FORM
5

Application No. : VEP-637/2024
Reference No. : (For official use) EP2/K14/Q/18

FORM 5
ENVIRONMENTAL IMPACT ASSESSMENT ORDINANCE
(CHAPTER 499)
SECTION 13(1)

Application for Variation of an Environmental Permit

PART A PREVIOUS APPLICATIONS

☐ No previous application for variation of an environmental permit.

☑ The environmental permit was previously amended.

Application No. : VEP-616/2022

PART B DETAILS OF APPLICANT

B1. Name : (person or company)

Civil Engineering and Development Department

[Note : In accordance with section 13(1) of the Ordinance, the person holding an environmental permit or a person who assumes responsibility for the designated project may apply for variation of the environmental permit.]

B2. Business Registration No. : (if applicable) [redacted]

B3. Correspondence Address : [redacted]

B4. Name of Contact Person : [redacted]

B5. Position of Contact Person : [redacted]

B6. Telephone No. : [redacted]

B7. Fax No. : [redacted]

B8. E-mail Address : (if any) [redacted]

PART C DETAILS OF CURRENT ENVIRONMENTAL PERMIT

C1. Name of the Current Environmental Permit Holder :

Civil Engineering and Development Department

C2. Application No. of the Current Environmental Permit : VEP-616/2022

C3. The Current Environmental Permit was Issued in : month / year

07 / 2022

Important Notes : Please submit the application together with

(a) 3 copies of this completed form; and

(b) appropriate fee as stipulated in the Environmental Impact Assessment (Fees) Regulation

to the Environmental Protection Department at the following address :

The EIA Ordinance Register Office,
27th floor, Southorn Centre,130 Hennessy Road,
Wan Chai, Hong Kong.

RECEIVED
- 7 MAY 2024
EIAO Register Office, E.P.D.

☐ Tick (✓) the appropriate box

PART D PROPOSED VARIATIONS TO THE CONDITIONS IN CURRENT ENVIRONMENTAL PERMIT

D1. Condition(s) in the Current Environmental Permit :	D2. Proposed Variation(s) :	D3. Reason for Variation(s) :	D4. Describe the environmental changes arising from the proposed variation(s) :	D5. Describe how the environment and the community might be affected by the proposed variation(s) :	D6. Describe how and to what extent the environmental performance requirements set out in the EIA report previously approved or project profile previously submitted for this project may be affected :	D7. Describe any additional measures proposed to eliminate, reduce or control any adverse environmental impact arising from the proposed variation(s) and to meet the requirements in the Technical Memorandum on Environmental Impact Assessment Process :
Figure 1	Inclusion of Enabling Adit B and tunnel portal at Anderson Road (Portal B)	Provide access for future cavern development(s) within SCVA No. 28 – Tai Sheung Tok	Inclusion of tunnel portal area (Portal B) which may generate construction dust and construction noise. The blasting works for Enabling Adit B may also induce hazard to life issue. The key environmental issues induced are described in Table 2.3 of the ERR.	As there are new works areas in Portal B near Anderson Road, new sensitive receivers near Anderson Road would be affected by the proposed works area. Potential air quality impact and noise impact and new sensitive receivers are described in Section 3 and Section 4 of the ERR.	The potential air quality impact, noise, water quality, waste management, ecological impact and hazard to life impact have been reviewed and confirmed that the relevant performance requirements set out in the approved Project Profile (DIR-283/2021) and the Technical Memorandum on EIA Process would not be exceeded or violated, as shown in the ERR.	Adoption of mitigation measures as stated in Section 3.5.10 to Section 3.5.11 and Section 4.4.10 to Section 4.4.18.

PART E DECLARATION BY APPLICANT

E1. I hereby certify that the particulars given above are correct and true to the best of my knowledge and belief. I understand the environmental permit may be suspended, varied or cancelled if any information given above is false, misleading, wrong or incomplete.

[redacted] [redacted] [redacted]

Signature of Applicant | Full Name in Block Letters | Position

on behalf of Geotechnical Engineering Office, Civil Engineering and Development Department

Company Name and Chop (as appropriate)

06 May 2024

Date

NOTES :

1. A person who constructs or operates a designated project in Part I of Schedule 2 of the Ordinance or decommissions a designated project listed in Part II of Schedule 2 of the Ordinance without an environmental permit or contrary to the permit conditions commits an offence under the Ordinance and is liable to a maximum fine of $5,000,000 and to a maximum imprisonment for 2 years.

2. A person for whom a designated project is constructed, operated or decommissioned and who permits the carrying out of the designated project in contravention of the Ordinance commits an offence and is liable to a maximum fine of $5,000,000 and to a maximum imprisonment for 2 years.

China State – Alchmex Joint Venture

AtkinsRéalis

Contract No. GE/2022/14 Joint Cavern Development at Anderson Road Quarry Site

Environmental Review Report

China State- Alchmex Joint Venture (CSAJV)

May 2024

GE/2022/14-OR008-07

Notice

This document and its contents have been prepared and are intended solely as information for China State-Alchmex Join Venture (CSAJV) and use in relation to Draft Issue

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This document has 53 pages including the cover.

Document history

Document title: Environmental Review Report

Document reference: GE/2022/14-OR008-07

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
1.0	First Submission	Various	Grace YANG	WK CHIU	YC LAM	25 July 2023
2.0	Second Submission	Various	Grace YANG	WK CHIU	YC LAM	7 Dec 2023
2.1	Second Submission	Various	Grace YANG	WK CHIU	YC LAM	13 Dec 2023
3.0	Third Submission	Various	WK CHIU	Vincent CHUNG	Jacky TSUN	14 Feb 2024
4.0	Forth Submission	Various	WK CHIU	Vincent CHUNG	Jacky TSUN	7 March 2024
5.0	Fifth Submission	Various	WK CHIU	Vincent CHUNG	Jacky TSUN	25 April 2024
6.0	Sixth Submission	Various	WK CHIU 	Vincent CHUNG 	Jacky TSUN 	6 May 2024

Client signoff

Client	China State- Alchmex Join Venture (CSAJV)
Project	Contract No. GE/2022/14 Joint Cavern Development at Anderson Road Quarry Site
Job number	5222058
Client signature/date	

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1. Introduction

1.1. Background

1.1.1. In 2015, the Civil Engineering and Development Department (CEDD) completed an Engineering Feasibility Study (EFS) under Agreement No. CE 12/2012 (GE) "Long-term Strategy for Cavern Development – Feasibility Study", which ascertained the technical feasibility of provisioning of various public facilities within caverns on the rock slopes at the Anderson Road Quarry (ARQ) site that is within the Strategic Cavern Area (SCVA) No. 28 – Tai Sheung Tok of the Cavern Master Plan (CMP). The location of SCVA No. 28 is shown in **Appendix 1.1**.

1.1.2. The rock slopes at Tai Sheung Tok overlooking ARQ Development was selected as the most suitable location and committed for rock cavern development to accommodate the Reprovisioned Public Works Central Laboratory (PWCL) Building, which currently houses the PWCL of the CEDD, the Force Laboratory of the Innovation and Technology Commission (ITC) and the Product Testing & Dutiable Commodities (PTDC) Section of the Government Laboratory in Kowloon Bay, under Agreement No. CE13/2018 (GE) "Relocation of Public Works Central Laboratory to Caverns - Feasibility Study" (FS).

1.1.3. The committed rock cavern development covers construction and operation of two caverns, each with dimensions of 25 m(W) × 28 m(H) × 100 m(D), connecting with adits and a portal building on the north-eastern rock slopes at platform of around +195mPD adjoining the planned internal road at ARQ site and is targeted to be completed/commissioned in year 2026. As it involves construction of rock caverns and is classified as a designated project (DP) by virtue of Item Q.2 of Part 1, Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO) — "Underground rock caverns", a Project Profile (PP) was submitted for Applications for Permission to Apply Directly for an Environmental Permit (DIR) (Register No. DIR-283/2021) and was approved on 27 April 2021 under the EIAO. Following the approval of the DIR, the Environmental Permit (EP) (EP No: EP- 591/2021), covering the construction and operation of the rock cavern development, was granted on 20 May 2021.

1.1.4. Subsequent to the completion of the FS, the design of the committed rock cavern development at ARQ site has been proceeded and reviewed under Agreement No. CE 54/2021 (GE) "Joint Cavern Development at Anderson Road Quarry Site – Reprovisioning of Public Works Central Laboratory and Building of Government Records Service's Archives Centre – Investigation, Design and Construction", with a view to minimising project interfaces and achieving better coordination in design and construction by taking advantages of the synergy prospect in shared use of space and/or common provisions. Variation of the EP (EP No: EP- 591/2021) with application no. VEP-616/2022 has been applied and EPD granted the EP (EP-591/2021/A) on 26 July 2022.

1.1.5. In July 2023, Civil Engineering Development Department (CEDD) awarded the Contract No. GE/2022/14 - Joint Cavern Development at Anderson Road Quarry Site to Caverns to China State-Alchmex Join Venture (CSAJV). The Engineer is AECOM Asia Company Limited (AECOM). Atkins China Limited (ACL) has been employed by CSAJV to undertake the detailed design works of civil works. The location of the project is shown in **Figure 1.1**.

1.1.6. A brief description of the works to be carried out under this Contract is listed below:

- The design and construction of the Reprovisioned PWCL Caverns;
- The design and construction of the New AC Caverns;
- The design and construction of the Enabling Adit A (EAA), Enabling Adit B (EAB) and temporary Construction Adits (CA);

1.2. Purpose of this Environmental Review Report (ERR)

1.2.1. This supporting document provides information to identify and describe the potential impacts on the environment and the community due to the proposed amendments and evaluate the potential impacts. The information presented herein forms part of the submission to the Environmental Protection Department (EPD) for an Application for VEP. The purpose of this supporting document is to demonstrate that no unacceptable impacts will be resulted from the proposed amendments and hence a VEP can be granted.

1.2.2. The remainder of this supporting document is presented as follows:

- Section 2 describes the proposed variation since the approval of previous VEP-616/2022 and the key environmental issues;
- Section 3 provides the results of supplementary air quality impact assessment;
- Section 4 provides the results of supplementary noise impact assessment;
- Section 5 provides the ecological impact assessment;
- Section 6 provides the hazard to life review;
- Section 7 reviews the need for any changes of environmental monitoring and audit; and
- Section 8 presents the conclusion.

2. Proposed Variation

2.1. Project Description

2.1.1. The Project includes the excavation of the caverns and tunnel adits together with the building structures and related E&M installation for accommodating the Reprovisioned PWCL and New AC. To safeguard the future cavern development potential of SCVA No. 28, Enabling Adit B with the portal at Anderson Road (namely Portal B) is proposed which is located at the southern part of SCVA No. 28.

Construction Method and Construction Programme

2.1.2. The Enabling Adit B will be excavated by drill and blast method while no delivery of explosive at Portal B is required. The portal area (Portal B) at Anderson Road will adopt mechanical excavation. The extent of construction method of the Project is detailed in **Appendix 2.1**. The drill and blast operation will be carried out in frequency up to once a day and would be carried out outside sensitive hour as far as practicable and the blasting schedule should be submitted to the concerned authority for approval prior for its implementation. The explosive would be delivered to the blasting site by GEO Mine Divisions. Provision of a project magazine and storage of explosives on site in not anticipated.

2.1.3. The duration for cavern formation for PWCL and AC would be about 2 years from mid-2023 to mid-2025, which remains unchanged from VEP-616/2022, and is anticipated to complete before population intake of Sites R2-4 and R2-6 of the Anderson Road Quarry Development. Construction of Enabling Adit B and Portal B will be completed by December 2026, and should not induce any adverse impact to the residential sites within the Anderson Road Quarry Development as it is located remotely within the mountain of Tai Sheung Tok. The construction programme of the Project and the anticipated completion of Sites R2-4 and R2-6 is illustrated in **Table 2.1** below.

Table 2.1 Construction Programme and Completion Timeframe of R2-4 & R2-6

Item	2023	2024	2025	2026	2027
Cavern formation for PWCL and AC					
Construction of Enabling Adit and Portal B					
Project Completion of R2-6					
Project Completion of R2-4					

Note: The project completion year of the planned development is extracted from press release on 1 June 2022 (https://www.info.gov.hk/gia/general/202206/01/P2022060100310.htm)

Operational Use of the Project

2.1.4. As compared to the previous VEP-616/2022, the use of the cavern would remain unchanged, i.e. Reprovisioning of Public Works Central Laboratory and Building of Government Records Service's Archives Centre.

2.1.5. The Portal B at Anderson Road would be closed during the operational phase.

2.2. Proposed Variation

2.2.1. As the Project has progressed to the detailed design and build stage, more detailed engineering information has become available. **Table 2.2** below list out the proposed variation and the rationale of change as compared to the previous VEP-616/2022.

Table 2.2 Proposed Variation

Item No.	Proposed Change	Rationale
A	Addition of Enabling Adit B and tunnel portal (Portal B) next to Anderson Road	Provide access for future cavern development(s) within SCVA No. 28 – Tai Sheung Tok

2.3. Key Environmental Issues

2.3.1. The potential environmental impacts associated with the proposed variations are summarized in **Table 2.3** below.

