", utility mapping must be conducted to identify any underground utility within the site before any construction work commences. This could minimize the risk of damaging any existing underground utility. In addition, HKCG has issued a "Requirements for Construction Works Adjacent to Existing Gas Offtake Station and in the Vicinity of Gas Main", which the Contractor should strictly follow. Clearance distances from the underground HPTGP, as well as safety precautions during the construction works are indicated in the requirements.

Nevertheless, generic loss of containment due to third party damages is still considered credible in this study.

External Fire

External fire means the occurrence of a fire event which leads to the failure of the pipelines or equipment. The HPTGP is buried underground at a minimum depth of 1.1m. External fire from aboveground is considered not possible to damage underground gas pipelines. Hence, external fire causing loss of containment is not further assessed.

5 FREQUENCY ASSESSMENT

5.1 Overview

Frequency analysis involves estimation of failure frequencies resulting in a release of hazardous materials. This section examines the failure frequencies of the pipeline and the station that result in loss of containment. The analysis is based on the EMSD's Guidance Note [2] and historical data, with modifications to reflect the local factors, such as good safety practice, anchorage protection, pipeline integrity, etc.

5.2 EGIG Historical Failure Data

EGIG is an industry group of 15 major gas transmission system operators in Europe, which owns an extensive database of pipeline incident data since 1970. The failure frequency over the reporting period of 1970 – 2019 is 2.92×10^{-4} per km-year [9]. A steady reduction of the failure frequency over the last two decades is observed, showing improved safety performance. The recent failure frequency during 2007 – 2019 is significantly lower with only 1.28×10^{-4} per km-year.

The breakdown of the accident frequencies by causes for all types of pipelines is shown in **Table 7**. External interference remains the dominant cause for gas leakage.

Table 7 Incident Causes for onshore pipeline gas leakage

Causes	Distribution of Incidents	
	Period 1970-2019	Period 2010-2019
External interference	45.9%	27.3%
Corrosion (Internal and external)	17.1%	26.6%
Construction defect/ Material failure	16.4%	15.6%
Ground movement	8.6%	15.6%
Hot tap made by error	4.5%	1.6%
Other and unknown	7.5%	13.3%
Total	100%	100%

5.3 Analysis of Modification Factors

5.3.1 External Interference

The major contributor of external interference in Hong Kong is third party damage, such as the inadvertent damages during excavation. The degree of damage depends on surrounding environment, wall thickness, buried depth and protection from concrete cover.

The underground HPTGP in this study are of size 600mm (O.D. 24 inch) and the nominal wall thickness is 12.7 mm. The HPTGP are buried at a minimum depth of 1.1 m with concrete cover, giving significant protection to the pipeline against external interference.

In addition, the following practices are required while carrying out underground works to reduce the probability of third party damage to HPTGP:

- Contractor should carry out utility survey and trial trench inspection for any underground works before construction work commences.

- Much of the gas pipeline is laid under carriageway in which excavation is under stringent control. The HKCG's "Requirements for Construction Works in the Vicinity of Gas Main" and EMSD's Code of Practice on "Avoidance of Damage to Gas Pipe 2nd Edition" should be strictly followed for any underground excavation works to be done nearby the HKCG's gas pipeline.

Giving consideration to the above preventive measures, a reduction factor of 0.1 is applied to the failure frequencies of underground gas pipeline due to external interference to account for the pipeline design and the safe practices.

5.3.2 Corrosion (Internal and External)

There is a decreasing trend in incidents due to corrosion against year of construction. No leak case due to corrosion has been reported for pipeline which was constructed after 1994. In addition, internal corrosion is very unlikely since town gas is dry and free from corrosive gases. External corrosion of the pipeline is prevented by cathodic protection. Hence, a reduction factor of 0.5 is adopted for all pipelines with nominal wall thickness of 12.7mm.

5.3.3 Construction Defect/ Material Failure

There is a decreasing trend in incidents due to welding, mechanical strength and material failure against year of construction. Majority of incidents were caused by pipelines that were built before 1973. As per IGEM/TD/2 [10], the failure frequency due to material and construction defects reduces as the wall thickness increase. Moreover, The HKCG has adopted a NDT by X-ray for each butt weld and magnetic particle inspection/ ultrasonic test for fillet welds of the underground pipeline in accordance to IGEM/TD/1 [11] to prevent material and construction defects. Therefore, a reduction factor of 0.1 is adopted.

5.3.4 Ground Movement

Ground movement can be caused by a number of causes, e.g. subsidence, landslides or flooding. Pipes of smaller diameter are more susceptible to ground movement. The major cause of the ground movement failures was due to landslide. Considering the pipeline is not constructed in a hilly region, landslides are unlikely. The pipeline is buried with a cover of at least 1.1 m deep and with safety measure as described in "External Interference" section above. A reduction factor of 0.1 is assumed to reflect the actual situation.

5.3.5 Hot Tap Made by Error

"Hot tap made by error" means that a connection has been made by error to a live gas transmission pipeline. Hot tap is not used by the HKCG for gas transmission pipeline and thus is irrelevant to this study. A 100% reduction is adopted.

5.3.6 Other and Unknown

Others and unknown include failure caused by design error, lightning and maintenance error. The HKCG has extensive experience in designing and operating the underground gas pipes. It also applies stringent in-house procedures to monitor operation and maintenance of the gas pipes. The HPTGP is buried under the ground with a minimum concrete cover of 1.1m, lightning striking the pipeline is unlikely. A reduction factor of 0.1 is therefore assumed.

5.4 Adopted Failure Frequencies of the HPTGP

A direct application of the EGIG database is not appropriate to Hong Kong's situation. Reduction factors have been adopted to modify the failure rate to reflect the actual condition in Hong Kong. The breakdown of failure rates with reduction factors are listed in **Table 8**.

Table 8 Breakdown of EGIG Incidents with reduction factors

Causes	Failure Rate (per km-year)	Reduction Factor	Modified Failure Rate (per km-year)
External event for Pipe Diameter (23-29")	2.50E-05	0.1	2.50E-06
Corrosion (thickness10-15mm)	1.50E-06	0.5	7.50E-07
Construction defects/ material failure (Year of construction 1984-2019)	2.58E-05	0.1	2.58E-06
Ground movement (23-29")	1.63E-05	0.1	1.63E-06
Hot Tap made by error	0	0	0
Others and unknown	1.70E-06	0.1	1.70E-07
Total	7.03E-05		7.63E-06
Failure rate in this assessment			**1.00E-05**

Note: Based on 11th EGIG Report [9]

The modified failure rates from the EGIG database for pipeline are 7.63×10^{-6} per km-year for pipe of size 600mm. The modified failure rate for underground pipeline is conservatively taken as 1.0×10^{-5} per km year, as recommended in EMSD's Guidance Note [2].

5.4.1 Hole size Distribution

The failure of pipes and equipment may be resulted in gas leakage from various hole sizes. According to EMSD's Guidance Note [2], the hole size distributions of underground pipes are assumed as listed in **Table 9**.

The pipeline has a design factor of 0.3 or better and has a nominal thickness of 12.7 mm, which makes full bore rupture extremely unlikely. Nevertheless, it is considered in this study by allocating a probability of 1%.

Table 9 Hole Size Distribution of Underground Pipeline

Hole Size	Percentage
Full Bore	1%
100 mm	19%
50 mm	30%
25 mm	30%
10 mm	20%

5.4.2 Summary of Hazardous Failure Frequencies

The failure scenarios considered in this study is summarized in **Table 10**. The corresponding failure frequencies are tabulated in **Table 11**.

Table 10 Failure of Pipework

Facility	Scenarios
Underground High Pressure Pipelines (600mm)	• Partial failure: 10mm leak, 25mm leak, 50mm leak, 100mm leak (with 50% modelled as vertical release and 50% modelled as inclined release of 45°) • Catastrophic rupture: Full bore rupture

Table 11 Base failure frequencies of hazardous scenarios

Scenario Name	Description	Size of Release	Frequency (per km per year)
UG-10mm	Underground High Pressure Pipeline (50% vertical release and 50% inclined release)	10 mm (pin hole)	2.00×10^{-6}
UG-25mm		25 mm	3.00×10^{-6}
UG-50mm		50 mm	3.00×10^{-6}
UG-100mm		100 mm (puncture)	1.90×10^{-6}
UG-FB	Underground High Pressure Pipeline (Full Bore Rupture)	Full Bore	1.00×10^{-7}
		Sub-total	**1.00×10^{-5}**

5.5 Event Outcome Frequencies

5.5.1 Orientation of Release

Consequence of a pipeline failure varies by the orientation of the release. Failure can occur at top, bottom, or side of the pipe. Pressured gas releasing at the top of a pipe will result in an unobstructed vertical jet release; whereas releasing at bottom of the pipe will be a diffused jet due to loss of gas momentum by impinging with the surrounding. Releasing from side of the pipeline will result in an inclined or horizontal release.

It is assumed that partial pipeline failures will have an equal probability, i.e. 50%, to result in gas releasing from top and side. According to EMSD's Guidance Note [2], releasing from the side of underground pipes will be considered as inclined release only. The angle of inclined release is assumed be at 45 degrees.

Catastrophic rupture of underground pipes is assumed to be top release only to account for completely unobstructed jet release.

5.5.2 Ignition Probability

Pressurized town gas release from pipeline disperses and may subsequently be ignited if the gas concentration is within the flammability limits. Immediate ignition probabilities are adopted from EMSD's Guidance Note [2] as listed in **Table 12** below.

Table 12 Immediate Ignition Probability

Leak Size	Immediate Ignition Probability
Minor (< 1 kg/s)	0.01
Major (1-50 kg/s)	0.07
Massive (>50 kg/s)	0.3

According to EMSD's Guidance Note [2], delayed ignition probability is estimated as 40% of immediate unignited probability. The ignition probabilities adopted in this study are summarized in **Table 13** below.

Table 13 Ignition Probabilities Adopted in this Study

	Ignition Probability (Vertical/ Inclined Release)	
Leak Size	**Immediate**	**Delayed**
Very Small Leak (10mm)	0.01	0.40
Small Leak (25mm)	0.07	0.38
Medium Leak (50mm)	0.07	0.38
Large Leak (100mm)	0.07	0.38
Full Bore Rupture	0.3	0.28

Vapour cloud explosion (VCE) may occur if gas cloud is ignited at confined or congested area. In view of possible congestion between buildings / village houses, VCE is conservatively considered in massive town gas release. The probabilities of explosion, adopted from Cox, Lees and Ang [12], are 0.12 and 0.3 for large leaks (100mm) and full bore rupture respectively.

5.6 Event Tree Analysis

Event tree analysis (ETA) is used to develop the evolution of a failure event from its initial release to the final outcome scenarios, namely jet fire, flash fire, fireball, etc. It also shows different consequences of vertical and horizontal leak scenarios of the cases of immediate ignition and delayed ignition. The detailed event tree analysis is included in **Appendix E**.

6 CONSEQUENCE ANALYSIS

6.1 Overview

The consequence assessment is conducted in two steps:

- **Source term modelling** -- to determine the release rate, duration and quantity; and
- **Physical effects modelling** -- to determine the gas dispersion, fire and explosion effect zones based on the output of the source term modelling. The impact of the hazardous outcomes on the surrounding population would be analyzed.

In this study, the simulation software –SAFETI 8.6 developed by Det Norske Veritas (DNV) was employed to calculate the hazardous release and the effects zones.

6.2 Source Term Modelling

Town gas is modelled as a mixture of hydrogen, methane, carbon dioxide and carbon monoxide. For pipelines connecting to a gas distribution network, release duration is determined by respond time for isolation.

6.3 Physical Effect Modelling

6.3.1 Gas Dispersion

Discharge rates are calculated from leak hole sizes and operating conditions of the pipeline, which are assumed to be fixed for smaller leaks as the amount of gas leaked per unit time is small comparing to the overall amount available for release. The releases are modelled by assuming a section of 6.2km of HPTGP of diameter 600mm, which can be isolated by manual isolation valves located at approximately 0.33km downstream and 5.87km upstream of the section of HPTGP. The discharge rate is estimated based on the normal operation conditions a flow velocity of 20m/s with the release inventory calculated from the length of pipeline and the amount release before the time of isolation.