Table 2.3 Key Environmental Issues

Environmental Aspects	Environmental issues of the proposed variations as compared to VEP-616/2022	Detailed Evaluation of Environmental Impacts
Construction Phase		
Construction Dust	Inclusion of tunnel portal area (Portal B) which may generate construction dust	Refer to Section 3
Construction Noise	Inclusion of tunnel portal area (Portal B) which may generate construction noise	Refer to Section 4
Water Quality	No direct impact on the water bodies	Refer to Section 2.3.2
Waste Management	Inclusion of tunnel portal area (Portal B) and Enabling Adit B, additional waste from the tunnelling work	Refer to Section 2.3.4
Ecology	Inclusion of tunnel portal area (Portal B) which would affect the existing secondary woodland.	Refer to Section 5
Hazard to Life	No blasting of portal area (Portal B) is needed while the Enabling Adit B with drill & blast method	Refer to Section 6
Cultural Heritage	No cultural heritage resources are identified within 50m of the portal area (Portal B).	Refer to Section 2.3.6
Operational Phase		
Air	No air pollution sources at the portal area	Refer to Section 3
Noise	No fixed plant noise sources at the portal area	Refer to Section 4
Water Quality	No water pollution source is anticipated	Refer to Section 2.3.3
Waste	No waste generation is anticipated	Refer to Section 2.3.5

Water Quality

2.3.2. As shown in **Figure 5.2**, there are two streams located in the vicinity of the Portal B area, while the site formation works has been designed to avoid direct encroachment on the watercourses identified within the Portal B area, no water quality impact during construction phase would be envisaged.

2.3.3. During the operational phase, no water pollution source is anticipated from the portal. Proper surface drainage system would be provided at the Portal B area that fitted with appropriate design measures to control pollution of drainage water before entering receiving bodies of water.

Waste Management

2.3.4. The volume of the caverns of the PWCL Portion and AC Portion would be the same as in the VEP-616/2022 and the C&D materials generated from building structural works has already been reduced due to the adoption of MiC/DfMA method. An additional C&D materials [approximately 63,700 m^3 inert C&D materials and 1,300 m^3 of non-inert C&D materials] would be generated from the enabling adit B and site formation works of Portal B. The workforces to be employed is expected to be 100 workers per day for the addition of Enabling Adit B and Portal B. Based on a generate rate of 0.94 kg per worker per day, approximately 94 kg of general refuse would be generated per day during the construction phase, the chemical wastes to be generated from plant and equipment maintenance is anticipated to be in the similar order of a few cubic meters per month. Similar to that in the approved PP for DIR, about 80% of the additional excavated rock would be sent to quarry and 20% would be sent to public fills reception facilities (PFRF) for recycle / beneficial reuse. A Construction and Demolition Material Management Plan (C&DMMP) following requirements as stipulated in Section 4.1.3 of Chapter 4 of the Project Administration Handbook (PAH) for Civil Engineering Works "Management of Construction and Demolition Material Including Rock" published by CEDD would be prepared based on the latest design described in Section 2.1 of for CEDD's vetting. With the implementation of standard good site practice and recommended appropriate mitigation measures in the approved PP for DIR, no adverse impact on waste management would be anticipated and hence no material change to waste management would be resulted from this change. No further review of waste management is considered necessary.

2.3.5. No generation of waste is anticipated during operation phase due to the proposed variation.

Cultural Heritage

2.3.6. Given that there are no major changes in the existing / planned land uses upon completion of VEP-616/2022 and no cultural heritage / archaeological resources (such as Site of Archaeological Interest (SAI), Declared Monuments and archaeological potential areas) identified within or in the vicinity of the addition of Portal B area, no cultural heritage impacts would be envisaged. No further review of cultural heritage is considered necessary. Nevertheless, if there are any buildings / structures both at grade level and underground which were built in or before 1969, or discovery of antiquities or supposed antiquities in the course of works, the Antiquities and Monuments Office (AMO) should be alerted in an early stage or once identified.

3. Air Quality

3.1. Introduction

3.1.1. This section presents a further review on the findings and recommendations of air quality assessment in the approved VEP-616/2022, taking into account the proposed design changes.

3.2. Environmental Legislation, Standards and Guidelines

3.2.1. The relevant legislations, standards and guidelines applicable to the present study for the assessment of air quality impact include:

- Air Pollution Control Ordinance (APCO) Cap. 311;
- Air Pollution Control (Construction Dust) Regulation;
- Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation;
- Recommended Pollution Control Clauses for Construction Contracts;
- Hong Kong Planning Standards and Guidelines (HKPSG);
- Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM);
- Development Bureau Technical Circular (Works) No. 13/2020 Timely Application of Temporary Electricity and Water Supply for Public Works Contract and Wider Use of Electric Vehicles in Public Works Contracts; and
- Development Bureau Technical Circular (Works) No. 1/2015 Emissions Control of NRMM in Capital Works Contracts of Public Works

3.2.2. The new set of Air Quality Objectives (AQOs) came into effect on 1 January 2022. A transitional period is provided under the Air Pollution Control (Amendment) Bill to the effect that, for a project in respect of which an EP has been issued under the EIAO before 1 January 2022, the new AQOs will not apply to an application for variation of an EP submitted within 36 months from 1 January 2022. As such, the previous AQO adopted in the approved PP for DIR, which was put in force since 1 January 2014, remains valid for this VEP document.

3.3. Baseline Condition

3.3.1. The existing air quality within the Air Quality Study Area is dominated by vehicle emission from nearby Po Lam Road and construction activities for the entire Anderson Quarry site.

3.3.2. There is no EPD Air Quality Monitoring Station (AQMS) in operation in the vicinity of the proposed cavern development. The nearest AQMS is located in Kwun Tong (situated at Kwun Tong Police Station, 9 Lei Yue Mun Road, Kwun Tong, Kowloon). The monitored air quality data from this station between 2018 to 2022 for the relevant pollutants at this station are summarized in **Table 3.1** and considered to be representative of the air quality condition at the proposed cavern development.

Table 3.1 Ambient Concentrations of Pollutants at Kwun Tong Monitoring Station (Year 2018 – 2022)

Pollutant	Averaging Time	Concentration (µg/m³)					
		2018	2019	2020	2021	2022	Prevailing AQOs(3) (µg/m³)
Respirable Suspended Particulates (RSP)	24-hr (10th Highest)	78	73	67	72	49	100 (9)
	Annual	38	38	32	31	24	50
Fine Suspended Particulates (FSP)	24-hr (19th Highest)	38	40	32	32	31	50 (18)

Pollutant	Averaging Time	Concentration (μg/m³)					
		2018	2019	2020	2021	2022	Prevailing AQOs(3) (μg/m³)
	24-hr (36th Highest)	34	34	27	28	26	50 (16)
	Annual	22	21	16	17	14	25
Nitrogen Dioxide (NO_2)	1-hr (19th Highest)	178	184	153	164	145	200 (18)
	Annual	**43**	**45**	**43**	**49**	**45**	40
Sulphur Dioxide (SO_2)	10-min (4th Highest)	51	41	24	24	19	500 (3)
	24-hr (4th Highest)	12	11	8	7	11	50 (3)
Ozone (O_3)	8-hr (10th Highest)	130	150	126	136	148	160 (9)
Carbon Monoxide (CO)	1-hr (1st Highest)	-	-	-	-	-	35,000
	8-hr (1st Highest)	-	-	-	-	-	10,000

Notes:

(1) The monitoring data is published on EPD's website: https://www.aqhi.gov.hk/en/download/air-quality-reportse469.html?showall=&start=1

(2) Monitoring results exceeding the prevailing AQOs during the monitoring period are in bold and underlined.

(3) The prevailing AQOs indicated in Table 3.1 were effective during the air quality monitoring period between 2018 and 2021. They have been replaced by the prevailing AQOs that have taken effect since 1 January 2022. Numbers in bracket refer to allowable number of exceedances.

3.3.1. As presented in **Table 3.1,** annual averaged concentration of NO_2 from 2018 to 2022 had exceeded the respective Air Quality Objectives (AQOs) during the monitoring period whereas concentrations of other pollutants from 2018 to 2022 were within the respective AQOs.

Predicted Background Air Quality

3.3.2. Background air quality has also been predicted based on hourly concentration data extracted from the EPD's Pollutants in the Atmosphere and their Transport over Hong Kong version 3.0 (PATH v3.0) model, which provides the latest predicted background data up to Year 2030, Year 2035 and Year 2040. The air quality study area is covered by the PATH v3.0 Grids (46,34), (47,34), (46,33) and (47,33). Given that the construction works would be commenced in mid 2024 tentatively, the predicted concentration data for the relevant pollutants for Year 2024 is presented. **Table 3.2** provides a summary of the predicted background levels against the prevailing AQOs. No exceedances of the AQOs except O_3 are predicted for the background concentration.

Table 3.2 PATH Background Data

Air Pollutant	Average Time	Prevailing AQO (μg/m³) [1]	Data Summary	PATH v3.0 Year 2024 (μg/m³)			
PATH Grid				(46,34)	(47,34)	(46,33)	(47,33)
RSP	24-hour	100 (9)	10th	63.05	64.57	66.32	64
			Exceedance	0	0	0	0
	Annual	50	-	25.91	26.84	27.98	27.02
FSP	24-hour	50 (18,35)	19th	30.5	30.6	32.17	30.91
			36th	21.76	22.52	24.56	22.96
			Exceedance	7	8	8	7
	Annual	25	-	13.87	14.29	15.15	14.5
NO_2	1-hour	200 (18)	19th	75.95	74.49	85.56	88.31
			Exceedance	0	0	0	0

Air Pollutant	Average Time	Prevailing AQO (μg/m³) [1]	Data Summary	PATH v3.0 Year 2024 (μg/m³)			
PATH Grid				(46,34)	(47,34)	(46,33)	(47,33)
	Annual	40	-	10.74	11.4	15.39	14.53
SO_2	10-Min	500 (3)	4th	52.37	44.69	44.96	44.99
			Exceedance	0	0	0	0
	24-hour	50 (3)	4th	9.73	9.78	9.83	9.78
			Exceedance	0	0	0	0
O_3	8-Hour	160 (9)	10th	**199.34**	**197.27**	**189.25**	**192.1**
			Exceedance	40	36	32	35
CO	1-Hour	35000 (0)	1st	855.92	868.65	876.71	867.74
			Exceedance	0	0	0	0
	8-Hour	10000 (0)	1st	754.91	766.36	772.5	759.14
			Exceedance	0	0	0	0

Note:

(1) Value in ( ) indicates the number of exceedances allowed per year.

(2) Monitoring results exceeding the prevailing AQOs are in bold and underlined.

3.4. Identification of Air Sensitive Receivers

3.4.1. In accordance with Annex 12 of the EIAO-TM, any domestic premises, hotel, hostel, hospital, clinic, nursery, temporary housing accommodation, school, educational institution, office, factory, shop, shopping centre, place of public worship, library, court of law, sports stadium or performing arts centre shall be considered to be air sensitive receiver. Places/premises in which exposure is transient in nature (for example, cycle track, pedestrian walkway, bus stop, mini-bus stop, and taxi stand) are not considered to be air sensitive receivers.

3.4.2. Existing and planned ASRs within 500m from the boundary of the works area have been identified with reference to the latest information provided on the survey maps, topographic maps, aerial photos, land status plans and confirmed by various site surveys undertaken.

3.4.3. With reference to the Kwun Tong OZP No. S/K14N/15, Tseng Lan Shue OZP No. S/SK-TLS/10 and the Tseung Kwan O OZP No. S/TKO/29, the existing and planned ASRs are mainly residential and government, institution and community uses and village type. Details of the identified representative ASRs are shown in **Figure 3.1** and summarised in **Table 3.3**.

Table 3.3 Representative Air Sensitive Receivers

ASR ID	Description	Uses	Assessment Height (mAG)	Approximate Shortest Horizontal Distance from the Nearest Aboveground Works Boundary (m)
A01	Sam Long Village	Residential	1.5	532.8
A02	Siu To Yuen Village	Residential	1.5, 5	289.4
A03	Wo Fat Hing Distillery	Industrial	1.5, 5	438.5
A04	Chi Yum Ching She	Place of Public Worship	1.5	446.6
A05	Planned Residential Development (R2-4) (Project completion in 2026-2027) [1]	Residential	1.5, 5, 10, 50, 80	39.3
A06	Planned Residential	Residential	1.5, 5, 10,	41.8

ASR ID	Description	Uses	Assessment Height (mAG)	Approximate Shortest Horizontal Distance from the Nearest Aboveground Works Boundary (m)
	Development (R2-4) (Project completion in 2026-2027) [1]		50, 80	
A07	Planned Residential Development (R2-6) (Project completion in 2025–2026) [1]	Residential	1.5, 5, 10, 50, 80	47.9
A08	Planned Residential Development (R2-6) (Project completion in 2025–2026) [1]	Residential	1.5, 5, 10, 50, 80	42.2
A09	Planned Residential Development (R2-9) (Mount Anderson)	Residential	1.5, 5, 10, 50, 70	153.4
A10	Village House No. 1, Anderson Road (Existing)	Residential	1.5, 5	90.4
A11	Heave of Hope Sunnyside School (Existing)	Educational Institution	1.5, 5, 10	181.9
A12	Star Legend Terrace (Existing)	Residential	1.5, 5, 10	121.2
A13	Open Space (Planned)	Recreational	1.5	97.9

Note:

(1) The project completion year of the planned development is extracted from press release on 1 June 2022 (https://www.info.gov.hk/gia/general/202206/01/P2022060100310.htm)

3.5. Construction Dust Impact Assessment

Main Cavern for PWCL and AC and associated adits

3.5.1. According to the Environmental Review Report (ERR) under the VEP-616/2022, drill and blast construction method for the cavern and tunnel would still be adopted in the current design. The cavern formation will commence immediately without major site formation works. The cavern construction works would be mainly carried out underground/ inside rock mass or enclosed condition except for the building construction and landscaping works at the portal area. The duration for cavern formation for PWCL and AC would be about 2 years from mid-2023 to mid-2025, which remains unchanged from VEP-616/2022, and is anticipated to complete before population intake of Sites R2-4 and R2-6 of the Anderson Road Quarry Development. The following mitigation measures stipulated in the current environmental permit (EP-591/2021/A) would be still applicable during the drill & blast works:

- EP 2.4 – Install the enclosures (acting as blasting door) with ventilation system at all portals before the commencement of any construction works conducted underground/ inside rock mass and during drill and blast works;
- EP 2.5 – The drill & blast works should be carried out with blasting doors fully closed and the blasting works shall be carried out outside the sensitive hours no more than once daily; and
- EP 2.6 – To minimise the construction dust impact, the following dust mitigation measures shall be implemented:

(a) dust collectors with at least 85% dust removal efficiency shall be installed at the ventilation system as mentioned in Condition 2.4 for treatment of exhaust air before discharging to the atmosphere;

(b) the provision of vehicle wheel washing facilities inside the cavern with the blasting doors installed at the portal entrance; and

(c) watering once every working hour to keep active works areas, exposed areas and paved haul roads wet

3.5.2. Hence, it is concluded that there is no change in the construction method and construction scale of this main cavern portion as in the current EP, the construction dust impacts of this portion that evaluated in the ERR under VEP-616/2022 remain valid with the implementation of recommended mitigation measures.

Enabling Adit B and Portal B

3.5.3. Dust impact would be generated from excavation work, site erosion, backfilling, transportation of soil, storage of spoil on site, stockpiling etc. during the construction of Portal B. The tentative construction of Enabling Adit B and Portal B would be commenced in mid 2024 and anticipated to be completed in December 2026. The total excavation volume of the main cavern area and associate adits is 425,000m^3 with approximate daily excavation rate of 1,810m^3. The excavated material is estimated as approximate 63,700m^3 for Enabling Adit B and Portal B, i.e. around daily of 85m^3 excavated material to be handled (assuming 30 months construction works and 25 working days per month). In addition, the excavation works for Enabling Adit B would be scheduled after the completion of the main cavern works. The excavated material would be transported in and out through the main cavern portal with the provision of fully enclosed enclosure and the ventilation system equipped with dust collectors with at least 85% dust removal efficiency would be provided, the location of the fully enclosed enclosure and the ventilation system is shown in **Figure 3.1**.

3.5.4. The main cavern construction works would be carried out underground or enclosed condition except for the building construction and landscaping works, whereas the Enabling Adit B would also be carried out underground while the Portal B would be constructed in open area. With the implementation of hourly watering on the active construction works area (Portal B) to achieve a dust removal efficiency of 87.5% (reference from the Appendix 4.6 – Calculation of Dust Suppression Efficiency from Watering of approved EIA “Development of Anderson Road Quarry site - Rock Cavern Developments” (Register No.: AEIAR-194/2016)) and dust suppression measures stipulated in the Air Pollution Control (Construction Dust) Regulation, no adverse air quality impact to the surrounding ASRs is expected.

3.5.5. Fuel combustion from the use of Powered Mechanical Equipment (PME) during construction works is also a source of particulates, NOx, SO_2 and CO. The construction plant operating simultaneously on-site will be limited to less than 20 and therefore, the potential gaseous emissions from these plant and equipment are expected to be minimal and unlikely to cause adverse air quality impacts. Limited smoke and gaseous emissions would be generated from equipment with proper maintenance. In addition, according to the Air Pollution Control (Non-road Mobile Machinery (NRMM)) (Emission) Regulation, starting from 1 December 2015, only approved or exempted NRMMs with a proper label are allowed to be used in specified activities and locations including construction sites. The Contractor is required to ensure the adopted machines or non-road vehicle under the Project could meet the prescribed emission standards and requirement. In addition, legal control is imposed on the types of fuels allowed for use and their sulphur contents in commercial and industrial processes under the Air Pollution Control (Fuel Restriction) Regulation. To control the exhaust emissions from construction plant and equipment, the sulphur content of liquid fuel shall not exceed 0.005%. Hence, with the implementation of the said Regulation, the emissions from PMEs are considered relatively low, no adverse air quality impact to the surrounding ASRs is expected.

3.5.6. Dust impact would be generated from blasting works for Enabling Adit B and also the transportation of excavated material through the portal next to On Yu Road. The underground blasting works for Enabling Adit B would be carried out after the main cavern blasting works and the nearest distance between the Enabling Adit B and the nearest sensitive receiver (A08) would be over 180m. With this separation distance together with the implementation of mitigation measures in accordance with the EP Conditions 2.4, 2.5 and 2.6, the dust impact from the blasting works is insignificant.

3.5.7. For the transportation of excavated material through the portal next to On Yu Road, it is estimated a maximum of 10 dump trucks per hour for transportation of excavated material of construction of Enabling Adit B and Portal B. The loaded material of the dump truck would be covered entirely to ensure dusty material would not be leaked from the dump truck according to the APCO's requirement. In case temporary stockpiling of small amount of material is required, the stockpiling location will be covered by tarpaulin sheets as soon as possible.

3.5.8. In conclude, the air quality impacts due to generation of fugitive dust and exhaust emissions from the proposed construction activities are anticipated to be minor.

Cumulative Impact

3.5.9. No concurrent project is identified in the vicinity of the Main Cavern, Enabling Adit B and Portal B, hence no cumulative impact is anticipated.

Mitigation Measures

3.5.10. Dust suppression measures, including watering once per hour, will be incorporated in accordance with the requirements of the Air Pollution Control (Construction Dust) Regulation. Dust filter will be installed at the ventilation system of the emission source at the ventilation exhaust to minimise the dust impact. Mitigation measures have been proposed and presented in **Table 3.4**.

Table 3.4 Summary of Dust Suppression Measures

Process	Description	Dust Suppression Measures
Site Formation and Portal Construction	Heavy construction	• Watering will be provided once per hour.
Blasting	-	• Before blasting, blast nets/ canvas will be installed at the blasting area inside the tunnel/ cavern. Blast door will be installed at the portal and keep closed during blasting. The tunnel ventilation system will be provided with built-in filters for dust removal.
Trucks	Material handling, vehicle leaving the works area	• Vehicles would be required to pass through the wheel washing facilities provided at site exit. • Watering will be provided once per hour.
Shelters with ventilation system equipped with dust collector	All emissions inside cavern	• Shelters with ventilation system equipped with dust collector in the form of dust extraction and collection system with at least 85% dust removal efficiency for treatment before discharging into the atmosphere would be installed to the portal entrance to filter all emissions emitted inside cavern.

3.5.11. The contractor should also implement sufficient dust suppression measures as stipulated under the Air Pollution Control (Construction Dust) Regulation and Recommended Pollution Control Clauses for Construction Contracts, and good site practices wherever applicable, to limit the dust emissions generated. The following mitigation measures would be implemented during the construction phase to minimise impacts on air quality on nearby ASRs.

- In the process of material handling, any material which has the potential to create dust will be treated with water or sprayed with a wetting agent where practicable;
- Any vehicles with an open load compartment used for transferring dusty materials off-site will be

properly fitted with side and tail boards and cover;

- Provision of vehicle wheel washing facilities inside the shelters installed at the portal entrance;
- Stockpiles of sand and aggregate will be enclosed on three sides and water sprays will be used to dampen stored materials and when receiving raw material;
- The construction site will be frequently cleaned and watered to minimise fugitive dust emissions;
- Motorised vehicles on the construction site will be restricted to a maximum speed of 15 km/hr and shall be confined to designated haul routes which will be paved;
- Provide electric power supply for on-site machinery as far as practicable and diesel generators and machinery shall be avoided to minimize the gaseous and particulate emissions;
- Locate all the dusty activities away from any nearby ASRs as far as practicable;
- Erect higher hoarding at the locations with ASRs in immediate proximity to the project site boundary;
- Use of electric vehicles and timely provision of water supply and electricity for construction site;
- Consider using cleaner dump trucks (compliant with more stringent emission standards such as Euro VI) during the construction; and
- Use of appropriate dust suppression measures.

3.6. Operational Phase Impact Assessment

3.6.1. No air and odour pollution sources from the proposed portal. The Enabling Adit B is not a public road and will be handed over to CEDD/GEO and no operation vehicle will be expected to be used / maintained. This Enabling Adit B is to provide an access road for future possible cavern projects.

3.6.2. No adverse air quality during operational phase is anticipated and no mitigation measures is required.

4. Noise

4.1. Introduction

4.1.1. This section presents a further review on the findings and recommendations noise impact assessment in the approved VEP-616/2022, taking into account the proposed design changes.

4.2. Environmental Legislation, Standards and Guidelines

4.2.1. The Noise Control Ordinance (NCO) (Cap. 400) provides the statutory framework for noise control. Noise assessment for the Project has made reference to the following technical memoranda, guidelines and practice notes:

- 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);
- Technical Memorandum for the Assessment of Noise from Places Other Than Domestic Premises, Public Places or Construction Sites (IND-TM);
- Practice Note for Professional Persons on Noise from Construction Activities – Non-statutory Controls (ProPECC PN 1/24); and
- Hong Kong Planning Standards and Guidelines (HKPSG).

4.3. Identification of Noise Sensitive Receivers

4.3.1. The area within 300m from the works boundary is defined as the assessment area for noise impact assessment. Existing and planned noise sensitive receivers (NSRs) within 300m assessment area have been identified with reference to the latest information provided on the survey maps, topographic maps, aerial photos, land status plans and confirmed by site surveys.

4.3.2. With reference to the Kwun Tong OZP No. S/K14N/15, Tseng Lan Shue OZP No. S/SK-TLS/10 and the Tseung Kwan O OZP No. S/TKO/29, the existing NSRs are mainly residential and government, institution and community uses and village type. Details of the identified representative NSRs are shown in **Figure 4.1** and summarised in **Table 4.1**.

Table 4.1 Representative Noise Sensitive Receivers

NSR ID	Description	Uses	Approximate Shortest Horizontal Distance from the Nearest Aboveground Works Boundary (m)
N01	Village House No. 1, Anderson Road	Residential	90.4
N02	Heave of Hope Sunnyside School	Educational Institution	181.9
N03	Star Legend Terrace	Residential	121.2
N04	Planned Residential Development (R2-4)	Residential	39.3
N05	Planned Residential Development (R2-6)	Residential	42.2

4.4. Construction Noise Impact Assessment

4.4.1. The potential construction noise arising would be the use of PME. Cavern construction works to be carried out underground or enclosed condition except for the building construction and landscaping works. The adoption of MiC/DfMA for building structure construction could shorten the construction period and miminise construction noise impacts from building structural works to the nearby sensitive receivers. Shelter/enclosure would be installed at all portals of cavern and construction adits as part of the set-up works to protect the nearby existing and planned NSRs against the potential noise impacts from works undertaken underground/inside rock mass. With the provision of shelter/enclosure to fully enclose the portal areas and the adoption of standard good site practice and recommended mitigation measures as presented in the approved PP for DIR and VEP-616/2022, no adverse construction noise impact arising from the variations is anticipated. In addition, the cavern formation works would be completed before population intake of Sites R2-4 and R2-6. Hence, no material change to construction noise impact would be resulted from the proposed changes at representative NSR04 and NSR05.

4.4.2. No construction works will be carried out during restricted hours and no percussive piling work is expected. Should restricted hours works be required, the contractor shall apply for a Construction Noise Permit (CNP) and ensure full compliance with the NCO.

Assessment Methodology

4.4.3. The construction works associated at the Portal B include two main construction activities, (1) Portal B site formation works and (2) soft ground tunnelling works. The soft ground tunnelling works would only be carried out after the site formation works and hence both construction activities would not be carried out concurrently. The potential construction noise arising from the Portal B would be the use of PME. The key PMEs to be used for the construction works activities includes backhoe, breaker, drill rig, mobile crane, air compressors, generators and dump trucks etc.

4.4.4. The preliminary plant inventory is provided in **Appendix 4.1**. The plant inventory presented has been confirmed by the Contractor to be reasonable and practicable for the intended Project programme.

4.4.5. The construction noise impact assessment was undertaken in accordance with Annexes 5 and 13 of the EIAO-TM and the procedures outlined in the Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM).

4.4.6. The works are standard civil engineering works and the equipment will be those typically found in similar projects. The equipment used in the noise calculation was based on other similar environmental assessment, site experience and was reviewed by the Contractor. The types and numbers of PME and the percentage on time of each type of PME used in the calculation were confirmed to be reasonable and practical by the Contractor based on the tentative construction programme and the PME items have already represented the worst-case scenario concerning the construction noise impact for this assessment, though there may be variation in the actual construction stage. It should be noted that this is an assumption of the most likely equipment to be used.

4.4.7. The construction noise impacts at the nearest sensitive facades of the NSRs were assessed. The sound pressure level (SPL) of each construction task at NSRs was calculated, depending on the number of PME items involved and the distance from the NSRs. To account for the façade effect at each noise assessment point, a +3 dB(A) façade correction was applied to the predicted noise levels. For determining the distance correction factors, the horizontal distances between the site boundary of Portal B and the NSRs were used as a more conservative approach.

Prediction and Evaluation of Construction Noise Impacts

4.4.8. The unmitigated construction noise levels at the representative NSRs near Portal B as shown in **Figure 4.1** were predicted and summarised in **Table 4.2** with detailed results presented in **Appendix 4.2**.

Table 4.2 Predicted Construction Noise Level (Unmitigated Scenario)

NSR ID	Description	Noise Criteria, $L_{eq\ (30\ mins)}$, dB(A)	Predicted Maximum Noise Level, $L_{eq\ (30\ mins)}$, dB(A)
N01	Village House No. 1, Anderson Road	75	79
N02	Heave of Hope Sunnyside School	70 (65)	73
N03	Star Legend Terrace	75	76

4.4.9. The predicted noise levels at the representative NSRs range from 73 to 79 dB(A). Results indicate that the construction noise levels at the representative NSRs exceeded the daytime construction noise criteria. Therefore, mitigation measures will be required.