Transient nature of release is assumed for the case of full bore rupture. The release rate is expected to be very high in the first few seconds, followed by a rapid drop to a constant level. The initial release rate and quantity which is discharged to the release point in an event of fireball following the rupture of HPTGP are estimated from the empirical correlations developed by Bell and modified by Wilson [13][14]:

$$Q_0 = C_d A_p \psi \sqrt{\rho_0 P_0 \gamma (\frac{2}{\gamma+1})^{(\frac{\gamma+1}{\gamma-1})}}$$

$$Q_t = \frac{Q_0}{1+\alpha}(e^{\frac{-t}{\alpha^2\beta}} + \alpha e^{\frac{-t}{\beta}})$$

$$\alpha = \frac{W}{\beta Q_0}$$

$$\beta \approx \frac{L\sqrt{K_\gamma}}{C\sqrt{K_A}}$$

$$\beta \approx \frac{2L}{3C\sqrt{K_F}} \text{ for large holes where } \frac{K_A{}^2}{K_F K_\gamma} > 30$$

where

$$K_F = \frac{D_P}{\gamma f L_P}$$

$$K_A = \frac{A_h}{A_p}$$

$$K_\gamma = (\frac{\gamma+1}{2})^{\frac{\gamma+1}{\gamma-1}}$$

where Q_0 is initial mass discharge rate (kg/s)

Q_t is time dependent mass flow rate (kg/s)

W is inventory in the pipeline (kg)

C_d is discharge coefficient, assume 0.8

A_p is the cross sectional area of the pipeline (m^2)

Ψ is outflow coefficient, assume 1 for critical flow

ρ_0 is initial gas density (kg/m^3)

P_0 is initial gas pressure (N/m^3)

γ is gas specific heat ratio, 1.344 for town gas

t is the time in seconds

α is the non-dimensional mass conservation factor

β is the time constant for release rate in seconds

D_p is diameter of pipeline (m)

f is pipeline friction factor given by $f = [1/-2\log(\frac{\varepsilon}{3.715D_p})]^2$

ε is wall roughness of pipeline (m) taken as 45μm as per TNO [7]

In modelling fires following a rupture, the transient nature of the release should be estimated. The equation is used to estimate the mass inventory which is discharged to the release point in an event of fireball following the rupture of a high pressure pipeline as descripted in **Section 6.3.3**.

6.3.2 Jet Fire

A jet fire is developed when a jet of high velocity gas is ignited. The direction and orientation of fire depend on the release orientation, release velocity and wind direction. The majority concern regarding jet fire is the heat radiation effect generated from the fire. The thermal effect to adjacent population is quantified in the consequence model.

6.3.3 Fireball

Immediate ignition of an instantaneous release of massive inventory inside a pressurized vessel will result in a fireball. A fireball is characterized by its high thermal radiation intensity and short duration time. The principal hazard of fireball arises from thermal radiation, which is not significantly influenced by weather, wind direction or source of ignition.

Fireball is more likely for immediate ignition of instantaneous release and heat is evolved by radiation. The principal hazard of a fireball arises from its thermal radiations. As suggested in IGEM/TD/2 [10], the fireball resulted from an immediate ignition of a rupture case has a transient nature and can typically last for 30 seconds.

Due to its intensity, its effects are not significantly influenced by weather, wind direction or source of ignition. The size, height, shape, duration, heat flux and radiation of a fireball will be determined in the consequence analysis. A 100% fatality is assumed for anyone within the fireball radius.

The following equations from CCPS [13] are used to estimate of the fireball diameter (D) and duration (t).

$$D = 5.8M^{\frac{1}{3}}$$

$$t = 0.45M^{\frac{1}{3}}$$

where D is final diameter of fireball (m); t is fireball duration (s); M is mass of fuel (kg)

The mass of fuel is determined by calculating the quantity of fuel at each time step that can be consumed in a fireball with the same burning time as the time since the start of the release. By equating the two equations, the sizes of fireball are determined as approximately 15 tonnes for HPTGP of diameter 600 mm.

6.3.4 Thermal Radiation of Fires

Town gas contains methane and it is flammable gas upon ignition. The LFL for hydrogen, methane and CO is given below:

- Hydrogen: 4.0%;
- Methane: 5.0%; and
- CO: 12.5%

Carbon dioxide does not contribute to flammability. The LFL of town gas is estimated as 5.5%.

The major hazard of a jet fire, pool fire or fireball is the flame and the thermal radiation. Persons caught in the flame zone are considered be fatally injured. Persons outside the flame zone are determined by lethal probability using the following Probit equation [7]:

$$Pr = -36.38 + 2.56 \ln Q^{4/3t}$$

where Q is the thermal radiation intensity in W/m^2 and t is the exposure time in seconds.

A building is assumed to offer protection to its occupants against hazards from fires. The protection factor is assumed to be 50% for indoor population within fireball radius [2].

6.3.5 Flash Fire

A flash fire is the consequence of combustion of gas cloud resulting from delayed ignition. The flammable gas cloud can be ignited at its edge and cause a flash fire of the cloud within the LFL and Upper Flammable Limit (UFL) boundaries. Major hazards from a flash fire are thermal radiation and direct flame contact. Since the flash combustion of a gas cloud normally lasts for a short duration, the thermal radiation effect on people near a flash fire is limited. Humans who are encompassed outdoor by the flash fire is considered be fatally injured. A fatality rate of unity is assumed for outdoor population, and 90% protection factor is assumed for indoor occupants.

Since town gas is buoyant, this reduces the flash fire effects at ground level. However, the town gas plumes may be within the LFL which could have potential impact to the adjacent high rise buildings.

6.3.6 Vapor Cloud Explosion

If the vapour cloud passes through a congested area (e.g. cluster of pipe racks, a confined space) and be ignited, the confinement will limit the expansion of the burning cloud, causing an explosion and damage to the surroundings by the resulting overpressure. In SAFETI, the hazardous effects are modelled by two concentric circular areas corresponding to heavy and light building damage, respectively. Fatality rates for persons outdoors and indoors are determined from the HSE method [16], CIA guidelines [17] and TNO Purple Book [7].

Table 14 Fatality Probability of Vapour Cloud Explosion

Overpressure (barg)	Indoor Fatality Probability	Outdoor Fatality Probability
0.3	1	1
0.1	0.025	0

6.3.7 Toxic Effect

Town gas contains carbon dioxide and a small amount of carbon monoxide. Carbon dioxide can be considered as toxic due to the asphyxiating properties. The Immediate Dangerous to Life and Health (IDLH) value for carbon dioxide is 40,000 ppm. However, it is believed that people can find means of escape within 30 minutes without irreversible health effects.

The Probit Equation of toxic gas dispersion for carbon monoxide is adopted.

$$Pr = -37.98 + 3.7 \ln (C^*t) \text{ for CO,}$$

where C is concentration in ppm and t is exposure time in minutes.

The town gas dose level equivalent to 1% fatality for 10-minutes exposure is over 196,675 ppm, which is above the LFL. Gas cloud with such high concentration of town gas is likely to be ignited. According to consequence analysis (refer **Table 20**), the hazard zone of toxic release is small comparing with the flammable effects. Thus, the impact of toxic release of town gas is not further assessed in this study.

6.3.8 Indoor Protection Factor

Buildings are assumed to offer protection to occupants against fire. The protection factor is assumed to be 90% for population with flash fire envelope [2]. A 100% exposure is assumed for open space.

In case of fireball event, a protection factor of 50% is assumed for indoor population within fireball radius [18]. Fatality rate of 10% is assumed for indoor population within impact distance of thermal radiation from jet fire and fireball.

6.3.9 Shielding Factor

Shielding factors are assumed to account for protection by the front part of the building or by other buildings from fire effects [18]. A shielding factor of 0.5 is assigned to those buildings within the fireball radius, i.e. 74 m, and partly inside the fireball radius. Buildings that are outside the fireball are considered being protected by the buildings in the front. The shielding factor to the following populations:

Table 15 Population with Fireball Shielding Factor

Site ID	Description	Shielding Factor
1	Scenic Heights	0.5
2	Maple Garden	0.5
3	Rolling Hills I	0.5
4	Crescendo Milano	0.5
5	Casa Paradizo	0.5
6	Green Crest	0.5
7	La Maison Vineyard	0.5
10A	Yau Tam Mei Tsuen (Storage)	0.5
10A	Yau Tam Mei Tsuen (Residential)	0.5
11	Sheung Chuk Yuen	0.5
12	Kadoorie Villas	0.5
13	San Wai Tsuen	0.5
14	Ian court	0.5
15	Village type Development (Chuk Yuen Tsuen, Fortune Village, Tai Yuen Villa)	0.5
16	EIS International Pre-school	0.5
17	RCHE/RCHD	0.5
19	Yau Mei San Tsuen	0.5

Site ID	Description	Shielding Factor
20	Mission Ark Yuen Long Centre	0.5
21	Village Houses (Geranium Path)	0.5
22	Royal Palms	0.5
25	Village Houses (Ko Hang)	0.5
PD01	Proposed Development	0.5

6.3.10 Height Protection

People above the cloud height is not exposed to flash fire events. In another term, these populations are protected. Height protection factor may be considered when impacted areas of jet fire and flash fire are limited and do not cover the entire high-rise building, as recommended in EMSD's Guidance [2]. Since town gas is lighter than air, gas cloud release tends to lift off at height and may cover the village houses and even high rise buildings. Therefore, height protection factor is not considered in this study.

6.4 Consequence Result

Since the pipeline is covered with at least 1.1m earth, there is no immediate ignition source and no adequate air for fireball or jet fire to occur under normal circumstances. Fireball or jet fire from underground pipelines is only possible when all the earth cover of a local spot has been removed in the event of loss of containment. The HKCG has requirements for any excavation works to be carried out in the vicinity of gas mains, and boring and drilling in the vicinity of gas main is prohibited. Nonetheless, fireball and jet fire scenarios from the underground gas pipeline are considered as a conservative approach in this study.

The worst-case consequence results of fireball, jet fire, flash fire, vapour cloud explosion and toxicity for the pipeline and the station from a release source are tabulated in **Table 16** to **Table 20** below.

Table 16 Consequence Results of Fireball

Leak Size	Fireball Radius (m)	Fireball Duration (s)
Full bore rupture	74	10.4

Table 17 Consequence Results of Jet Fire

Leak Size	Effect Distance at Thermal Radiation of 12.5 kW/m^2 (m)	
	Vertical release	Inclined release
10 mm	2.19	5.54
25 mm	2.03	10.75
50 mm	3.42	18.24
100 mm	7.08	32.99

Table 18 Consequence Results of Flash Fire

Leak Size	Flash Fire Envelop, Distance at LFL (m)	
	Vertical release	Inclined release
10 mm	0.60	3.51

Leak Size	Flash Fire Envelop, Distance at LFL (m)	
	Vertical release	Inclined release
25 mm	0.94	8.57
50 mm	3.35	17.07
100 mm	7.01	34.59
Full bore rupture (600mm)(1)	34.95	N/A

Notes:
(1) Flash fire scenario under full bore rupture considers vertical release only.

Table 19 Consequence Results of Vapour Cloud Explosion

Leak Size	Distance at 0.3 barg (m)	
	Vertical release	Inclined release
100 mm	Not reached	38.67
Full bore rupture (600mm) (1)	64.45	N/A

Notes:
(1) Vapour cloud explosion scenario under full bore rupture considers vertical release only.

Table 20 Consequence Results of Toxic Effect

Leak Size	Maximum Distance at 1% Lethality (1) (m)	
	Vertical release	Inclined release
10 mm	0.1	0.7
25 mm	0.2	1.1
50 mm	0.2	1.3
100 mm	0.3	1.5
Full bore rupture (600mm)(2)	0.9	N/A

Notes:
(1) Based on an average exposure time of 10 minutes [7]
(2) Toxic release under full bore rupture is considered as vertical release only.

7 RISK ASSESSMENT

7.1 Risk Summation

Risk summation combines the estimation of the likelihood and consequence of hazardous event, as well as meteorological data and production in the hazard effect zones, to give a numerical measure of risks within the study zone of the 1.6 km section of HPTGP. The risk analysis is conducted by the simulation software – SAFETI 8.6 developed by DNV and the outcome results are presented in terms of individual risk (as individual risk contours) and societal risk (as F-N curves or PLL). The risk outcomes are compared to the criteria set out in the risk guidelines, as specified in **Section 1.3**.

7.2 Results of Individual Risk

The individual risk contours of the HPTGP is presented in **Figure 6**. The individual risk contours of the HPTGP corresponding to 1×10^{-5} per year does not appear and the maximum individual risk for the HPTGP is below 1×10^{-7} per year. Thus, the individual risk of the HPTGP satisfies with the individual risk criteria of the HKPSG.

7.3 Results of Societal Risk

The societal risk of the underground HPTGP in future year, Year 2027, is presented in **Figure 7**. Recapturing from **Section 1.4.2**, a total of two cases are studied namely:

- Case 1 – Base case; and
- Case 2 – Operation case

The F-N data are tabulated in **Table 21**. The societal risks of the underground HPTGP for both cases lie within the "ACCEPTABLE" region and satisfy the requirements of the HKPSG.