Mitigation Measures

4.4.10. The use of quiet PME is considered to be a practicable means to mitigate the construction noise impact. Quiet PMEs that have been adopted in the assessment are presented in **Appendix 4.3**.

4.4.11. Standard noise control measures such as adoption of quieter construction method, use of quieter PMEs with lower sound power level (SWL), use of movable noise barriers and noise enclosure to screen noise from PMEs, and implementation of good site practices to limit noise emissions at source would be implemented to ensure the construction noise impact would be minimised during the construction phase.

4.4.12. It is recommended that noisy equipment shall be replaced by quieter alternatives where possible. Silenced diesel and gasoline generators and power units, as well as silenced and super-silenced air compressors can be readily obtained. The noise control requirements stipulated in the "Recommended Pollution Control Clauses for Construction Contracts" of the EPD shall also be followed.

4.4.13. Quieter equipment shall be adopted as far as possible. Reference should be been made to the quieter construction equipment items qualified under the Quality Powered Mechanical Equipment (QPME) system developed by EPD, the quieter construction equipment/methods suggested in EPD website and the PMEs specified in British Standard 5228 1:2009+A1:2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise (BS 5228). These are quieter PMEs available in the local market. As per suggestion from the website from EPD and guideline in standard 5228 1:2009+A1:2014, the proposed quieter PMEs are technically feasible and practicable to replace the original PMEs for the intended construction programme.

4.4.14. The use of movable noise barriers is an effective means to mitigate the noise impact arising from the construction works. The use of noise barrier for certain PME could generally provide a 5 dB(A) reduction for movable PME and 10 dB(A) for stationary PME. The noise barriers shall have a minimum surface density of 10 kg/m^2 and fitted with appropriate absorptive material to minimize multiple reflections of noise due to confined space of the surroundings and the barriers. The contractor shall be responsible for the design and actual position of the movable noise barriers with due consideration given to the position and size of the PME, and the requirement of intercepting the line of sight from the NSRs to the PME, as well as ensuring that the barriers have no gaps and openings.

4.4.15. Noise enclosure with a sufficient surface density of no less than 10 kg/m^2 can be used to surround certain PMEs. The internal wall of the enclosure should be lined with 50 mm of sound-absorbent material, or with 25 mm of similar material if mounted on battens. Without direct view of the noisy part of the enclosed PME from NSRs, this design can achieve 10 dB(A) and 15 dB(A) reduction for stationary and static PMEs respectively.

4.4.16. The mitigated construction noise levels at the representative NSRs were predicted and summarised in **Table 4.3** with detailed results presented in **Appendix 4.4**.

Table 4.3 Predicted Construction Noise Level (Mitigated Scenario)

NSR ID	Description	Noise Criteria, $L_{eq\ (30\ mins)}$, dB(A)	Range of Predicted Noise Level, $L_{eq\ (30\ mins)}$, dB(A)
N01	Village House No. 1, Anderson Road	75	64 – 66
N02	Heave of Hope Sunnyside School	70 (65)	58 – 66
N03	Star Legend Terrace	75	62 – 64

4.4.17. With the adoption of the recommended mitigation measures, the construction noise levels at all the representative NSRs will comply with the required noise criteria.

4.4.18. Good site practice and noise management can significantly reduce the impact of construction activities on nearby NSRs. The noise benefits of these practices can vary according to specific site conditions and operations. The following site practices should be followed during the construction of the Project:

- Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction works;
- Machines and plant that may be in intermittent use should be shut down between work periods or throttled down to a minimum;
- Plant known to emit noise strongly in one direction should, where possible, be orientated to direct noise away from the nearby NSRs;
- Mobile plant should be sited as far away from NSRs as possible;
- Silencers or mufflers on construction equipment should be utilised where appropriate and properly maintained during the construction period;
- Material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities; and
- The contractor should devise, arrange methods of working and carry out the works in such manner as to minimise noise impacts on the surrounding environment, and should provide experienced personnel with suitable training to ensure that all these measures are implemented properly.

4.4.19. With the adoption of the recommended mitigation measures, no adverse construction noise impact is anticipated.

4.5. Operational Noise Impact Assessment

4.5.1. No ventilation building is required for the Portal B and hence no fixed plant noise for Portal B is anticipated.

5. Ecology

5.1. Introduction

5.1.1. This section assesses the potential ecological impact arising from the recent design changes to the proposed cavern development at ARQ Site and proposes mitigation measures wherever necessary to ensure no significant ecological impacts would occur to habitats and wildlife.

5.1.2. As discussed in Section 2, the proposed design change includes the addition of Enabling Adit B (EAB) and a tunnel portal (Portal B) next to Anderson Road, which is to provide access for future cavern development(s) within SCVA No. 28. Since EAB is underground works, from an ecological perspective, the assessment focuses on the above-ground works, which compromise the adit portal and associated slope works etc.

5.2. Environmental Legislation, Standards and Guidelines

Local Legislation, Standards and Guidelines

5.2.1. The relevant local legislation, standards and guidelines applicable to the present assessment of ecological impacts include:

- Forests and Countryside Ordinance (Cap. 96) and its subsidiary legislation, the Forestry Regulations (Cap. 96A),
- Wild Animals Protection Ordinance (Cap. 170),
- Country Parks Ordinance (Cap. 208) and its subsidiary legislation,
- Environmental Impact Assessment Ordinance (EIAO) (Cap. 499) and relevant annexes 8, 9, 11, 16, 17, 20 and 21 of the associated Technical Memorandum (EIAO-TM),
- Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) and its subsidiary legislation,
- EIAO Guidance Note No. 6/2010 – Some Observations on Ecological Assessment from the Environmental Impact Assessment Ordinance Perspective,
- EIAO Guidance Note No. 7/2010 – Ecological Baseline Survey for Ecological Assessment,
- EIAO Guidance Note No. 10/2010 – Methodologies for Terrestrial and Freshwater Ecological Baseline Surveys,
- List of Wild Animals under State Protection in China, and
- List of Wild Plants under State Protection in China.

International Conventions and Guidelines

5.2.2. International conventions and guidelines potentially relevant include:

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (“CITES”), and
- United Nations Convention on Biological Diversity.

5.3. Ecological Baseline

General

5.3.1. The area of the proposed portal at Anderson Road is part of a natural terrain where multiple ecological elements such as secondary woodland and stream courses are present. The area is located within the "Green Belt" zone under approved Kwun Tong (North) Outline Zoning Plan No. S/K14N/15. The planning intention of this zone is primarily for the conservation of the existing natural environment. A wooded area zoned as "Conservation Area" under approved Tseng Lan Shue Outline Zoning Plan No. S/SK-TLS/10 is situated about 60m to the northeast of the portal. This zoning is intended to protect and retain the existing and natural landscape, ecological or topographical features of the area for conservation, education and research purposes. There is a general presumption against development in both zones.

Literature Review

5.3.2. Two EIA studies conducted in the area around the proposed portal were reviewed:

- CEDD Agreement No. CE 10/2014 (CE) Development of Anderson Road Quarry Site – Road Improvement Works (January 2016); and
- CEDD Agreement No. CE 18/2012 (CE) Development of Anderson Road Quarry – Investigation (June 2014).

5.3.3. According to the results of habitat mapping in the above EIA studies, secondary woodland is the only habitat identified within the proposed portal extent, while secondary woodland, watercourse and developed area are major habitats present in vicinity. The secondary woodland is dominated by common and native woodland species, including trees *Celtis sinensis, Machilus chekiangensis, Schefflera heptaphylla, Litsea glutinosa,* shrubs *Eurya nitida, Litsea rotundifolia* var. *oblongifolia* and *Psychotria asiatica*. This patch of woodland is relatively young when compared to the mature woodland to the north at Tai Sheung Tok. Three plant species of conservation importance were recorded in the woodland around the area, namely *Canthium dicoccum, Ormosia pachycarpa* and *Diospyros vaccinioides.* None of them were recorded within the proposed portal extent. *Ormosia pachycarpa* is listed as Endangered in the China Plant Red Data Book and regarded as a rare and precious plants in Hong Kong (AFCD, 2003). For *Diospyros vaccinioides*, it is listed as Critically Endangered (CR) in the IUCN Red List (IUCN, 2023), though it is very common in the natural hillsides of Hong Kong. *Canthium dicoccum* is listed as Vulnerable by IUCN (2023) but assessed as common in Hong Kong (Corlett *et al.,* 2000; Hong Kong Herbarium, 2022).

5.3.4. Four faunal species of conservation importance were recorded near the proposed portal, including Yellow Rajah *Charaxes marmax* (butterfly) in the secondary woodland, Emerald Cascader Zygonyx iris insignis (dragonfly), Lesser Spiny Frog *Quasipaa exilispinosa* and the freshwater crab species *Cryptopotamon anacoluthon* in the watercourses. Yellow Rajah is considered as of Local Concern, while the other three are regarded as of Potential Global Concern (Fellowes *et al.* 2002). Moreover, Lesser Spiny Frog is assessed as Vulnerable globally and nationally (IUCN, 2023; Jiang *et al.*, 2016), while *Cryptopotamon anacoluthon* is listed to be globally Endangered by IUCN (2023).

Ecological Baseline Survey

5.3.5. In view of the small scale of the above-ground works and presence of existing ecological data, an ecological baseline survey covering the following aspects was conducted on the 25th and 28th of September 2023 to collect a representative and up-to-date ecological baseline for the following assessment of the potential ecological impacts. The Survey Extent covered the above-ground works area (i.e. proposed Portal Extent and Soil Nail Extent) and their vicinity (approx. 100m buffer, **Figure 5.1** refers)

Table 5.1 Survey Scope in September 2023

Type	Survey Time
Habitat and Vegetation	daytime
Mammal	daytime and nighttime
Herpetofauna	daytime and nighttime
Avifauna	early morning, dusk and nighttime
Odonate and Butterfly	daytime
Firefly	dusk and nighttime
Aquatic fauna (fish & invertebrate)	daytime

Habitat and Vegetation

5.3.6. Four habitats were identified within the Survey Extent, namely secondary woodland, agricultural land/ open space, stream and built-up area. The above-ground works area is currently occupied with secondary woodland. The survey recorded a total of 150 plant species, no mammal species, 17 bird species, seven herpetofauna species, 18 butterfly species, two odonata species, four freshwater fauna species and one firefly species. Among these, 68 plant species were found in the proposed above-ground Works Area, as well as four bird species and 16 butterfly species. The habitat map prepared based on this survey is in **Figure 5.2**. The flora and fauna lists are presented in **Appendix 5.1**. The representative habitat photos and photos of recorded species of conservation importance are in **Appendix 5.2**.

5.3.7. The proposed Above-ground Works Area falls within a secondary woodland, as an extension of the same habitat at Tai Sheung Tok. The woodland has a continuous, moderately-dense tree canopy with 8-10 m tall. The dominant trees are *Machilus chekiangensis*, *Acronychia pedunculata* and *Schefflera heptaphylla*. The understorey is mainly occupied by *Litsea rotundifolia* var. *oblongifolia*, *Desmos chinensis* and *Phyllanthus cochinchinensis*, which is also typical in most hillsides of Hong Kong. Two clusters of *Aquilaria sinensis* are located at the proposed Soil Nail Extent, where five individuals in the Cluster 1 and at least 10 individuals in the Cluster 2. There is also one individual near the southeast corner of the proposed Portal Extent. Additionally, two individuals of *Diospyros vaccinioides* are located at the Cluster 2 area. The locations of the recorded plant species of conservation importance are shown in **Figure 5.2**.

5.3.8. The 100m Survey Extent surrounding the proposed Above-ground Works Area is also mainly secondary woodland. The agricultural land within the 100 m survey extent, is likely to be created by villagers living nearby, where huts in a bad condition were seen near the farmland. Signs of vegetation clearance were seen and various crops are grown around the area. There is no species of conservation importance recorded in this habitat. There are four plant species of conservation importance present in the secondary woodland in the 100 m survey extent (**Figure 5.2**), including 13 individuals of *Ormosia pachycarpa* (three marked individuals and 10 seedlings in Cluster 3), one *Rhododendron simsii*, three *Aquilaria sinensis* and two *Diospyros vaccinioides* (they are growing adjacent to each other). Any native *Rhododendron* spp. in Hong Kong is protected under the Forestry Regulations (Cap. 96A); and *O. pachycarpa* is listed as Endangered in the China Plant Red Data Book and is regarded as a rare and precious plants in Hong Kong (AFCD, 2003).

Fauna

5.3.9. No mammals were recorded within the Survey Extent based on the two-day ecological surveys.

5.3.10. A total of 17 bird species were recorded in the Survey Extent, with four bird species in the proposed Portal Extent, one in the proposed Soil Nail Extent, 13 in the surrounding woodland area, one in the stream course nearby and none in the other habitats. Two species of conservation importance were recorded, i.e. two Black Kites and one Greater Coucal seen and/or heard in the woodland outside the

proposed Above-ground Works Area. However, the Black Kites were seen flying over the woodland and were not strictly associated with the habitat, which therefore constitutes no particular conservation concern from an ecological point of view. There were also no signs of breeding activities for the recorded Greater Coucal individual.

5.3.11. A total of seven herpetofaunal species were recorded within the Survey Extent. Among them, five were recorded in the stream course near the proposed Above-ground Works Area. The other two species, namely Brown Tree Frog and Asian Common Toad, were seen in the woodland and the agricultural land respectively. Two species present in the stream course, Anderson's Stream Snake and Lesser Spiny Frog, are regarded as of conservation importance. Anderson's Stream Snake is of potential global concern (Fellowes et al., 2002) and considered as Near Threatened in both Conservation status by Red List of China's Vertebrates (Jiang et al., 2016) and the IUCN Red List (IUCN, 2023); and Lesser Spiny Frog is of potential global concern (Fellowes et al., 2002) and listed as Vulnerable in both Conservation status by Red List of China's Vertebrates (Jiang et al., 2016) and the IUCN Red List (IUCN, 2023). Both were recorded in the "stream fauna" cluster shown in **Figure 5.2**. As tadpoles of Lesser Spiny Frog were seen in the stream, which are unlikely to be washed down from upstream due to absence of any heavy precipitation before the survey, this portion of the stream is a potential breeding ground of Lesser Spiny Frog.

5.3.12. A total of 18 butterfly species were recorded within the Survey Extent. Among them the majority are either very common or common species in Hong Kong. One species of conservation importance, namely Malayan, was recorded in the agricultural land to the east of the proposed Above-ground Works Area. This species is classified as Local Concern (Fellowes et al., 2002); during the survey, it was recorded in the agricultural land (**Figure 5.2**).

5.3.13. Two species of odonates were recorded within the Survey Extent, namely Lesser Blue Skimmer and Black-banded Gossamerwing. Both are common in Hong Kong without any particular conservation concern.

5.3.14. Four freshwater fauna were recorded in the stream course near the proposed Above-ground Works Area (**Figure 5.2**). Among them two freshwater crab species are of conservation importance, namely *Cryptopotamon anacoluthon* and *Nanhaipotamon hongkongense*. The former is of potential global concern (Fellowes et al., 2002) and listed as Vulnerable in the IUCN Red List (IUCN, 2023); while the latter is another species of potential global concern (Fellowes et al., 2002). Both species were found in the "stream fauna" cluster shown in **Figure 5.2**.

5.3.15. One firefly species, *Pygoluciola qingyu*, was recorded in the stream course east of the proposed Above-ground Works Area. A minimum of 15 larvae were found near the "stream fauna" cluster shown in **Figure 5.2**, without seeing any adults. It is a common species in Hong Kong, widely distributed along natural streams at all elevations (Viu, 2020).

5.4. Habitat Evaluation

5.4.1. Based on the flora composition and wildlife usage of each habitat, the baseline conditions of each habitat in the Survey Extent are summarised and evaluated in **Table 5.2**.

Table 5.2 Summary and Evaluation of Habitats within Survey Extent

Habitat	Location and Brief Description	Ecological Value
Secondary Woodland	Part of the continuous woodland at Tai Sheung Tok, mainly vegetated by native trees and shrubs species that are typical to the hillsides of Hong Kong. Floral species of conservation importance recorded: Within Above-ground Works Area: *Aquilaria sinensis* and *Diospyros vaccinioides*; Within Survey Extent (outside Above-ground Works Area): *Aquilaria sinensis, Diospyros vaccinioides*, *Ormosia pachycarpa* and *Rhododendron simsii* Fauna species of conservation importance recorded:	Secondary Woodland within Survey Extent: **Moderate**; secondary woodland within proposed Above-ground Works Area: **Low to Moderate** in view of its location on the woodland edge

Habitat	Location and Brief Description	Ecological Value
	Within Above-ground Works Area: not recorded; Within Survey Extent (outside Above-ground Works Area): Black Kite (flying over) and Greater Coucal.	and adjacency to Anderson Road.
Agricultural Land/ Open Space	Outside the proposed Above-ground Works Area. The portion to the north of Po Lam Road is ecologically connected to the surrounding secondary woodland, with signs of vegetation clearance. Both the northern and southern portions comprise village settlements, farmlands, and other associated structures. The vegetation is consisted of various crops. Floral species of conservation importance recorded: Not recorded. Fauna species of conservation importance recorded: Malayan	Agricultural land to the north of Po Lam Road: **Low to Moderate**, in view of the size and linkage with nearby woodland; agricultural land/ open space to the south of Po Lam Road: **Low**.
Stream	Outside the proposed Above-ground Works Area. A largely natural stream course with secondary forest forming the major stream bank vegetation. Terrestrial plants are scarce along the stream course as it largely consists of boulders. Other streams in the Survey Extent are seasonal, with no or very low water flow and volumn observed during the survey. Floral species of conservation importance recorded: Not recorded. Fauna species of conservation importance recorded: Anderson's Stream Snake, Lesser Spiny Frog, *Cryptopotamon anacoluthon* and *Nanhaipotamon hongkongense*	The stream to the east of the proposed Above-ground Works Area: **Moderate**; The other streams in Survey Extent: **Low**.
Built-up Area	Outside the proposed Above-ground Works Area. Comprised mainly road infrastructures and construction site. Highly urbanised and disturbed. Floral species of conservation importance recorded: Not recorded. Fauna species of conservation importance recorded: Not recorded.	**Low**.

5.5. Impact Identification and Evaluation

5.5.1. Compared to the design for which the EP (EP-591/2021/A) had been granted, the proposed variation include addition of EAB and the tunnel portal (Portal B) next to Anderson Road. The potential ecological impacts associated with such variated works during the construction and operational phases are listed below.

- Loss of habitat and the associated vegetation due to construction of the above-ground works, i.e. the adit portal and associated slope works installed with soil nails;
- Direct impact on wildlife, esp. fauna species of conservation importance; and
- Indirect impacts on surrounding habitats and associated flora and fauna species, esp. species of conservation importance.

Loss of Habitat and Vegetation

5.5.2. The habitat to be lost to the variated works is limited to the woodland that currently covers the proposed Portal Extent and Soil Nail Extent, with a total area of approximately 0.15ha; and this area of woodland to be permanently lost is considered to have Low to Moderate ecological value due to its location on a woodland edge and adjacency to an access road to an existing construction site. The level of anthropogenic disturbances received by the woodland to be lost is not low.

5.5.3. In view of the small size of woodland to be affected permanently and the existing level of anthropogenic disturbance they are currently receiving, the impact of direct permanent habitat loss

caused by the construction of proposed above-ground works is considered to be of **Low significance**. Direct permanent habitat loss caused by the project due to any maintenance activities during the operational phase would not be anticipated.

5.5.4. It is noted that there are two plant species of conservation importance present within the proposed Above-ground Works Area, including at least 16 individuals of *Aquilaria sinensis* and two individuals of *Diospyros vaccinioides*. All of them are small seedlings to saplings with no more than 2 m tall. Given vegetation clearance would be unavoidable in this proposed Works Area, preserving them *in situ* is unlikely to be an option, or environmental condition becomes undesirable for them to be preserved *in situ*. In the absence of mitigation measures, loss of these individuals (i.e. direct impact of the variated works on plants of conservation importance) is considered to be of **Moderate significance**.

Direct Impact on wildlife, esp. Fauna Species of Conservation Importance

5.5.5. In addition to the direct loss of terrestrial habitats and the colonised vegetation, the construction activities could potentially cause direct injury / mortality to wildlife. Fauna with high mobility (e.g. bats, avifauna and butterflies) are not anticipated to be significantly impacted as they could utilise less disturbed habitats outside the works area. However, fauna with lower mobility (e.g. herpetofauna) would be subjected to higher risk of damage or mortality by construction activities. The woodland to be lost is small, with only birds and butterflies recorded during the survey. The proposed works would probably cause negligible impact to species with larger home range like them. No fauna species of conservation importance nor significant breeding/ nursery grounds were observed. direct impact of the proposed above-ground works on wildlife species (i.e. injury and mortality) is considered to be of **Low significance** during construction and of **Very Low Significance** during operation.

Indirect Impacts on Surrounding Habitats and Associated Flora and Fauna Species

5.5.6. The Above-ground Works Area of the Project is small and localised; only the habitats and associated wildlife in adjacency may be subject to indirect impacts resulting from increased disturbances caused by the Project. Such impact will be limited to construction phase; disturbance during the operational phase would not be anticipated as the activities will be limited to maintenance works when necessary.

5.5.7. Habitats that would potentially receive increased disturbances as a result of the proposed construction works include the adjacent woodland area only. In these area, some plant species of conservation importance (including *Aquilaria sinensis, Diospyros vaccinioides*, *Ormosia pachycarpa* and *Rhododendron simsii*) are present.

5.5.8. Dust generated due to the construction works, if not effectively controlled, could affect the health of adjacent vegetation. Excessive dust covering leaves can lead to reduction in their photosynthetic rates, abrasion and blocking of stomata. Improper dumping of construction materials and waste within and/or near to the works areas may result in environmental degradation of the surrounding habitat, which is more sensitive to the adjacent woodland. Potential disturbance by construction noise and increased human activities may cause wildlife to avoid using areas adjacent to construction site, and thereby reduce wildlife density in the area. However, it should be noted that fauna species of conservation importance were not recorded in the adjacent woodland during the survey. Therefore, without mitigation, such disturbance to the nearby woodland of the construction works would be of **Low to Moderate significance**. As no above-ground works at night time are scheduled during the construction phase, any significant potential ecological impact on nocturnal wildlife (e.g. glare impact) is not anticipated.

5.5.9. In view of the woodland in between, the stream to the east of the above-ground works area is unlikely to be significantly affected by the construction as the potential disturbances would be sufficiently screened out by the dense trees and other vegetation growing in the area.

5.6. Proposed Mitigation Measures

5.6.1. The potential ecological impacts due to construction and operation of the Project are all considered to be of Low Significance, except the direct ecological impact on plant species of conservation importance within the proposed above-ground works area and indirect disturbance to the surrounding woodland habitat. Measures are therefore proposed to mitigate these ecological impacts, with the aim to reduce their significance to an acceptable level.

Mitigation to Direct Loss of Plant Species of Conservation Importance

5.6.2. Before the site formation works at Portal B, a detailed vegetation survey with the objective to update the presence and precise locations of floral species of conservation importance, including but not limited to *Aquilaria sinensis* and *Diospyros vaccinioides* recorded during the current baseline survey, should be undertaken by an experienced Plant Ecologist with at least 3 years' experience in vegetation survey before the commencement of any site clearance work. The survey should cover all the Above-ground Works Areas to be directly affected by the variated works as well as 2m from its site boundary. The Plant Ecologist should earmark the location(s) regardless of size and growth habit of the concerned plant species. The detail vegetation survey should follow the numbering, tagging and reporting requirements of tree survey as stipulated under the DEVB TC(W) No. 4/2020 as far as practicable, and the results should be presented in a plant schedule and location plan.

5.6.3. Suitability for transplanting the plants to be affected by the works should be assessed on an individual basis. A "Preservation and Transplanting Proposal for Flora of Conservation importance (the Proposal)" should be prepared by the Plant Ecologist and submitted to AFCD and the future maintenance department for agreement before the commencement of the transplanting work. In the Proposal, the details of the preservation measures, transplanting arrangement including program, operation, location(s) of the receptor site, site preparation work required etc., as well as monitoring requirements (including trigger-action plan) and maintenance arrangement should be presented. In order to secure a satisfactory post-transplantation survival rate, the proposed receptor site should be the same habitat type to the one where they are growing but with minimal disturbances potentially arising from the variated works of this Project.

Mitigation to Indirect Disturbances to Surrounding Woodland

5.6.4. Potential indirect impacts of the construction activities on adjacent woodland and associated flora and fauna species would be of Low to Moderate Significance in absence of mitigation measures. As no significant ecological impacts arising from the operation of the Project are anticipated, the proposed mitigation measures to minimise disturbances focus on the construction phase. The following construction phase mitigation measures are proposed to reduce predicted disturbance impact to an acceptable level.

- Fences or hoardings along the boundary of the site will be erected before commencement of the construction works to prevent encroachment of workers onto adjacent woodland area;
- Regularly check the construction site boundaries to ensure that they are not breached and that no damage occurs to surrounding ecologically sensitive habitat(s);
- Implement dust suppression measures and Air Pollution Control (Construction Dust) Regulation wherever applicable to limit the dust emissions generated and protect the health of adjacent vegetation;
- To minimise potential degradation of surrounding habitats due to improper dumping of construction materials and waste within and/or near the works areas, provide waste skips to collect general refuse and construction waste, which should be disposed regularly and properly off-site;
- Disposal of C&D materials in accordance with the DEVB TC(W) No. 6/2010 "Trip Ticket System for Disposal of Construction & Demolition Material";
- Implementing measures to avoid/ minimise the potential impact of spillage events, if any;

- Choose quieter plant and use silencers, acoustic louvres or acoustic; where necessary;
- Develop and implement a regularly scheduled plant maintenance programme so that equipment is properly operated and serviced in order to maintain controlled level of noise. The programme should be implemented by properly trained personnel;
- Construction site runoff will be directed into existing drainage channel via adequately designed sand/silt removal facilities incl. sand/silt traps and oil interceptors. Channels, bunds or sandbag barriers will be provided on site to properly direct runoff to such silt removal facilities;
- Appropriate measures including provision of temporary movable toilets and use of drilling fluid recycling system should also be adopted. Controlled wastewater discharge to the nearby water bodies will be implemented in accordance with the guidelines stipulated in EPD's Practice Note for Professional Persons on Construction Site Drainage (ProPECC PN2/23) during the construction works to properly control site run-off and drainage and to minimise the potential water quality impact;
- Excavated materials will be covered and/or properly disposed of as soon as possible to avoid being washed into nearby water bodies; and
- Reinstate temporary work sites/ disturbed areas (if any) immediately after completion of the construction works.

5.7. Precautionary Measures

5.7.1. While construction and operation of the variation works are not anticipated to have significant ecological impact on any steam habitat nearby, it is recommended that any runoff generated from the Works Area shall be gathered and controlled such that contamination of the natural stream course is avoided. After each work day of soil nailing works, exposed earth surface shall be covered with tarpaulin to prevent soil erosion to the stream course nearby. Any run-off generated from construction activities shall be minimized in order to prevent undesirable ecological consequences.