Table 21 F-N Data

No. of Fatality (N)	Frequency (per year)	
	Case 1 – Year 2027 without the proposed development	**Case 2 – Year 2027 with the proposed development**
1	1.36E-07	1.36E-07
2	6.57E-08	6.60E-08
3	6.24E-08	6.24E-08
4	6.15E-08	6.16E-08
5	6.05E-08	6.06E-08
6	5.95E-08	5.96E-08
8	5.75E-08	5.76E-08
10	5.45E-08	5.46E-08
12	5.16E-08	5.19E-08
15	4.69E-08	4.72E-08
20	4.17E-08	4.20E-08
25	3.41E-08	3.61E-08
30	2.56E-08	2.96E-08
40	4.10E-09	1.00E-08
50	8.74E-12	4.51E-09
60		4.31E-09
80		3.76E-09
90		1.50E-09
100		9.59E-19

Notes:
Values less than 1×10^{-9} per year are not shown in the figure of F-N curve

Societal risk can also be represented in the form of Potential Loss of Life (PLL). It expresses the risk to the population as a whole and for each scenario and its location. The PLL is an integrated measure of societal risk obtained by summing the product of each F-N pair:

$$PLL=f_1N_1+f_2N_2+\cdots+f_nN_n$$

PLL values of the top contributors are shown in **Table 22**. With the additional population brought by the Proposed Development, the total PLL of the HPTGP is increased by 17.5%, from 1.62×10^{-6} no. of fatality per year to 1.90×10^{-5} no. of fatality per year.

Table 22 PLL Breakdown of HPTGP

Case 1 – Year 2027 without the proposed development			**Case 2 – Year 2027 with the proposed development**		
Event	**PLL (per year)**	**% of total PLL**	**Event**	**PLL (per year)**	**% of total PLL**
Full bore rupture of underground pipeline	1.56E-06	96.20%	Full bore rupture of underground pipeline	1.84E-06	96.73%
100mm leak of underground pipeline	4.94E-08	3.05%	100mm leak of underground pipeline	5.00E-08	2.63%
50mm leak of underground pipeline	1.05E-08	0.65%	50mm leak of underground pipeline	1.05E-08	0.55%
Others	1.61E-09	0.10%	Others	1.61E-09	0.08%
Total PLL	**1.62E-06**	**100%**	**Total PLL**	**1.90E-06**	**100%**

8 Conclusion

This QRA has studied the risk impact of a section of HPTGP to the nearby proposed development at Lot 4823 in D.D.104, Ngau Tam Mei, Yuen Long and its surrounding population in the future year of 2027.

The results show that the proposed development would contribute slightly increased risk posed by the HPTGP. The overall risks in terms of individual risk and societal risk as a result of an increase in population from the proposed development are in the ACCEPTABLE region. The criteria stipulated in the Hong Kong Planning Standards and Guidelines are met. No limitation or constraint would be required to be imposed on the proposed development in related to the operation of the HPTGP.

9 Reference

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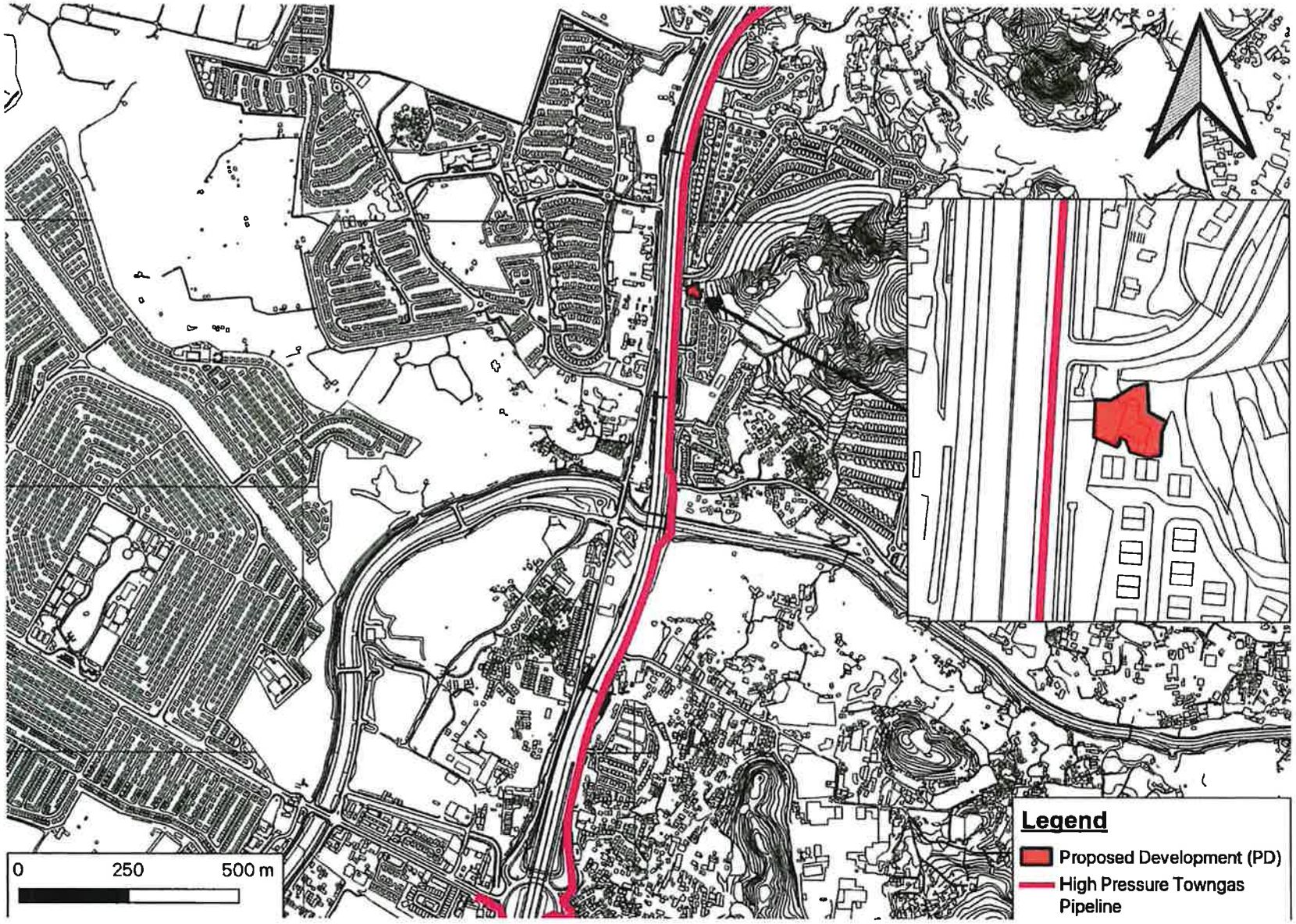
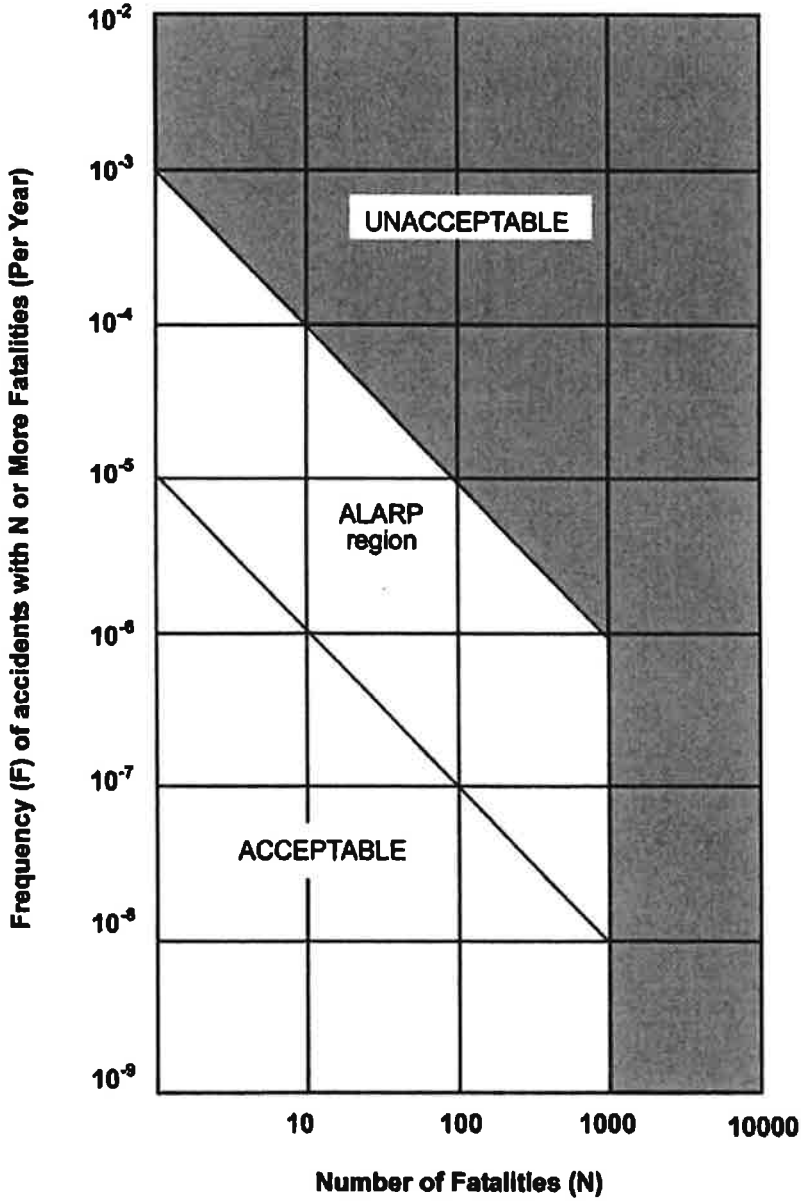
Figures



MEINHARDT

Quantitative Risk Assessment for S12A Planning Application of a proposed RCHE at 81 San Tam Road, Yuen Long

Figure 1 Location of the Proposed Project and High Pressure Town Gas Pipeline



MEINHARDT	Quantitative Risk Assessment for S12A Planning Application of a proposed RCHE at 81 San Tam Road, Yuen Long	Figure 2 Societal Risk Guidelines from Hong Kong Planning Standards and Guidelines