5.7.2. The Portal B at Anderson Road would be closed during the operational phase. Soft landscaping is an option for store the vegetation cover of the above-ground works area. Planting of native species would facilitate natural succession against invasion of exotic species in disturbed areas. Open space also makes the site receive more heat and loss in soil moisture, and consequently more susceptible to invasion of exotic or undesirable weed species, such as *Bidens alba, Lantana camara, Leucaena leucocephala, Mikania micrantha* and *Ageratum conyzoides*. In addition, any invasive plants detected during the construction phase should be uprooted whenever pracitable, packed carefully and removed from the construction site.

5.8. Evaluation of Residual Ecological Impacts

5.8.1. With the implementation of the mitigation measures discussed above, it is predicted that the Project will fully mitigate for its potential significant ecological impacts, adverse residual impacts from construction and operation of the variated works on the ecological resources within and in the vicinity of the Above-ground Works Area of the Project would not be anticipated.

5.8.2. As no adverse impact is anticipated with the implementation of mitigation measures, no environmental monitoring is required, while environmental audit on the mitigation measures implemented during the construction phase is recommended. Details of environmental monitoring requirement is presented in **Section 7**.

6. Hazard to Life

6.1. Introduction

6.1.1. This section provides a review of the hazard to life associated with the storage, use and transport of explosives from the Project during the construction and operation phases.

6.2. Environmental Legislation, Standard and Guidelines

6.2.1. This section provides a review of the hazard to life associated with the storage, use and transport of explosives from the Project during the construction and operation phases.

- Environmental Impact Assessment Ordinance (EIAO), Chapter 499; and
- Annex 4 of Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM)

6.3. Hazard Review

6.3.1. Provision of a project magazine and storage of explosives on site is not required. Although Enabling Adit B would be carried out by drill & blast, the maximum explosives charge weight per delay will still be limited according to the separation distance between the face of blasting and the sensitive receivers, and also the vibration limit of the sensitive receivers. The drill & blast operation will be carried out in frequency up to once a day with shelters acted as blast doors installed at all the construction adit/cavern portals to ensure that the drill-and-blast activities are undertaken underground/inside rock mass in a fully enclosed condition. Blasting would also be carried out outside sensitive hours as far as practicable and the blasting schedule should be submitted to the concerned authority for approval prior for its implementation. The administrative and procedural control of all blasting operations in Hong Kong are vested in the Superintendent of Mines. The DGO also stipulates that no person shall carry out blasting unless he/she possesses a valid Mine Blasting Certificate to be issued by the Superintendent of Mines, who will review applications on a case–by–case basis before issuing a Mine Blasting Certificate.

6.3.2. The Project was originally consisted of four caverns and a tunnel. A portal would also be provided near On Yu Road as an access to the caverns and the tunnel.

6.3.3. In order to cope with the needs of the Project, the tunnel will be extended by 752m and it will be connected with a new portal located near Anderson Road (Portal B).

6.3.4. Similar to other cavern development projects in Hong Kong, drill and blast method will be mainly adopted for the construction of the extended tunnel. However, it will be replaced by drill and break method when it is about 38m from the new portal area (Portal B).

6.3.5. In this Project, both cartridge emulsion explosives and bulk emulsion explosives will be used for the blasting. In addition, the maximum storage capacity of the contractor's explosives delivery truck will be 200kg and the Maximum Instantaneous Charge (MIC) for each blast hole is 10kg. Explosives used for the construction of the Enabling Adit B will not be transported through the new portal area (Portal B).

6.3.6. Accidental detonation of explosives 1) at the portal near On Yu Road, 2) during transport inside the tunnel, and 3) simultaneous detonation of multiple MIC during blasting at blast face of the Enabling Adit B are identified as the three hazardous scenarios associated with the explosive for this Project. Overpressure and ground vibration generated by the hazardous scenarios may pose an impact to the nearby population and sensitive receiver such as building structures and slope. The explosives pickup point by Contractor and transport route by Contractor's truck and also the layout of the extended tunnel and the location of nearby building structures and slopes are given in **Figure 6.1** and **Appendix 6.1**.

6.3.7. The three hazardous scenarios were also identified in Hazard to Life Assessment for the project of CE87 Relocation of Tsuen Wan No. 2 Fresh Water Service Reservoir to Caverns (TWFWSR) (DIR-298/2023), which also adopted drill and blast method for the construction of cavern and tunnel. In the assessment, the impact of overpressure and ground vibration due to the three hazardous scenarios to the nearby population and sensitive receivers were evaluated. Some of the analysis results are extracted from the assessment and they are shown from **Table 6.1** to **Table 6.3**. The analysis results will be made reference for evaluating the impact of drill and blast method to the nearby population and sensitive receivers identified in the current Project.

Table 6.1 Impact to Building Structure and Slope due to Accidental Detonation of Explosives during Transport inside Tunnel/ Cavern (extracted from Hazard to Life Assessment of DIR-298/2023)

Sensitive Receiver	Amount of Explosives (kg)	PPVc (mm/s)	Separation Distance (m)	Vibration (mm/s)	Slope Movement (mm)
Building Structure	200	-	40	55	-
Slope	200	10	40	55	7

Table 6.2 Impact to Building Structure and Slope due to Simultaneous Detonation of 5 MIC during Blasting at Blast Face (extracted from Hazard to Life Assessment of DIR-298/2023)

Sensitive Receiver	MIC (kg)	PPVc (mm/s)	Separation Distance (m)	Vibration due to Detonation of 5MIC (mm/s)	Slope Movement (mm)
Building Structure	10	-	53	100	-
Slope	10	23	67	76	2.9

Table 6.3 Hazard Distance for Overpressure due to Accidental Detonation of Explosives (200kg of Explosives)

Fatality Level (%)	Hazard Distance (m)	
	Indoor Population	Outdoor Population
90	18	14.5
50	21	15
10	31	17
1	54	19

6.3.8. In the current Project, both residential site R2-6 and RS-1 and a village house near Anderson Road, as shown in **Figure 6.1**, are identified as the building structure nearest, but more than 68m away from, the tunnel for the transportation of explosives. By referring to **Table 6.1**, ground vibration imposed to the building structure will be lower than the object threshold limit of 100mm/s for building structure, under the occurrence of the detonation of explosives during transportation inside the tunnel.

6.3.9. For the blasting at the blast face inside the Enabling Adit B, residential site RS-1 and the village house near Anderson Road are identified as the nearest building structure, with a separation distance of more than 100m away from the blast face. By referring to **Table 6.2**, ground vibration imposed to the building structure will be lower than the object threshold limit of 100mm/s for building structure, under the occurrence of the simultaneous detonation of 5 MIC during blasting at blast face.

6.3.10. Rock slopes, as shown in **Figure 6.1**, are identified along On Yu Road. The rock slopes have Critical Peak Particle Velocity (PPVc) value of 25mm/s, as shown in **Appendix 6.2,** and they are more than 80m from the extended tunnel. With reference to **Table 6.1**, slope movement will be less than 20mm under the occurrence of the accidental detonation of explosives during transportation inside the extended tunnel. Similarly, by referring to **Table 6.2**, slope movement will also be less than 20mm for the scenario of simultaneous detonation of 5MIC at the blast face inside the extended tunnel. Therefore, the chance of slope failure will be less than 0.01%.

6.3.11. Upon detonation of explosives at the portal near On Yu Road, overpressure will be generated and may affect the nearby population. Residential site R2-6 is identified near the portal with a separation distance of 68m. According to **Table 6.3**, the fatality level would be lesser than 1% at that separation distance. Therefore, the risk of overpressure imposed to the residential site R2-6 would be insignificant and it would not be further considered.

6.3.12. Boulder is not identified near to the extended tunnel.

6.3.13. Since high pressure underground town gas pipeline is not observed within 250m from the extended tunnel, the potential risk of the explosives to the pipeline is not further considered.

6.3.14. In view of the discussion above, it is concluded that risk to life during the construction phase of the Project is not a key issue with respect to Risk Guidelines.

6.3.15. Since the operation phase of the Project does not involve the use, transport and overnight storage of explosives, risk to life is considered not a key issue with respect to Risk Guidelines.

7. Environmental Monitoring and Auditing Requirement

7.1. Objectives and Requirements

7.1.1. The objectives and requirements of EM&A for the construction of the Project described in the approved PP for DIR follows the ARQ Rock Cavern Sch. 2 EIA.

7.2. Change in EM&A Requirements Associated with Proposed Variation

7.2.1. With the implementation of mitigation measures recommended and most of the construction works are in underground (Enabling Adit B) and relatively small scale of above ground site formation works at Portal B, no adverse environmental impact is anticipated. Nevertheless, the project proponent has taken the initiative to implement a monitoring and audit programme during the construction phase so as to check compliance with the legislative requirements.

7.2.2. The required environmental monitoring and audits are summarised in **Table 7.1** below.

Table 7.1 Summary of Environmental Monitoring and Audit (EM&A) Requirement

Environmental Aspect	Inspection/ Audit	Monitoring
Air Quality	✓	✓
Noise	✓	-
Water Quality	✓	-
Waste Management	✓	-
Ecology	✓	-
Hazard to Life	✓	-

7.2.3. The construction dust impact during construction phase has been evaluated. Mitigation measures include implementation of frequently watering, blasting door and filter system for construction dust shall be followed. It is proposed to carry out real time dust monitoring (RSP and FSP) in order to monitor the construction dust during construction period of the Enabling Adit B at one planned receiver (ASR07 – R2-6) once population intake. The location of construction dust monitoring station is indicated in **Figure 7.1** and **Table 7.2**.

Table 7.2 Proposed Monitoring Location

ID	Description
Construction Dust	
AMP1	Residential Site R2-6

7.2.4. An Environmental Team (ET) led and managed by an Environmental Team Leader (ETL), who shall possess at least 7 years of experience in EM&A has been employed under the contract requirement of this Project. ET will be responsible to conduct site inspections/ audit at least once per week to ensure the Contractor has implemented proper mitigation measures to comply with the Project's environmental requirements during the construction phase under this Environmental Review Report. The ET should also carry out the real time dust monitoring as stated above.

8. Conclusion

8.1.1. An environmental review/assessment has been conducted for the proposed variation covering the following change compared to the design adopted in the approved VEP-616/2022:

- Item A – The addition of Enabling Adit B and tunnel portal (Portal B) next to Anderson Road

8.1.2. The potential environmental issues pertinent to the proposed change have been assessed and the required mitigation requirements have also been identified.

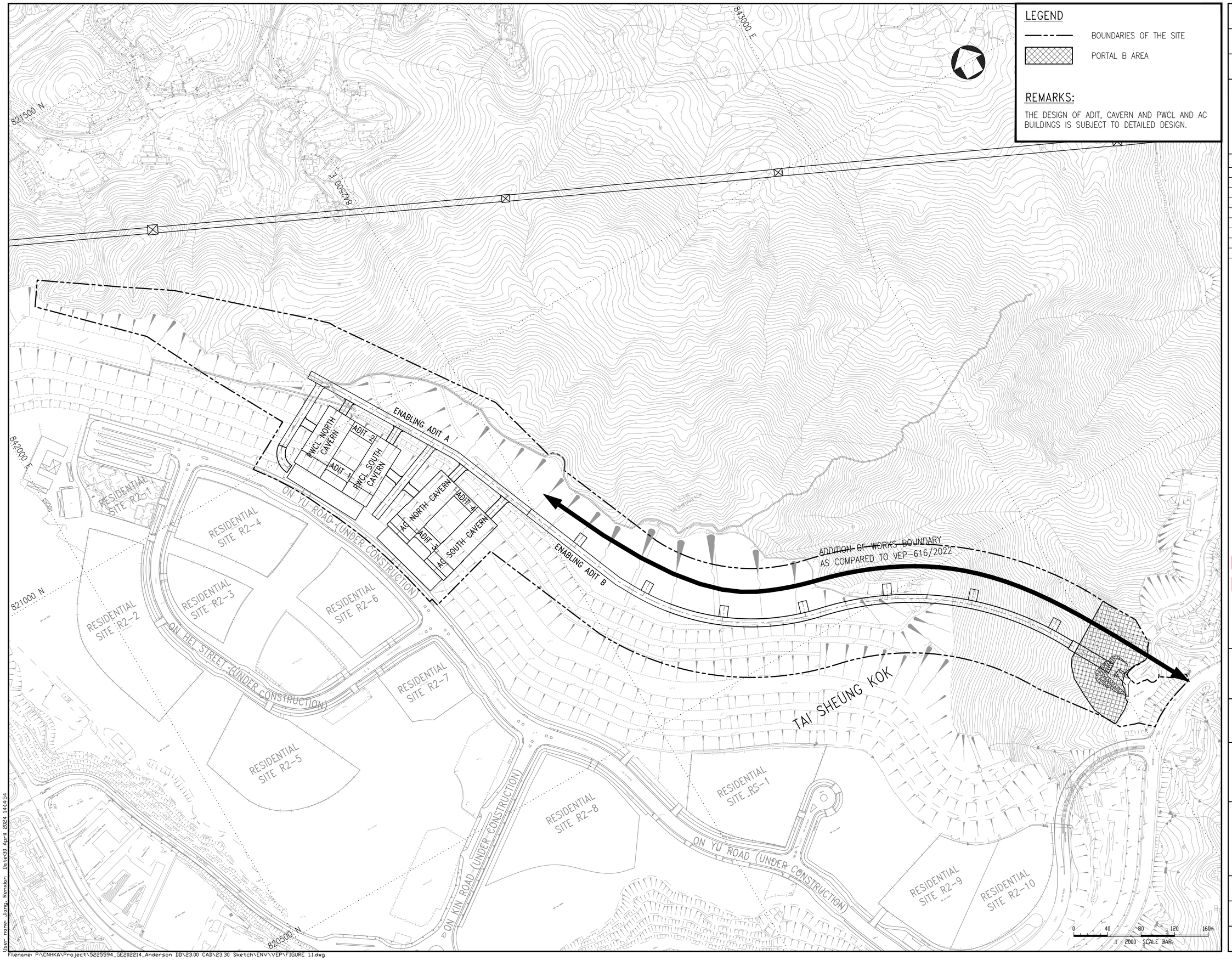
8.1.3. It is concluded that the proposed variation of the Project would not result in material change to the environmental impacts leading to adverse residual environmental impact with the implementation of the recommended mitigation measures and the project still complies with the requirements described in the EIAO-TM.