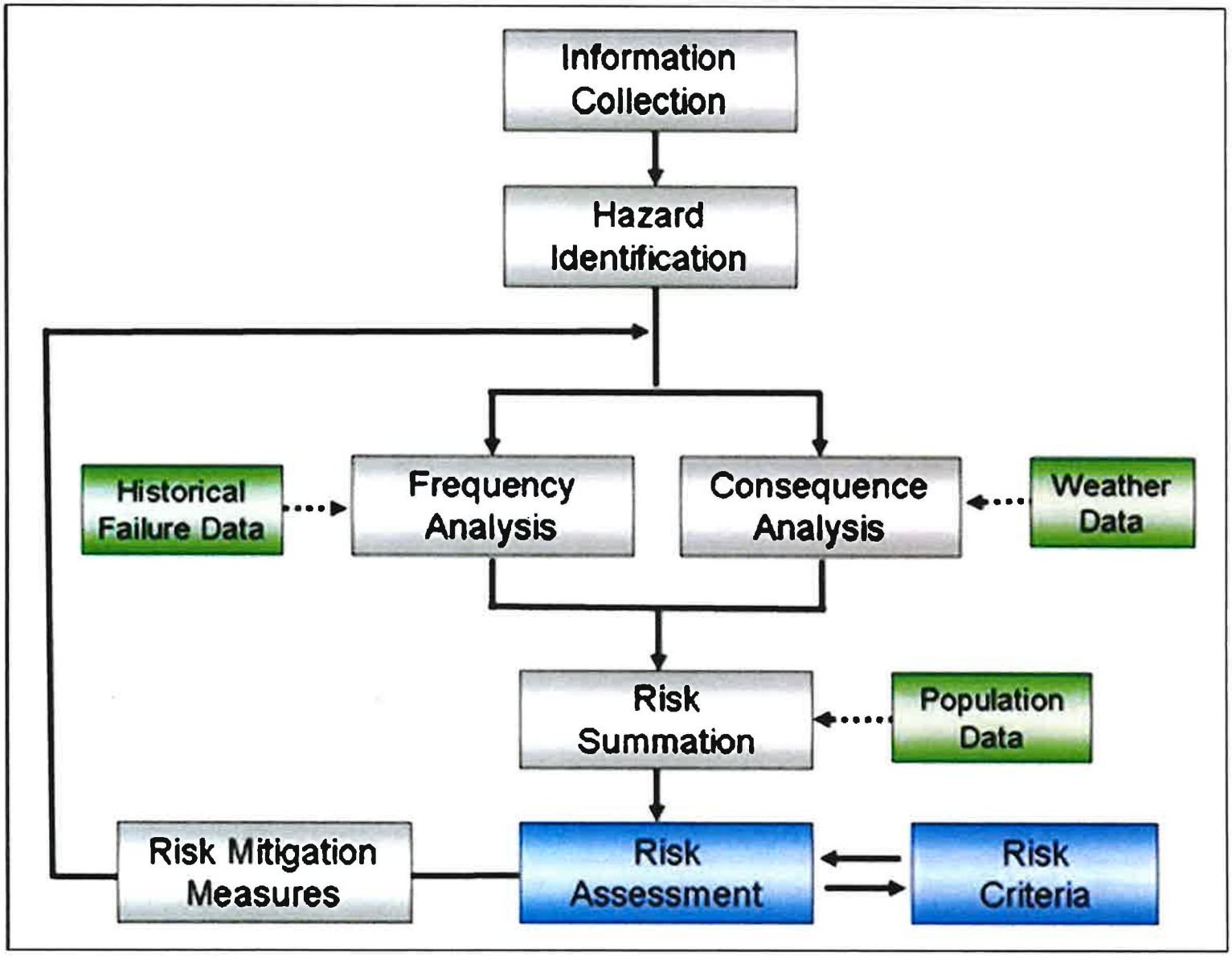
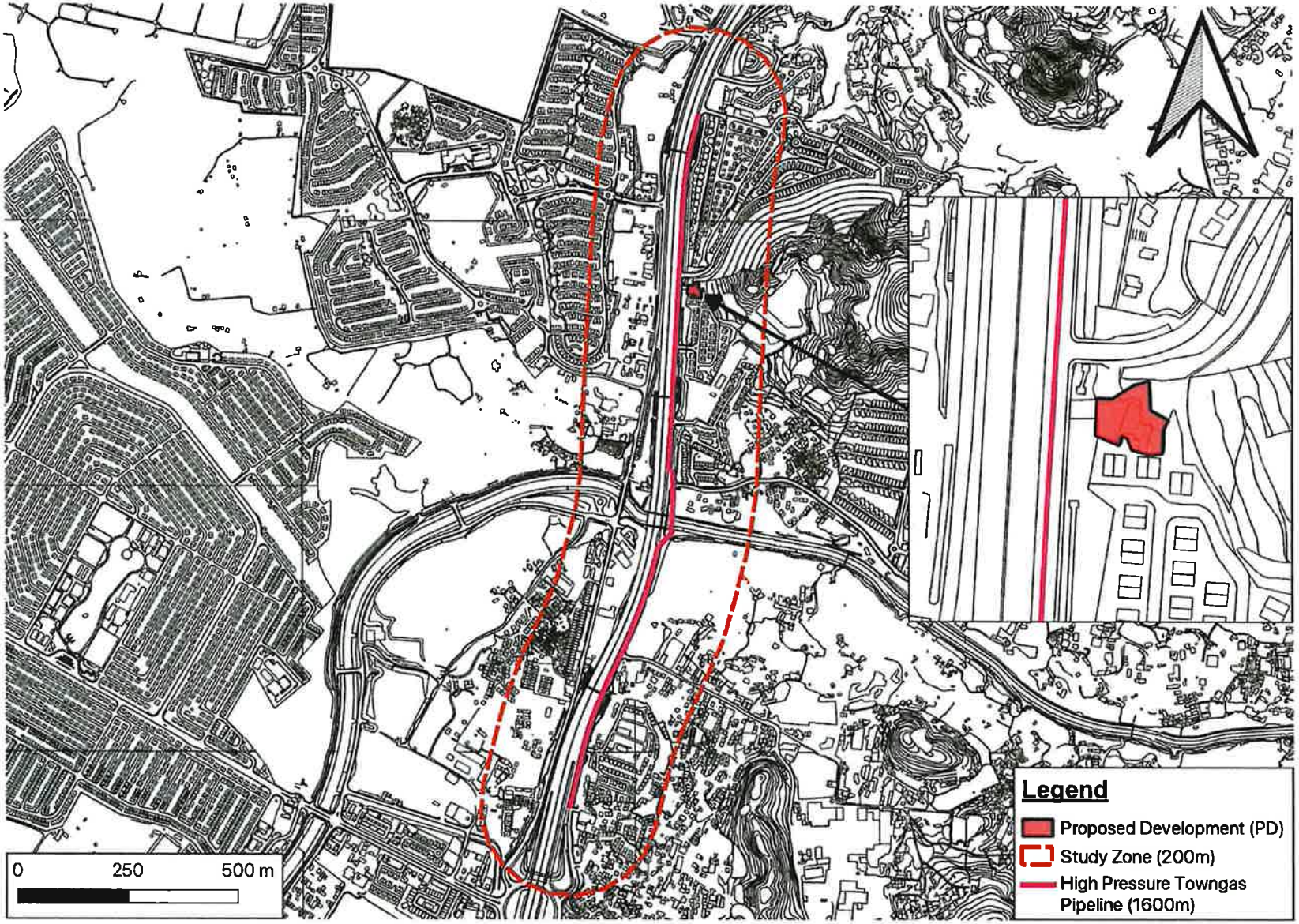


Figure 3 Quantitative Risk Assessment Methodology



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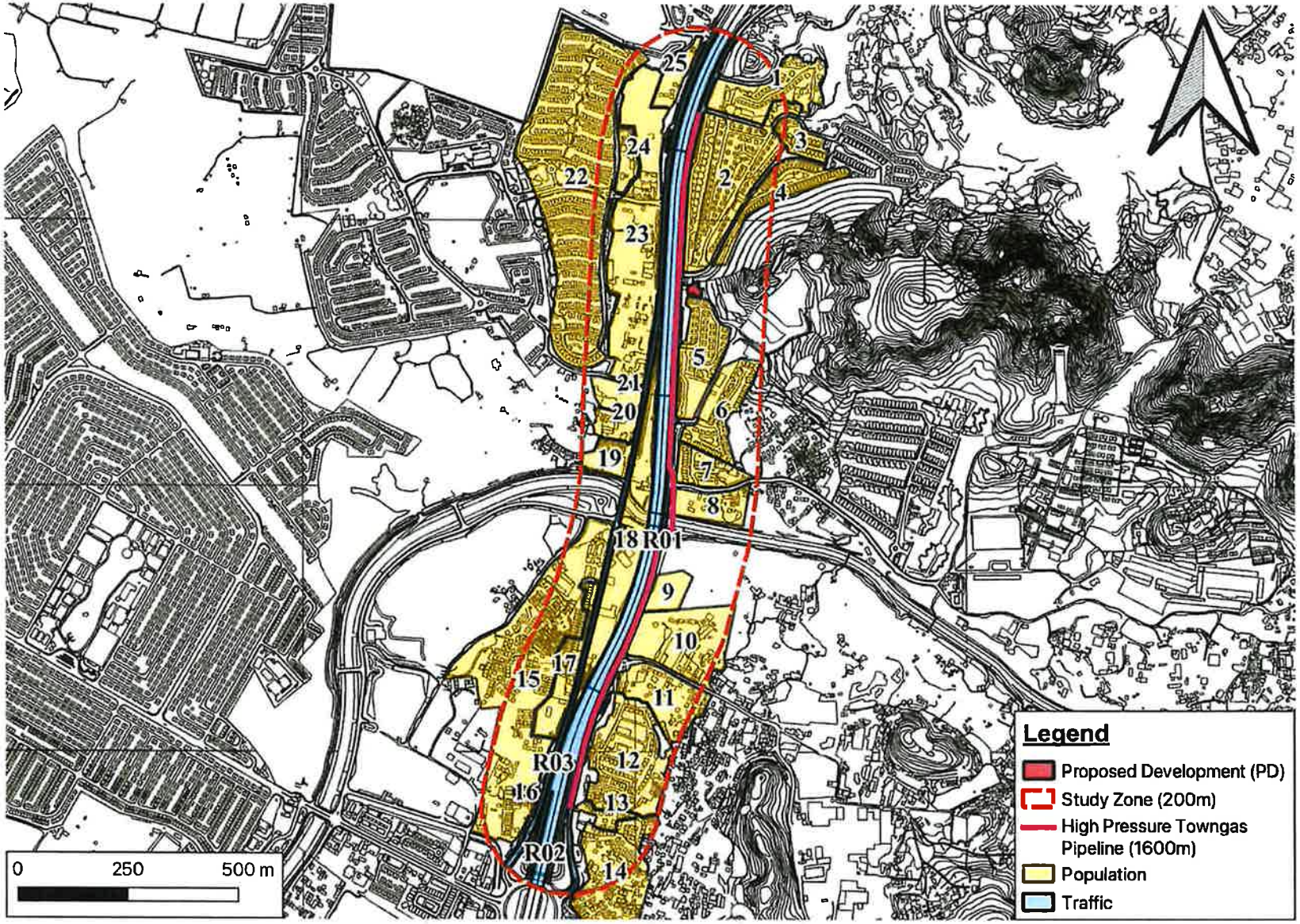
Quantitative Risk Assessment for S12A Planning Application of a proposed RCHE at 81 San Tam Road, Yuen Long

Figure 4 Study Zone of the Proposed Project



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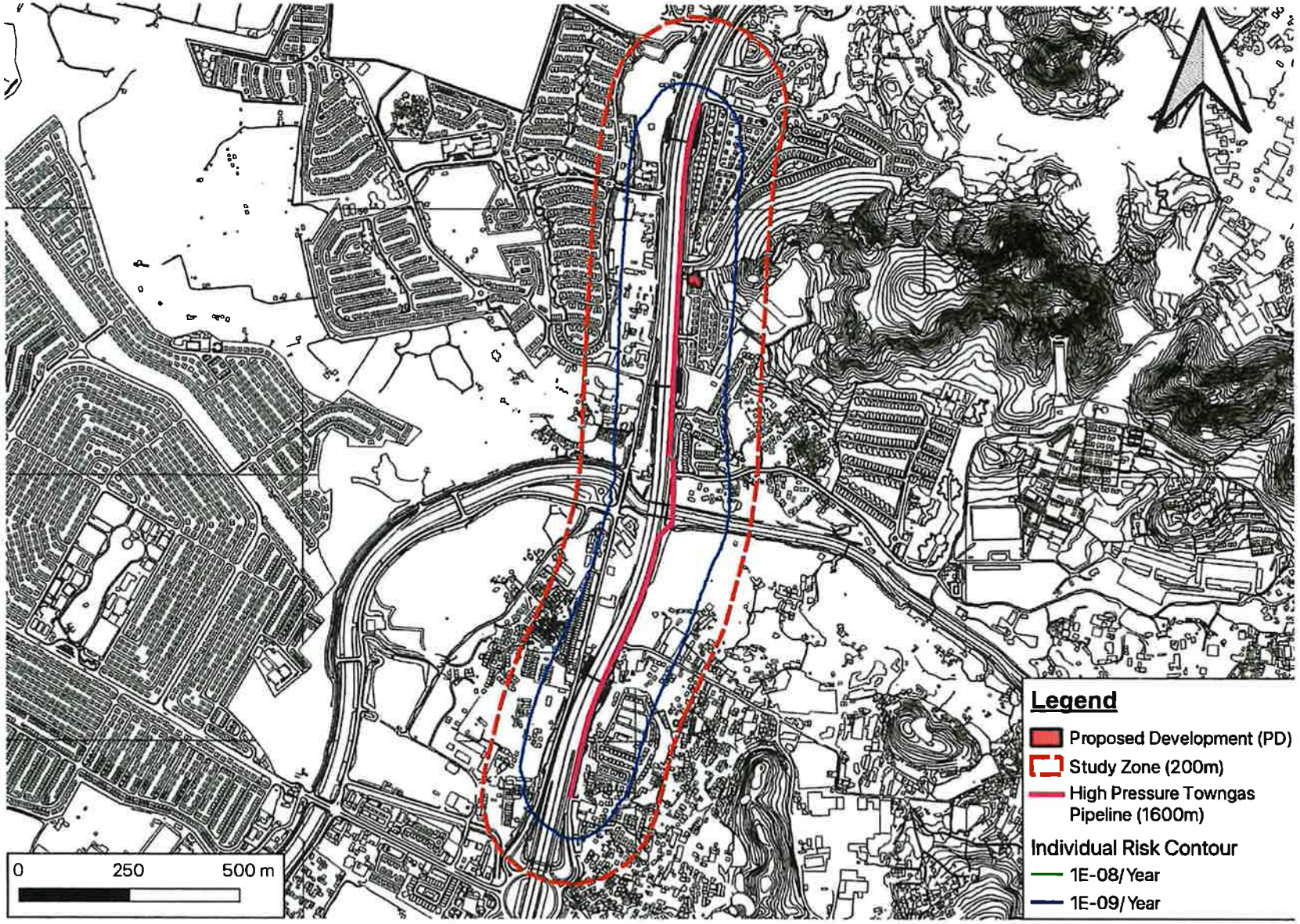
Quantitative Risk Assessment for S12A Planning Application of a proposed RCHE at 81 San Tam Road, Yuen Long

Figure 5 Population groups in the Vicinity in the Study Zone (200m radius)



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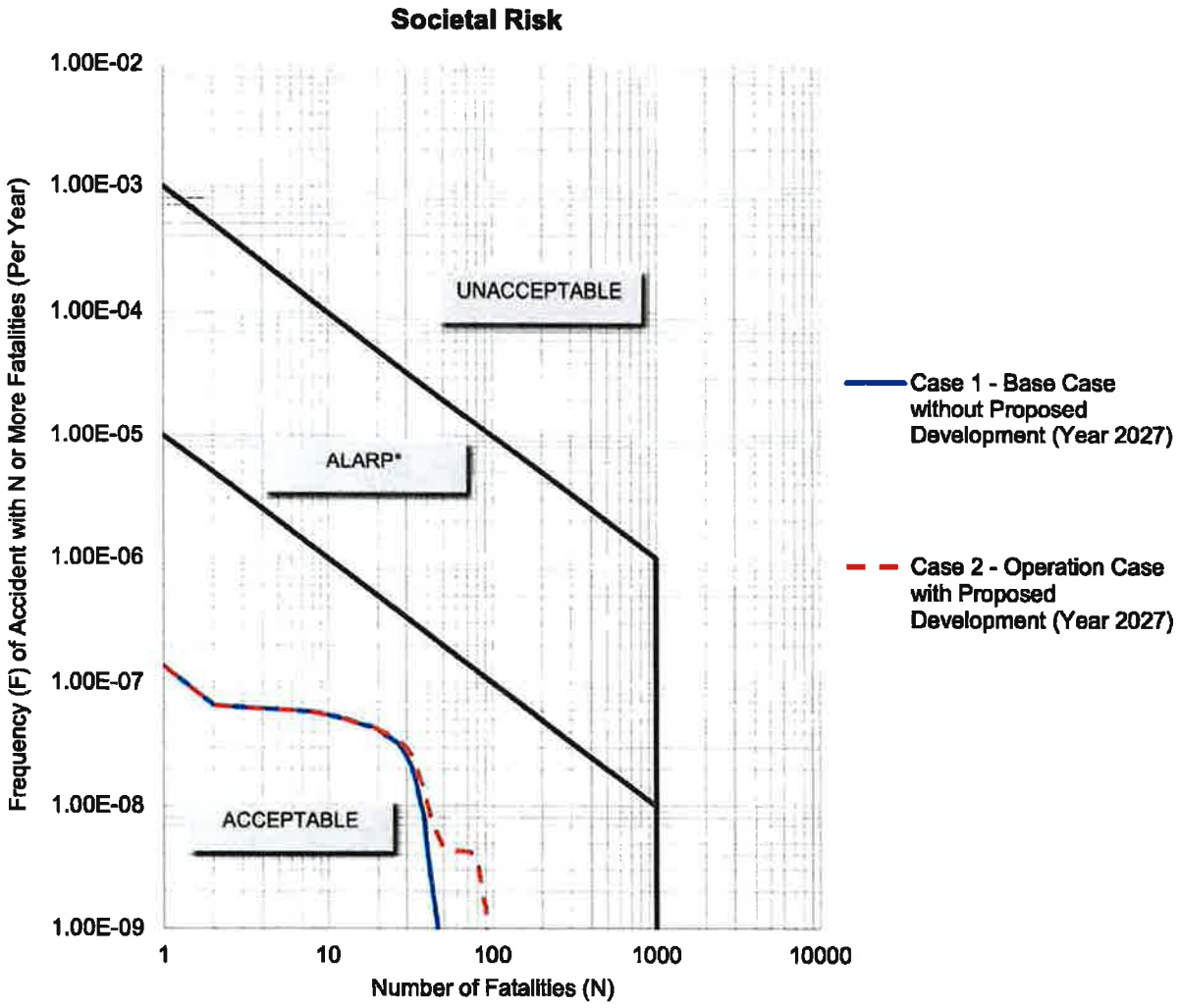
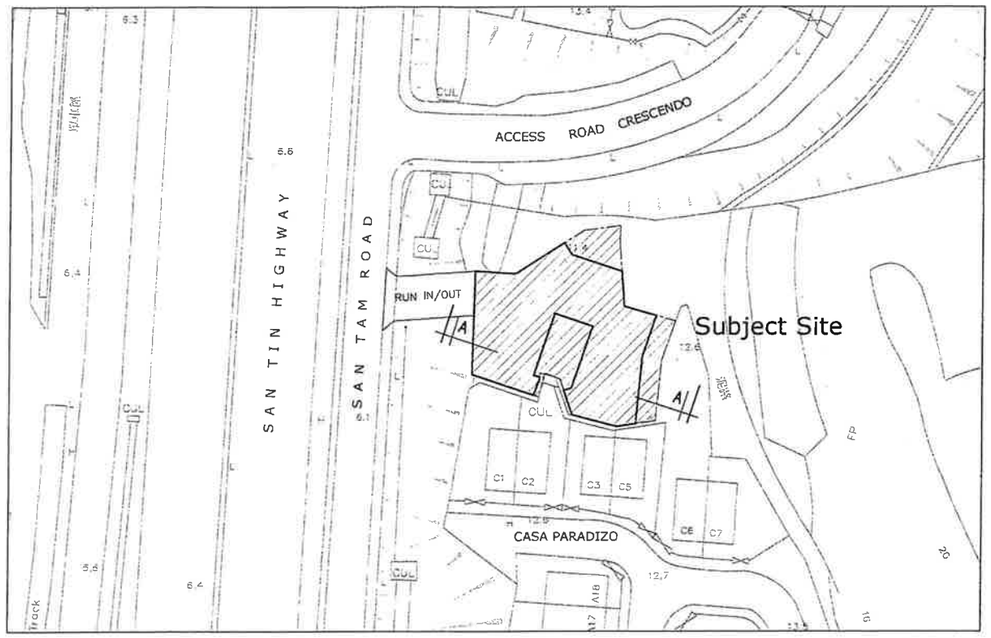
Quantitative Risk Assessment for S12A Planning Application of a proposed RCHE at 81 San Tam Road, Yuen Long

Figure 6 Individual Risk Contour of High Pressure Town Gas Pipeline


Societal Risk
1.00E-02
1.00E-03
1.00E-04
1.00E-05
1.00E-06
1.00E-07
1.00E-08
1.00E-09
Frequency (F) of Accident with N or More Fatalities (Per Year)
UNACCEPTABLE
ALARP*
ACCEPTABLE
1
10
100
1000
10000
Number of Fatalities (N)
Case 1 - Base Case without Proposed Development (Year 2027)
Case 2 - Operation Case with Proposed Development (Year 2027)

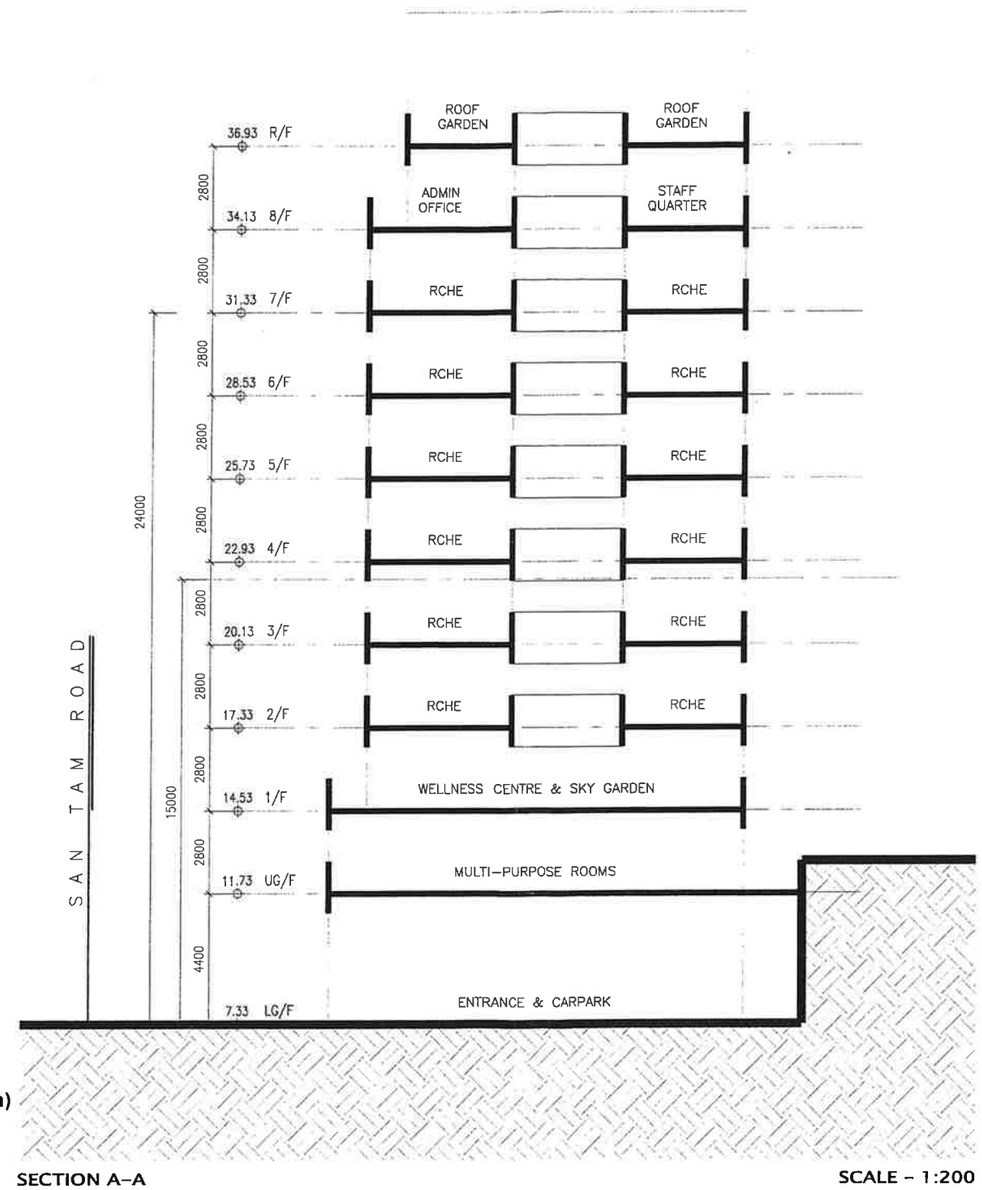
Appendix A
Layout Plans of the Proposed Development



BLOCK PLAN SCALE – 1:1000

DEVELOPMENT SCHEDULE:

Site Area	:	736.3 m²	(7926 ft²)
Class of Site	:	A	
Proposed Plot Ratio For Non-Domestic	:	7.33	
Proposed Site Coverage above For Non-Domestic (Above 15m)	:	75.558%	
Maximum Gross Floor Area	:	5400 m²	(58125.6 ft²)
Proposed Building Height	:	36.93 mPD	
Absolute Height	:	29.6 m	
Proposed No. Of Storey	:	10 STOREYS	
Proposed Gross Floor Area			
LG/F (ENTRANCE & CARPARK)	:	352.479 m²	
UG/F (MULTI-PURPOSE ROOMS)	:	617.819 m²	
1/F (WELLNESS CENTRE + SKY GARDEN)	:	626.160 m²	
2/F (RCHE)	:	595.090 m²	(45 nos. of bed)
3/F (RCHE)	:	556.330 m²	(17 nos. of bed + 3 nos. of isolation room)
4/F - 7/F (RCHE)	:	556.330 m² x 4 storeys = 2225.32 m²	(20 nos. of bed x 4 storeys)
8/F (ADMIN OFFIC + STAFF QUARTER)	:	426.802 m²	
TOTAL	:	**5400.000 m²**	**(142 nos. of bed + 3 nos. of isolation room)**



SECTION A–A SCALE – 1:200

Parking Spaces :

No. of LGV	: 1 Nos.
No. of Minibus	: 1 Nos.
No. of Private Car Parking	: 1 Nos. + 1 Nos. (Accessible Car Parking)
No. of Motorcycle Parking	: 1 Nos.