8.1.4. The proposed variation to the condition in current Environmental Permit is listed in **Table 8.1** below.

Table 8.1 Proposed Variation of current Environmental Permit (EP-591/2021/A)

Conditions in the current Environmental Permit	Proposed Variations	Reason for Variation	Describe the environmental changes arising from the proposed variation	Describe how the environment and the community might be affected by the proposed variation	Describe how and to what extent the environmental performance requirements set out in the EIA report previously approved or project profile previously submitted for this project may be affected	Describe any additional measures proposed to eliminate, reduce or control any adverse environmental impact arising from the proposed variation(s) and to meet the requirements in the Technical Memorandum on Environmental Impact Assessment Process
Figure 1	Inclusion of Enabling Adit B and tunnel portal at Anderson Road (Portal B)	Provide access for future cavern development(s) within SCVA No. 28 – Tai Sheung Tok	Inclusion of tunnel portal area (Portal B) which may generate construction dust and construction noise. The blasting works for Enabling Adit B may also induce hazard to life issue. The key environmental issues induced are described in Table 2.3 of the ERR.	As there are new works areas in Portal B near Anderson Road, new sensitive receivers near Anderson Road would be affected by the proposed works area. Potential air quality impact and noise impact and new sensitive receivers are described in Section 3 and Section 4 of the ERR.	The potential air quality impact, noise, water quality, waste management, ecological impact and hazard to life impact have been reviewed and confirmed that the relevant performance requirements set out in the approved Project Profile (DIR-283/2021) and the Technical Memorandum on EIA Process would not be exceeded or violated, as shown in the ERR.	Adoption of mitigation measures as stated in Section 3.5.10 to Section 3.5.11 and Section 4.4.10 to Section 4.4.18.

Figure



LEGEND

BOUNDARIES OF THE SITE

PORTAL B AREA

REMARKS:

THE DESIGN OF ADIT, CAVERN AND PWCL AND AC BUILDINGS IS SUBJECT TO DETAILED DESIGN.

F.S.D. REFERENCE 消防處檔案
FSD xxxxxxxxx

W.W.O. REFERENCE 水務署檔案
WWO xxxxxxxxx

CAD FILE NAME 檔案編號
FIGURE 1.1

NOTES 注釋

NO. 修定號	REVISIONS 修定內容	DATE 日期	BY 經手人
–	FIRST ISSUE	06SEP23	WKC

CLIENT

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

PROJECT MANAGER

AECOM

MAIN CONTRACTOR

China State – Alchmex Joint Venture

CONSULTANTS

DLN Architects Limited 營業廣信建築師事務有限公司

ATKINS Member of the SNC-Lavalin Group

SYW

wsp

Urbis

RAINYSKY

aurecon www.aurecongroup.com

中國海龍建築科技有限公司 CHINA STATE HAILONG CONSTRUCTION TECHNOLOGY COMPANY LIMITED

中海海創智造科技(珠海)有限公司 CHINA OVERSEAS INNOVATION & TECHNOLOGY (ZHUHAI) COMPANY LIMITED

ARCHITECTURAL DESIGN CHECKER

WU CHI YUN FRANK : AP(A) 53/82

ALL MEASUREMENTS MUST BE CHECKED AT THE WORK BY THE CONTRACTOR 所有尺寸應由承建商於工地核實

DO NOT SCALE FROM DRAWINGS 尺寸不應由圖紙直接量度

PROJECT 項目名稱

CONTRACT NO. GE/2022/14
JOINT CAVERN DEVELOPMENT
ANDERSON QUARRY SITE

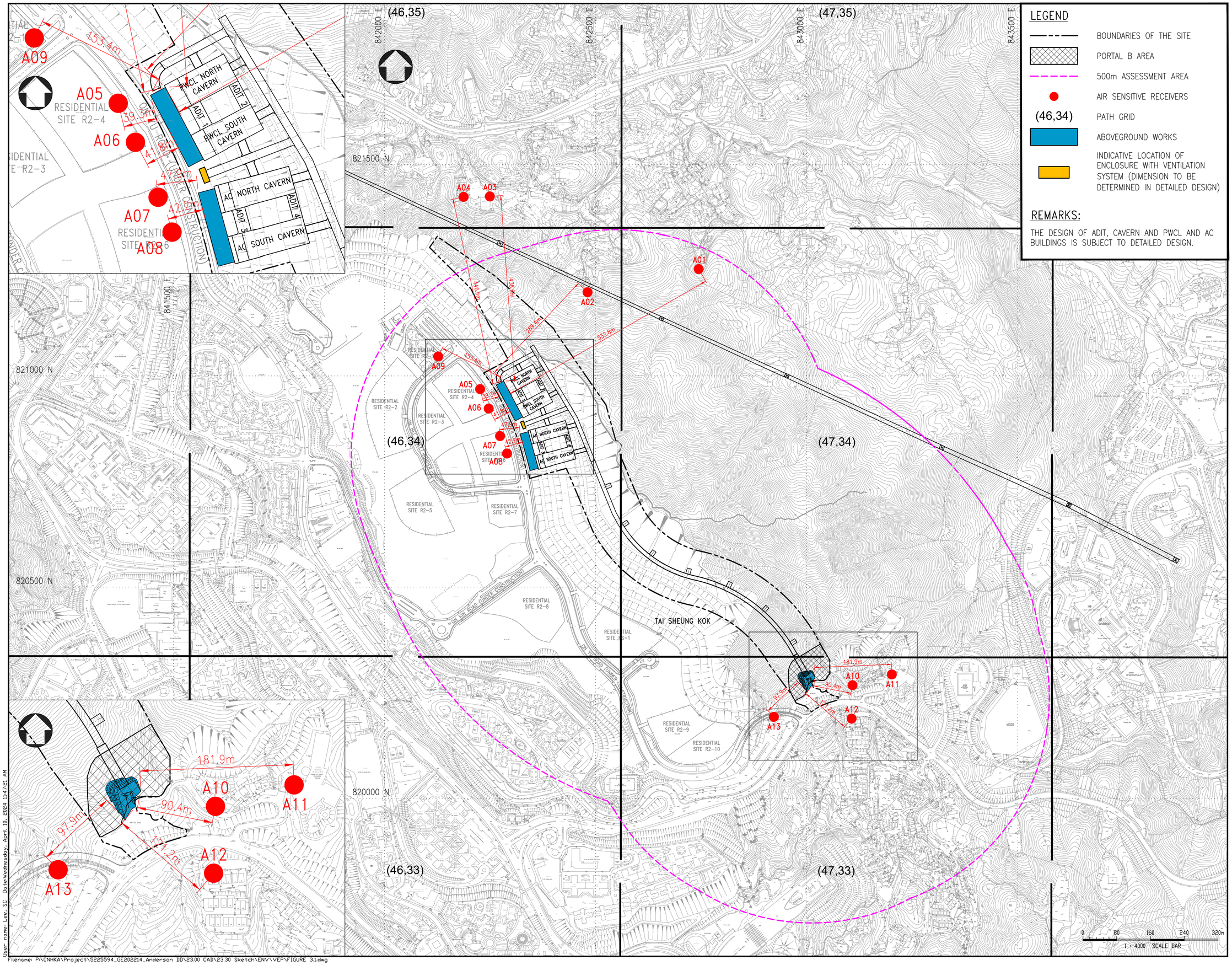
DRAWING TITLE 標題

LOCATION OF PROJECT

SCALE 比例	DATE 日期
1:2000 @ A1	09/2023
DRAWN BY 製作人 WMC	CHECKED BY 檢查 WKC
JOB NO. 工程項目 N3209–H	DRAWING NO. 圖號 FIGURE 1.1

User name: Jiang, Renxian Date:30 April 2024 14:14:54

Filename: P:\CNHKA\Project\5225594_GE202214_Anderson DD\23.00 CAD\23.30 Sketch\ENV\VEP\FIGURE 1.1.dwg



LEGEND

- BOUNDARIES OF THE SITE
- PORTAL B AREA
- 500m ASSESSMENT AREA
- AIR SENSITIVE RECEIVERS
- (46,34) PATH GRID
- ABOVEGROUND WORKS
- INDICATIVE LOCATION OF ENCLOSURE WITH VENTILATION SYSTEM (DIMENSION TO BE DETERMINED IN DETAILED DESIGN)

REMARKS:

THE DESIGN OF ADIT, CAVERN AND PWCL AND AC BUILDINGS IS SUBJECT TO DETAILED DESIGN.

F.S.D. REFERENCE 消防處檔案: FSD xxxxxxxxx

W.W.O. REFERENCE 水務署檔案: WWO xxxxxxxxx

CAD FILE NAME 檔案編號: FIGURE 3.1

NOTES 注釋

NO. 修定號	REVISIONS 修定內容	DATE 日期	BY 經手人
–	FIRST ISSUE	06SEP23	WKC

CLIENT

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中海海創智造科技(珠海)有限公司 CHINA OVERSEAS INNOVATION & TECHNOLOGY (ZHUHAI) COMPANY LIMITED

ARCHITECTURAL DESIGN CHECKER

WU CHI YUN FRANK : AP(A) 53/82

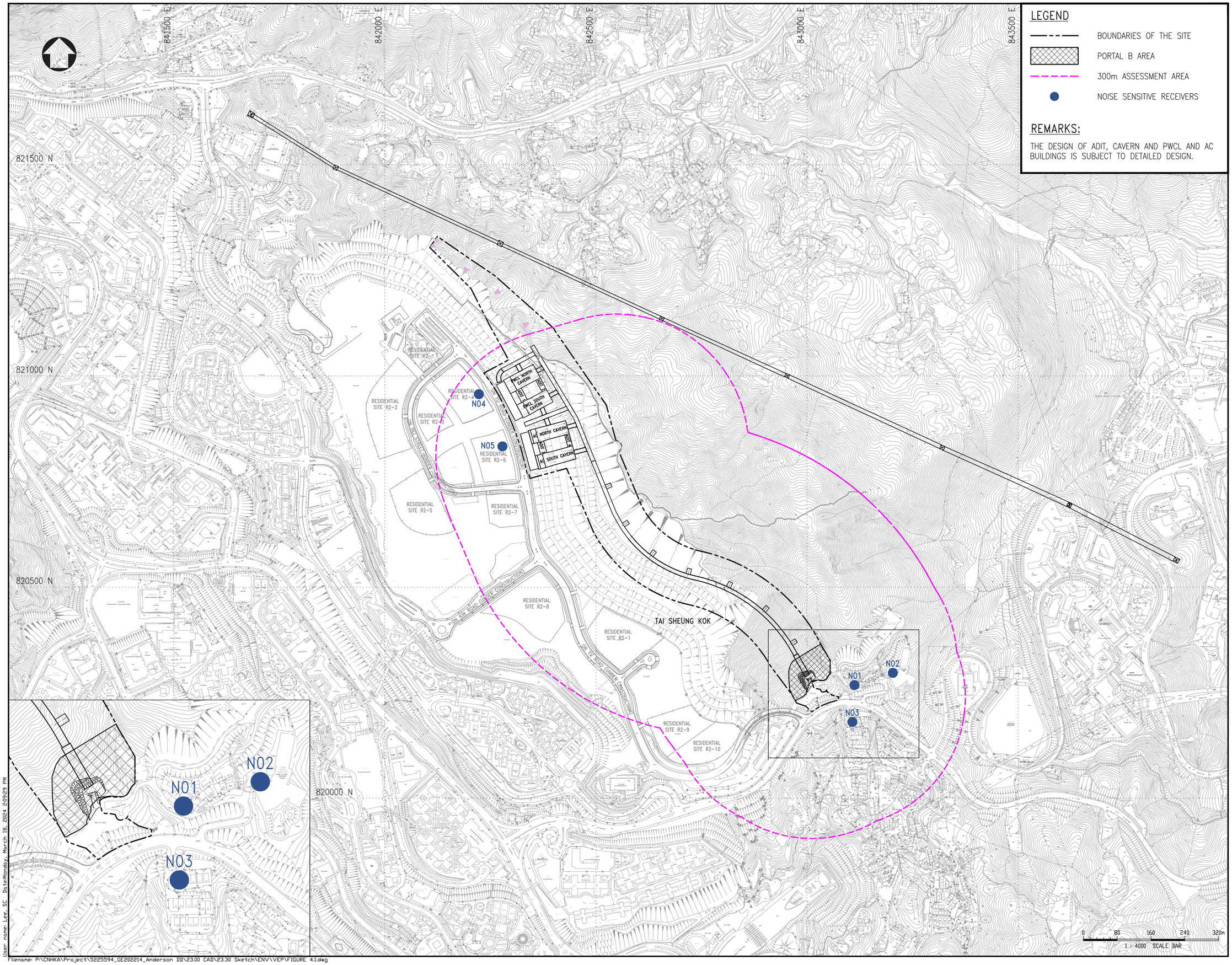
PROJECT 項目名稱

CONTRACT NO. GE/2022/14
JOINT CAVERN DEVELOPMENT
ANDERSON QUARRY SITE

DRAWING TITLE 標題

LOCATION OF REPRESENTATIVE AIR SENSITIVE RECEIVERS

SCALE 比例	DATE 日期
1:4000 @ A1	09/2023
DRAWN BY 製作人: WMC	CHECKED BY 檢查: WKC
JOB NO. 工程項目: N3209-H	DRAWING NO. 圖號: FIGURE 3.1



LEGEND

- BOUNDARIES OF THE SITE
- PORTAL B AREA
- 300m ASSESSMENT AREA
- NOISE SENSITIVE RECEIVERS

REMARKS:

THE DESIGN OF ADIT, CAVERN AND PWCL AND AC BUILDINGS IS SUBJECT TO DETAILED DESIGN.