NO AIR–SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202

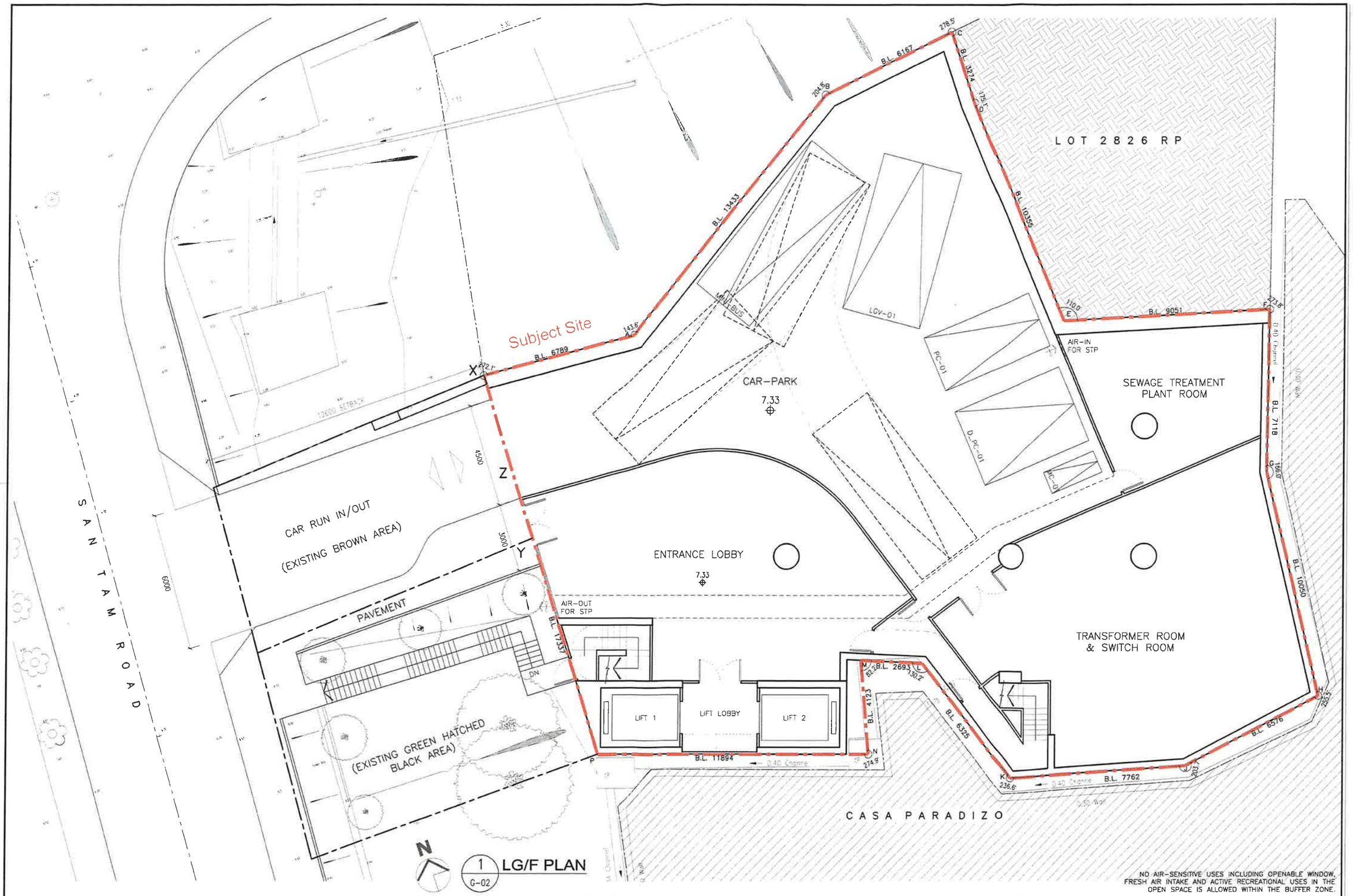
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

DEVELOPMENT SCHEDULE & SECTION

G–01 N.T.S. (A3)

B	OCT. 2022
A	JULY. 2022

RLEE



2202

PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

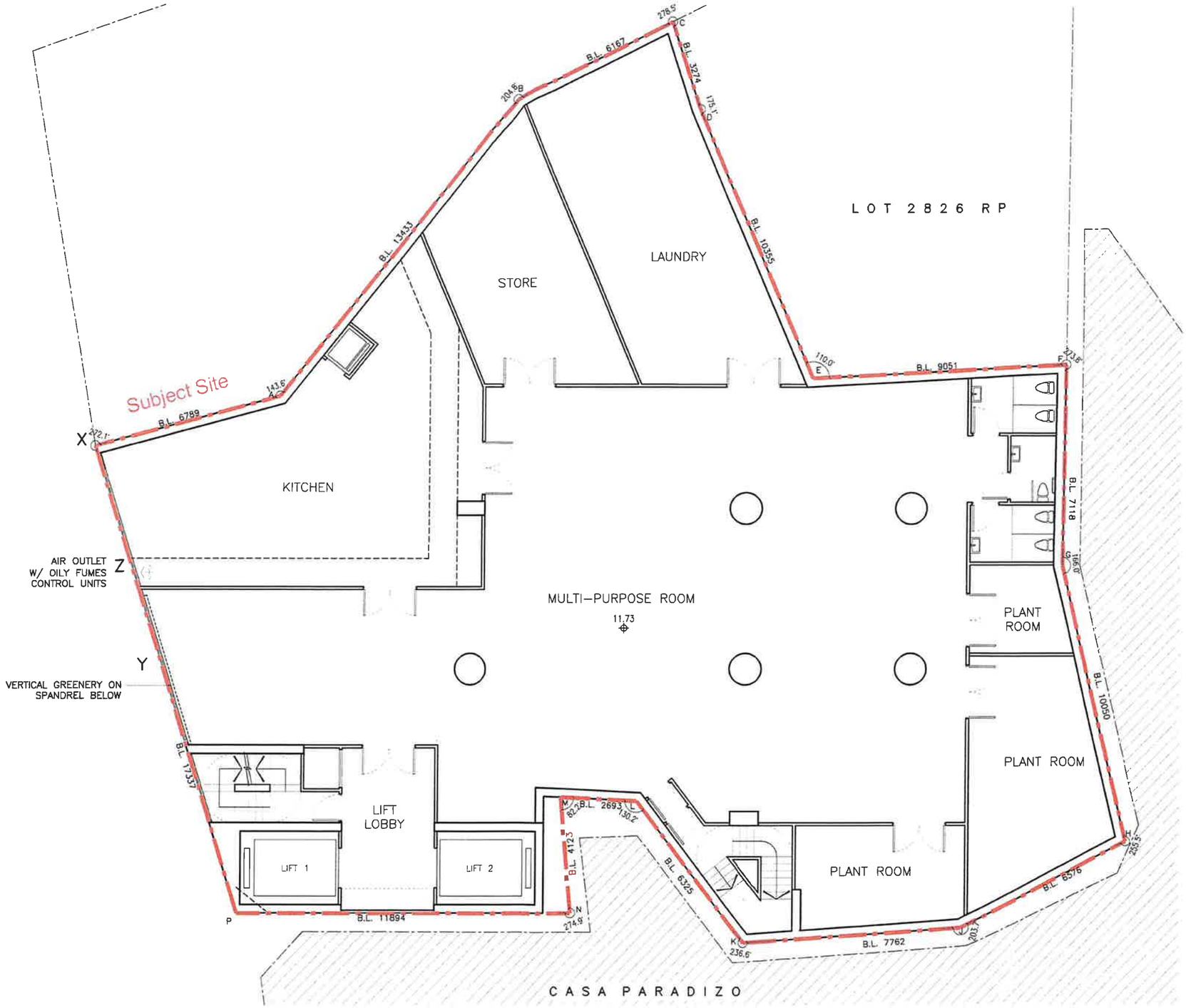
LG/F PLAN
ENTRANCE & CARPARK

G-02 1:150 (A3)

B	OCT. 2022	
A	JULY. 2022	

Do not scale drawing.
Contractors are required to verify exact dimensions on site.
The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate.
The design remains to be the property of "R.Lee Architects (HK) Ltd" unless otherwise specified.
This drawing is not for construction purposes unless expressedly certified.

R.LEE



N

1 UG/F PLAN
G-03

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202

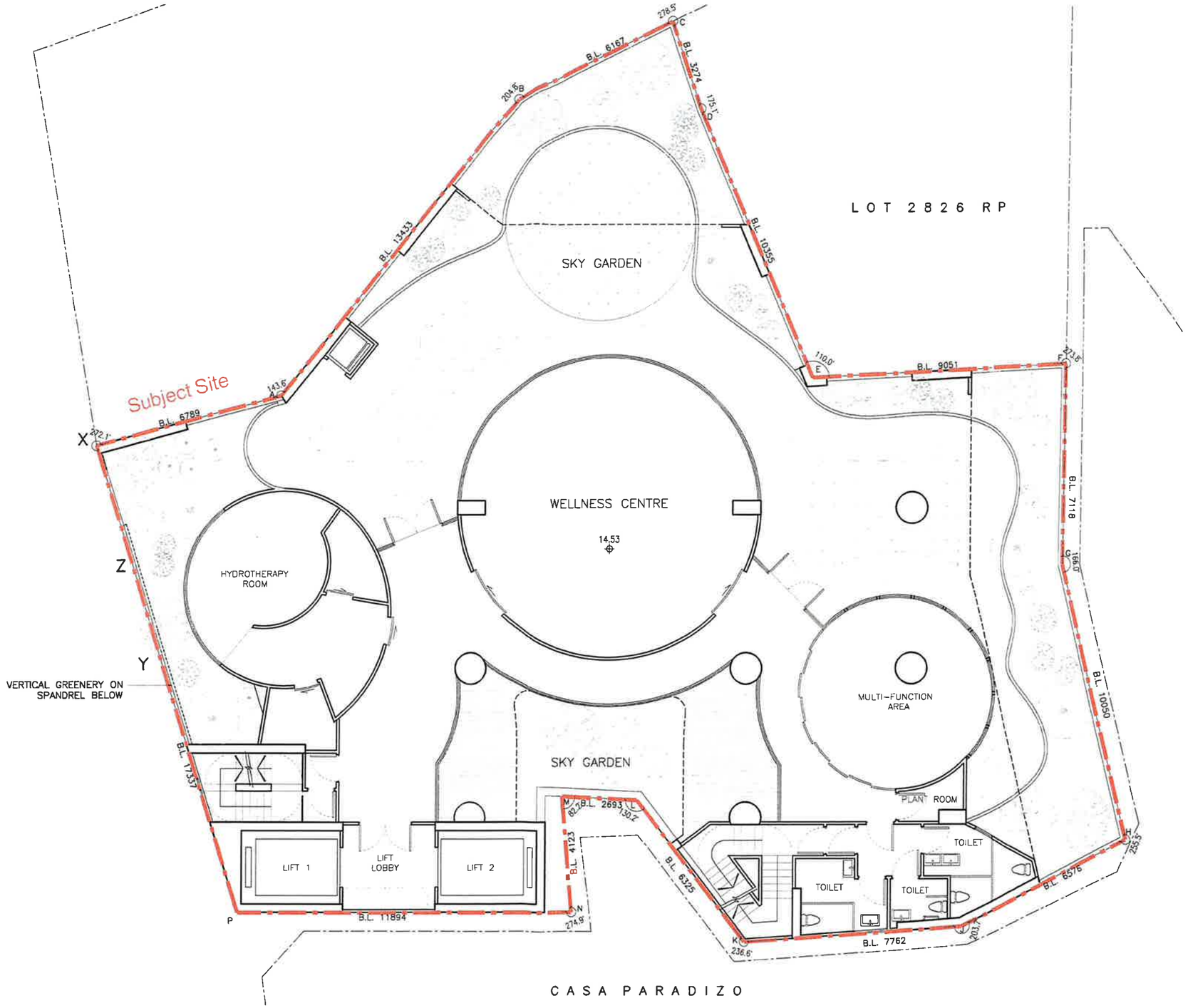
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

UG/F PLAN
MULTI-PURPOSE ROOMS

G-03 1:150 (A3)

B	OCT. 2022	
A	JULY. 2022	

RLEE



N

1 / G-04 **1/F PLAN**

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202

PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

1/F PLAN
WELLNESS CENTRE & SKY GARDEN

G-04 1:150 (A3)

B	OCT. 2022	
A	JULY. 2022	

RLEE

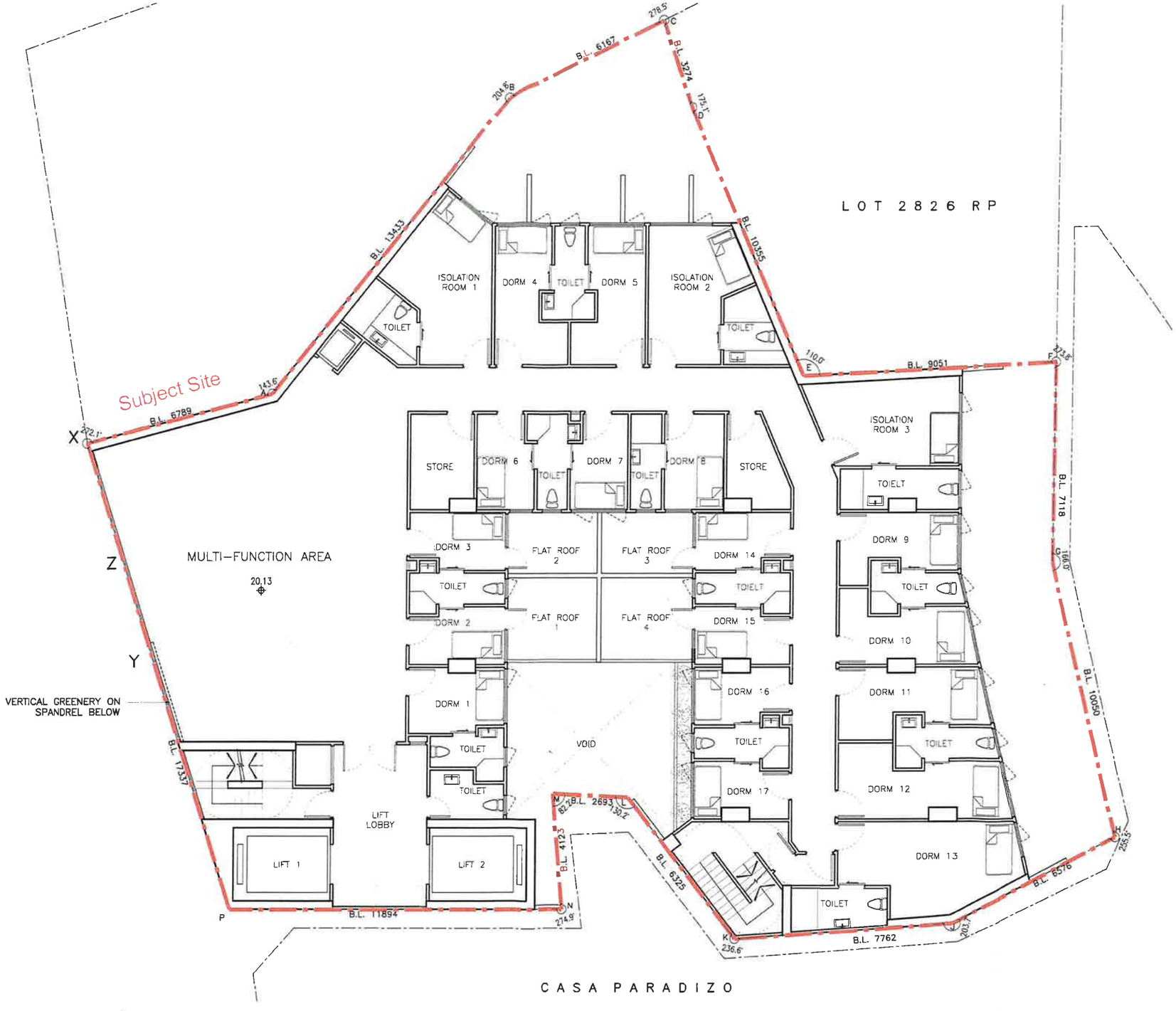
N

1 / G-05 2/F PLAN

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202 PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.	2/F PLAN RCHE	G-05	1:150 (A3)	B OCT. 2022 A JULY. 2022	Do not scale drawing. Contractors are required to verify exact dimensions on site. The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate. The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified. This drawing is not for construction purposes unless expressedly certified.

RLEE



N

1 G-06 3/F PLAN

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202

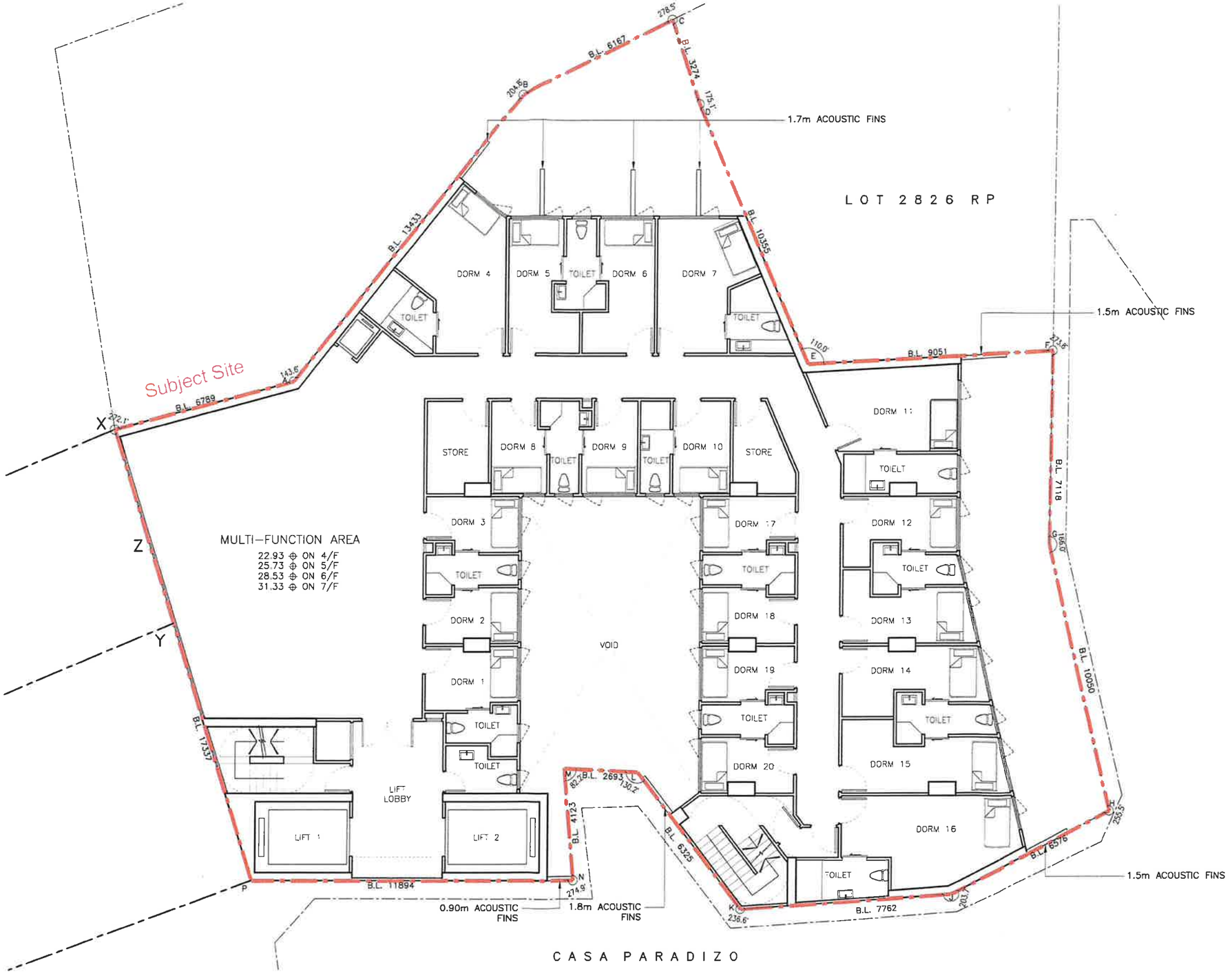
PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

3/F PLAN
RCHE

G-06 1:150 (A3)

B	OCT. 2022	
A	JULY. 2022	

RLEE



1 TYPICAL FLOOR PLAN PLAN

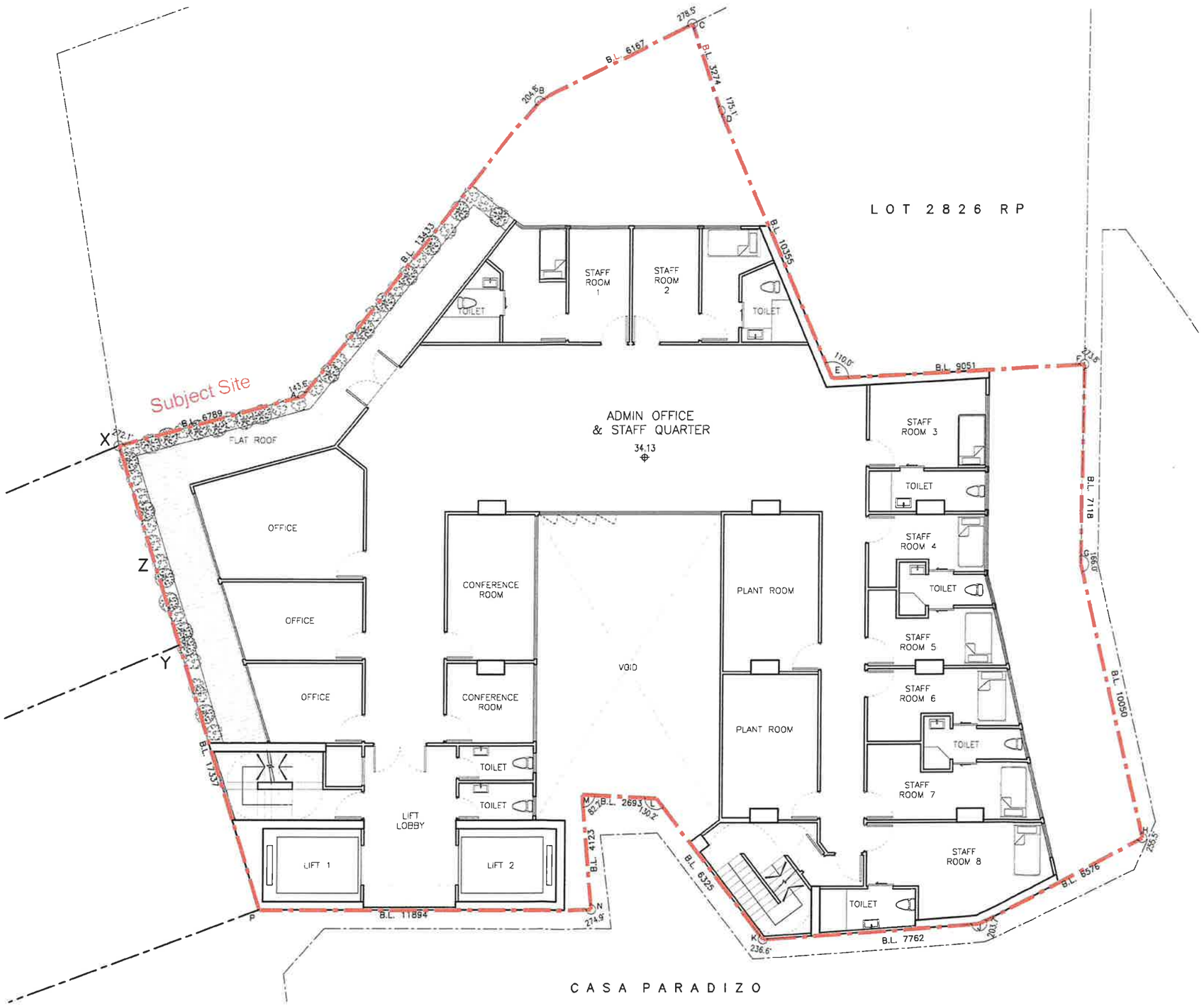
G-07

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202 PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.	TYPICAL FLOOR PLAN PLAN RCHE	G-07	1:150 (A3)	B OCT. 2022 A JULY. 2022

Do not scale drawing.
Contractors are required to verify exact dimensions on site.
The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate.
The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified.
This drawing is not for construction purposes unless expressedly certified.

RLEE



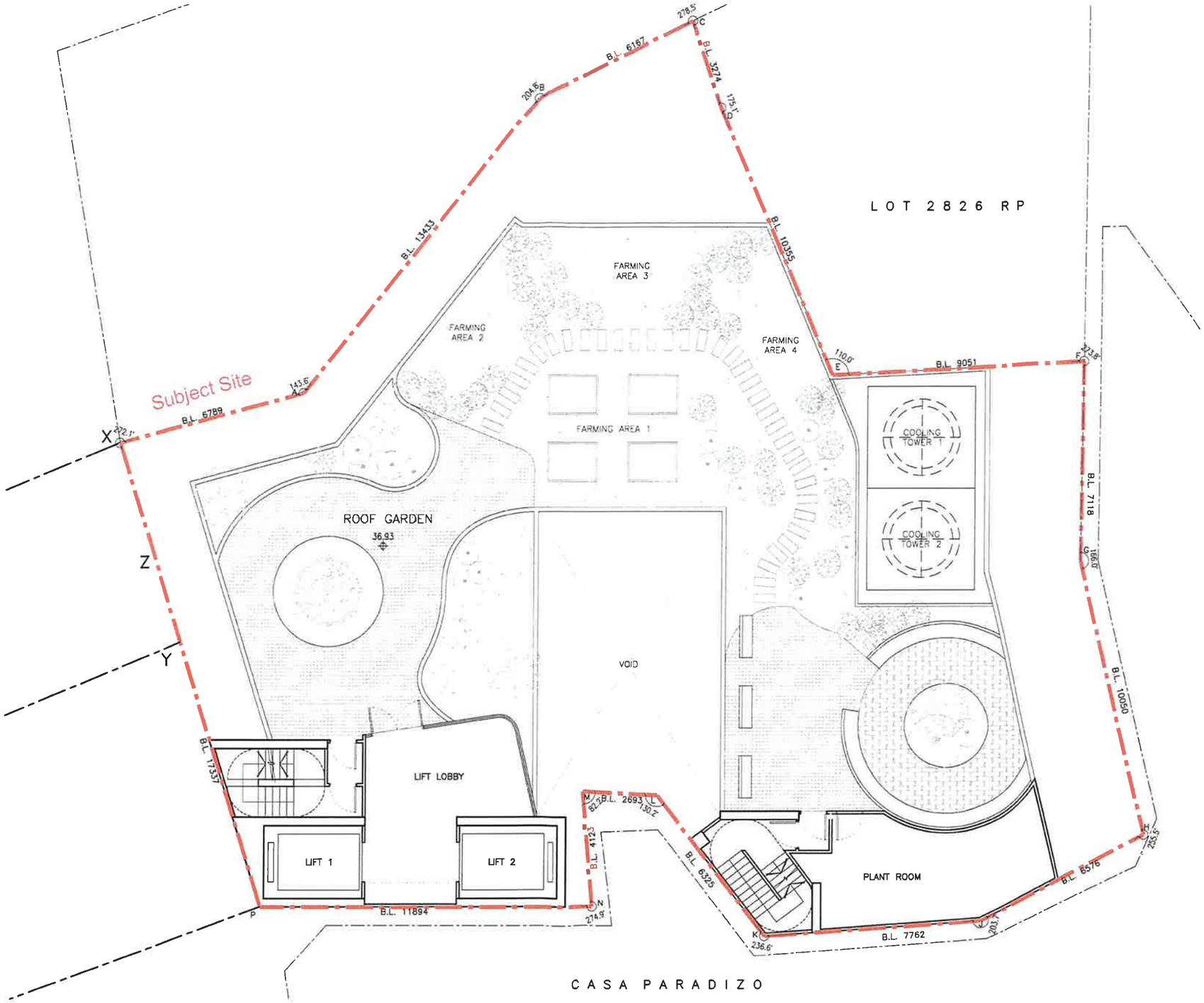
N

1 / G-08 8/F PLAN

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202 PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY at 81 SAN TAM ROAD, YUEN LONG, N.T.	8/F PLAN ADMIN OFFICE & STAFF QUARTER	G-08	1:150 (A3)	B OCT. 2022 A JULY. 2022	Do not scale drawing. Contractors are required to verify exact dimensions on site. The drawings show the design intent of the architect only, contractors are required to submit shop drawings where appropriate. The design remains to be the property of "RLee Architects (HK) Ltd" unless otherwise specified. This drawing is not for construction purposes unless expressedly certified.

RLEE



N

1 / G-09 ROOF GARDEN PLAN

NO AIR-SENSITIVE USES INCLUDING OPENABLE WINDOW, FRESH AIR INTAKE AND ACTIVE RECREATIONAL USES IN THE OPEN SPACE IS ALLOWED WITHIN THE BUFFER ZONE.

2202

PROPOSED RESIDENTIAL CARE HOME FOR ELDERLY
at 81 SAN TAM ROAD,
YUEN LONG, N.T.

ROOF GARDEN PLAN

G-09 1:150 (A3)

B	OCT. 2022
A	JULY. 2022

RLEE

Appendix B
Town Gas High Pressure Town Gas Pipeline Information

煤氣 Towngas
香港中華煤氣有限公司
The Hong Kong and China Gas Company Limited

網絡發展部

時間：11:00:56

比例：1 : 3000

圖例

量測圖示的管道位置只作參考之用。其實際位置和深度仍須以人手開挖探先確定。在確認管道地點前進行工程時，必須參照指示。

繪圖日期：Jan 13 2023

坐標 xy (824025,837894)

San Tam Road, Yuen Long - Technical Information

Pipe Diameter	600mm N.B.
Pipe Alignment	Please refer to the attached drawings
Pipe wall thickness	12.7mm
Minimum Depth	1.1m
Operating Pressure of pipeline	35 barg
Pipe Material	Steel
Material Grading (Pipe/ Fitting)	API 5L X42 / X52
External Coating	400 micron of fusion bonded epoxy coating
Year of Construction	1986 – 1989
Jointing Method	Butt Welding complied with BS P2
Non-Destructive Test of Jointing	100% X-Ray
Backfilling Material	Surrounded by 150mm Thick Zone 2 fresh sand
Cathodic Protection	Cathodic Protection System - Sacrificial Anode at about 300 m Interval
Isolation Valves (Cameron Full Bore Ball Valve)	Upstream: BV24066 Castle Peak Road - Chau Tau Downstream: BV24118 BV16116 Fairview Park Boulevard Round About
Pipe Length between isolation valves	6.2km

Appendix C
Traffic Population Calculation

All Information in this appendix was obtained from The Annual Traffic Census 2021.

i. Calculation of average occupancy

Station S5016	Motor Cycle	Private car	Taxi	Private light bus	Public light bus	Light Goods vehicle	Medium & heavy Goods vehicle	Non-franchised bus	Single-decker franchised bus	Double-decker franchised bus
Probability (%)	1.5	46.1	5.6	0.6	2.5	19.3	21.7	1.4	0.1	1.3
Occupancy (person/veh)	1.1	1.3	1.8	3.1	12.9	1.3	1.1	14.0	8.0	36.2

Note: Assume traffic occupancy of roads in Study Zone follows that of Traffic Station no. 5016 which is the nearest traffic stations with occupancy profile

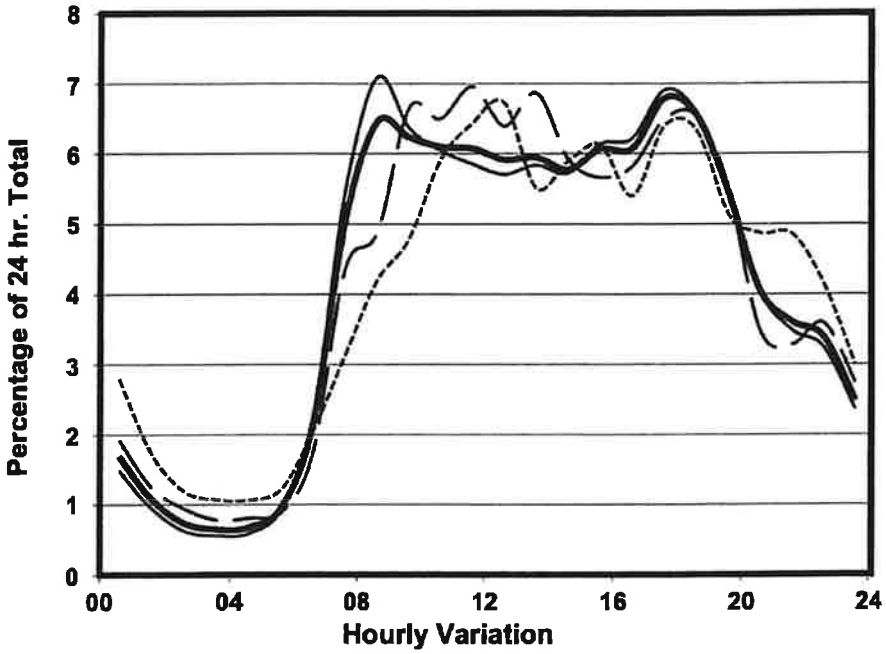
Average occupancy = $\sum(Probability_i \times Occupancy_i)/\sum Probability_i$ = **2.2**

ii. Calculation of growth factor

Road	2016 AADT (veh/day)	2017 AADT (veh/day)	2018 AADT (veh/day)	2019 AADT (veh/day)	2020 AADT (veh/day)	2021 AADT (veh/day)	Average annual growth rate (1)
R01 San Tam Road (2)	6400	6300	8540	7530	7220	7510	**5%**
R02 San Tin Highway (3)	90760	90110	92980	80460	82010	86000	**0%**
R03 Castle Peak Rd-Tam Mi, Mai Po & San Tin (4)	10940	10770	11980	11910	11420	11880	**2%**

Note: (1) Average annual growth rates are assumed to be zero as the calculated average annual growth rate is a negative value
(2) Information from S5297 – From Castle Peak Rd-Mai Po to Fairview Park Boulevard RA
(3) Information from S5508 – From Fairview Park Boulevard to Lok Ma Chau Rd
(4) Information from S5257 -- From Fairview Park Boulevard to Lok Ma Chau Rd

iii. Calculation of Traffic flow



Station S5016 all-day traffic hourly variation

Distribution of traffic in Day-time and night-time can be obtained from the all-day traffic hourly variation. Day-time: 07:00-19:00, Night-time: 19:00-07:00. The results are as follows:

Day-time variation	73.1%	Day-time ratio (1)	100.0%
Night-time variation	26.9%	Night-time ratio (2)	36.9%

Note: (1) Day-time ratio = Day-time variation/Day-time variation
(2) Night-time ratio= Night-time variation/Day-time variation

Road	2027 Forecasted AADT (1) (veh/day)	Day-time Hourly Traffic (2) (veh/hr)	Night-time Hourly Traffic (3) (veh/hr)
R01 San Tam Road	9932	605	54
R02 San Tin Highway	82010	4994	222
R03 Castle Peak Rd- Tam Mi, Mai Po & San Tin	13270	808	298

Note: (1) 2027 Forecasted AADT is obtained from 2021 AADT and average annual growth factor
(2) Day-time Hourly Traffic = 2027 Forecasted AADT × Day-time Variation /12 hours
(3) Night-time Hourly Traffic = 2027 Forecasted AADT × Night-time Variation /12 hours

iv. Calculation of Population (year 2027)

ID	Road Name	Average Occupancy	Speed (km/hr)	Road Length (m)	Day-time Traffic Population (1)	Pedestrian	Day-time Population (2)
R01	San Tam Road	2.2	50	2005	54	20	74
R02	San Tin Highway	2.2	100	2001	222	0	222
R03	Castle Peak Rd-Tam Mi, Mai Po & San Tin	2.2	70	1964	51	20	71

Note: (1) Day-time Traffic Population = Day-time Hourly Traffic × Average Occupancy × Road Length / Speed
(2) Day-time Population = Day-time Traffic Population + Pedestrian

Appendix D
Atmospheric Stability Class-Wind Speed Frequencies

Day Time Atmospheric Stability Class-Wind Speed Frequencies at Wetland Park Weather Station (Year 2021)

DAY	Stability Class						Total
Wind Speed	A	B	C	D	E	F	
0-2	25.6%	7.9%	0.0%	13.8%	0.0%	14.5%	61.8%
2-4	7.6%	14.3%	6.4%	6.3%	1.8%	0.4%	36.7%
4-6	0.0%	1.1%	0.3%	0.2%	0.0%	0.0%	1.5%
6-8	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
>8	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Night Time Atmospheric Stability Class-Wind Speed Frequencies at Wetland Park Weather Station (Year 2021)

NIGHT	Stability Class						Total
Wind Speed	A	B	C	D	E	F	
0-2	0.0%	0.0%	0.0%	3.8%	0.0%	82.3%	86.0%
2-4	0.0%	0.0%	0.0%	2.3%	8.8%	2.4%	13.5%
4-6	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	0.5%
6-8	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
>8	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Appendix E
Event Tree Analysis of High Pressure Town Gas Pipeline

UNDERGROUND HIGH PRESSURE TOWNGAS PIPELINE

Underground Land Pipeline

Underground Land Pipeline Failure (per km-yr)
1.00E-05

Assume jet fire inclined from horizontal by 45 deg

Release Frequency (/km-yr)	Failure Probability	Release Orientation	Immediate Ignition	Delayed Ignition	Explosion after Ignition	Outcome Frequency (/km-yr)	Outcome Consequence
1.00E-05	0.20	Vertical	0.5 Yes 0.01			1.00E-08	Vertical jet fire
	leak 10mm		No 0.99	Yes 0.4		3.96E-07	Flash fire
	2.00E-06 /km-yr			No 0.6		5.94E-07	No ignition
		Inclined	0.5 Yes 0.01			1.00E-08	Inclined jet fire
			No 0.99	Yes 0.4		3.96E-07	Flash fire
				No 0.6		5.94E-07	No ignition
	0.30	Vertical	0.5 Yes 0.07			1.05E-07	Vertical jet fire
	leak 25mm		No 0.93	Yes 0.38		5.30E-07	Flash fire
	3.00E-06 /km-yr			No 0.62		8.65E-07	No ignition
		Inclined	0.5 Yes 0.07			1.05E-07	Inclined jet fire
			No 0.93	Yes 0.38		5.30E-07	Flash fire
				No 0.62		8.65E-07	No ignition
	0.30	Vertical	0.5 Yes 0.07			1.05E-07	Vertical jet fire
	leak 50mm		No 0.93	Yes 0.38		5.30E-07	Flash fire
	3.00E-06 /km-yr			No 0.62		8.65E-07	No ignition
		Inclined	0.5 Yes 0.07			1.05E-07	Inclined jet fire
			No 0.93	Yes 0.38		5.30E-07	Flash fire
				No 0.62		8.65E-07	No ignition
	0.19	Vertical	0.5 Yes 0.07			6.65E-08	Vertical jet fire
	leak 100mm		No 0.93	Yes 0.38	Yes 0.12	4.03E-08	Flash fire followed by explosion
	1.90E-06 /km-yr				No 0.88	2.95E-07	Flash fire
				No 0.62		5.48E-07	No ignition
		Inclined	0.5 Yes 0.07			6.65E-08	Inclined jet fire
			No 0.93	Yes 0.38	Yes 0.12	4.03E-08	Flash fire followed by explosion
					No 0.88	2.95E-07	Flash fire
				No 0.62		5.48E-07	No ignition
	0.01	Vertical	1 Yes 0.3			3.00E-08	Fireball
	Full bore rupture		No 0.7	Yes 0.28	Yes 0.3	5.88E-09	Flash fire followed by explosion
	1.00E-07 /km-yr				No 0.7	1.37E-08	Flash fire
				No 0.72		5.04E-08	No ignition

MEINHARDT

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