F.S.D. REFERENCE 消防處檔案: FSD xxxxxxxxx

W.W.O. REFERENCE 水務署檔案: WWO xxxxxxxxx

CAD FILE NAME 檔案編號: FIGURE 4.1

NOTES 注釋

NO. 修定號	REVISIONS 修定內容	DATE 日期	BY 經手人
–	FIRST ISSUE	06SEP23	WKC

CLIENT

土木工程拓展署
Civil Engineering and Development Department

PROJECT MANAGER

AECOM

MAIN CONTRACTOR

China State – Alchmex Joint Venture

CONSULTANTS

DLN Architects Limited 營業廣信建築師事務有限公司

ATKINS Member of the SNC-Lavalin Group

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ARCHITECTURAL DESIGN CHECKER

WU CHI YUN FRANK : AP(A) 53/82

PROJECT 項目名稱

CONTRACT NO. GE/2022/14
JOINT CAVERN DEVELOPMENT
ANDERSON QUARRY SITE

DRAWING TITLE 標題

LOCATION OF REPRESENTATIVE NOISE SENSITIVE RECEIVERS

SCALE 比例	DATE 日期
1:4000 @ A1	09/2023
DRAWN BY 製作人: WMC	CHECKED BY 檢查: WKC
JOB NO. 工程項目: N3209-H	DRAWING NO. 圖號: FIGURE 4.1

User name: Lee, SC Date:Monday, March 18, 2024 2:09:29 PM

Filename: P:\CNHKA\Project\5225594_GE202214_Anderson DD\23.00 CAD\23.30 Sketch\ENV\VEP\FIGURE 4.1.dwg

REMARKS:

THE DESIGN OF ADIT, CAVERN AND PWCL AND AC BUILDINGS IS SUBJECT TO DETAILED DESIGN.

LEGEND

- BOUNDARIES OF THE SITE
- VEP/TREE SURVEY EXTENT
- PORTAL EXTENT
- SOIL NAIL EXTENT

842900 E
843000 E
843100 E
820400 N
820300 N
820200 N
VBH115
WIP Oct 2023
Proposed Road
擬建道路
Tunnel Portal
隧道口
隧道
Tunnel
資琳路
安達臣道
ANDERSON ROAD
PO LAM ROAD
Road
道路
CUL
TS
WT
0 5 10 15 20 25m
1 : 500 SCALE BAR

F.S.D. REFERENCE 消防處檔案	FSD xxxxxxxxx
W.W.O. REFERENCE 水務署檔案	WWO xxxxxxxxx
CAD FILE NAME 檔案編號	GE202214-SK0219
NOTES 注釋	

NO. 修定號	REVISIONS 修定內容	DATE 日期	BY 經手人

CLIENT

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Civil Engineering and Development Department

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PROJECT 項目名稱

CONTRACT NO. GE/2022/14
JOINT CAVERN DEVELOPMENT
ANDERSON QUARRY SITE

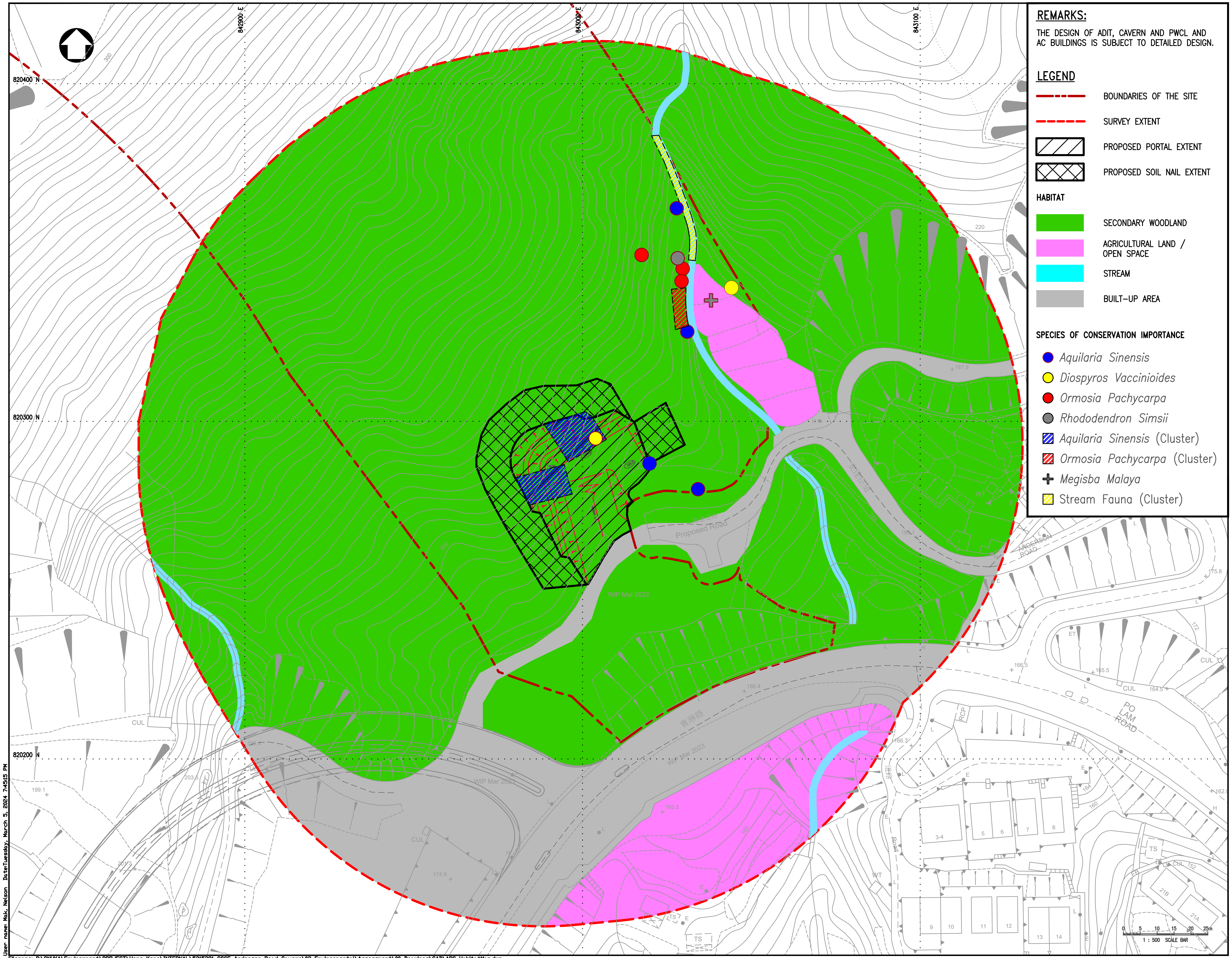
DRAWING TITLE 標題

SURVEY EXTENT
FOR SLOPE WORKS
AT PORTAL B

SCALE 比例	DATE 日期
1:500 @ A1	10/2023
DRAWN BY 製作人	CHECKED BY 檢查
SCL	JT
JOB NO. 工程項目	DRAWING NO. 圖號
N3209-H	FIGURE 5.1

User name: Chow, Wing Man Date:Wednesday, March 6, 2024 10:06:48 AM

Filename: P:\CNHKA\Project\5225594_GE202214_Anderson DD\23.00 CAD\23.30 Sketch\CIV\GE202214-SK0219.dwg



F.S.D. REFERENCE 消防處檔案
FSD ---

W.W.O. REFERENCE 水務署檔案
WWO ---

CAD FILE NAME 檔案編號
ARC_HABITATMAP

NOTES 注釋

NO. 修定號	REVISIONS 修定內容	DATE 日期	BY 經手人

CLIENT
土木工程拓展署
Civil Engineering and Development Department

PROJECT MANAGER
AECOM

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ALL MEASUREMENTS MUST BE CHECKED AT THE WORK BY THE CONTRACTOR
所有尺寸應由承建商於工地核實

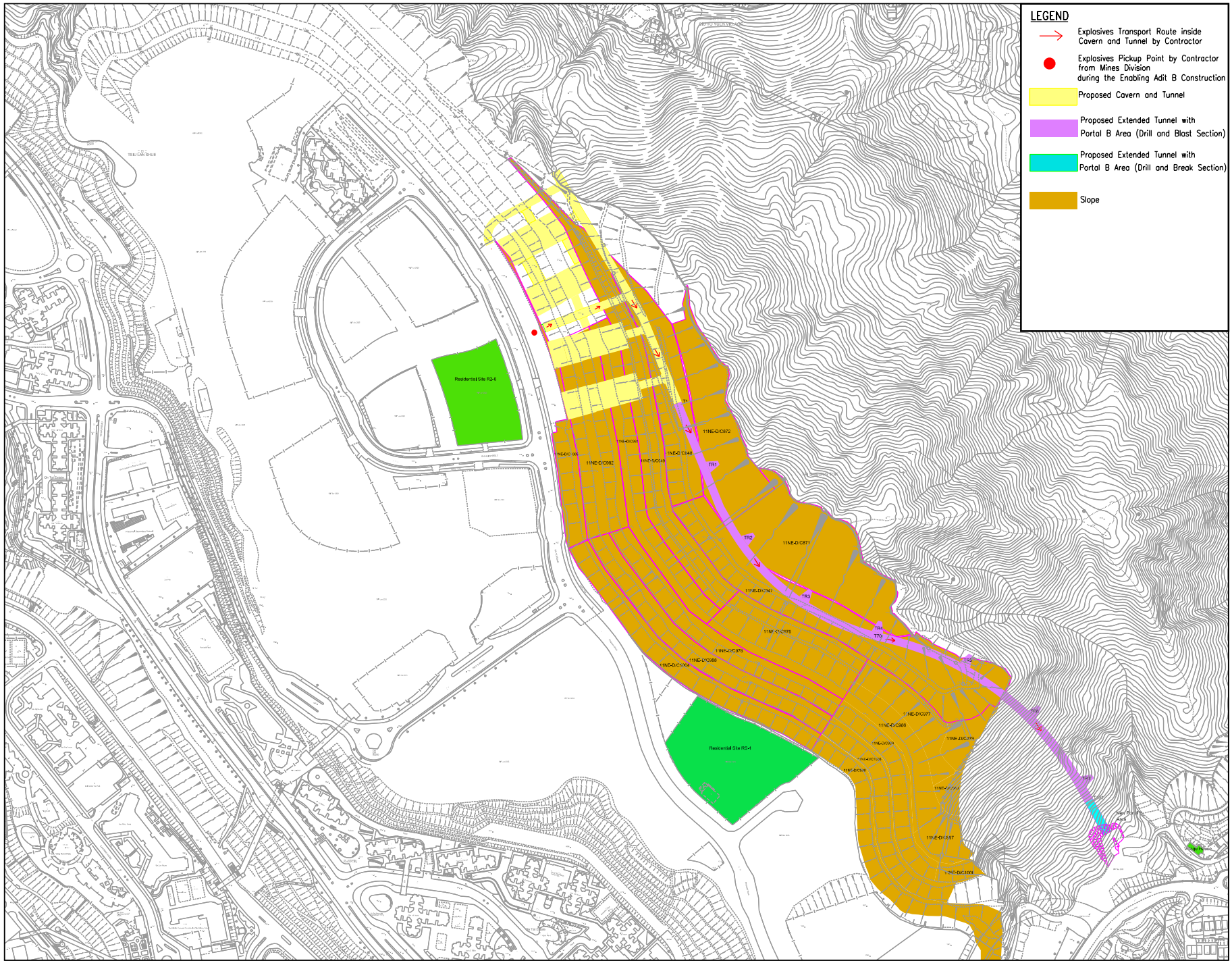
DO NOT SCALE FROM DRAWINGS 尺寸不應由圖紙直接量度

PROJECT 項目名稱
CONTRACT NO. GE/2022/14
JOINT CAVERN DEVELOPMENT
ANDERSON QUARRY SITE

DRAWING TITLE 標題
HABITAT MAP

SCALE 比例	DATE 日期
AS SHOWN	03/2024
DRAWN BY 製作人	CHECKED BY 檢查
NM	KC
JOB NO. 工程項目	DRAWING NO. 圖號
N3209-H	FIGURE 5.2

User name: Mak, Nelson Date:Tuesday, March 5, 2024 7:45:15 PM
Filename: P:\CNHKA\Environment\PROJECT\Hong Kong\INTERNAL\5215281 CSCE Anderson Road Cavern\02 Environmental\Assessment\00_Drawings\CAD\ARC_HabitatMap.dwg



F.S.D. REFERENCE 消防處檔案
-

W.W.O. REFERENCE 水務署檔案
-

CAD FILE NAME 檔案檔號
-

NOTES 註釋

NO. 修改項	REVISIONS 修改內容	DATE 日期	BY 經手人
A	FIRST ISSUE	5MAR24	HF

CLIENT
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Civil Engineering and Development Department

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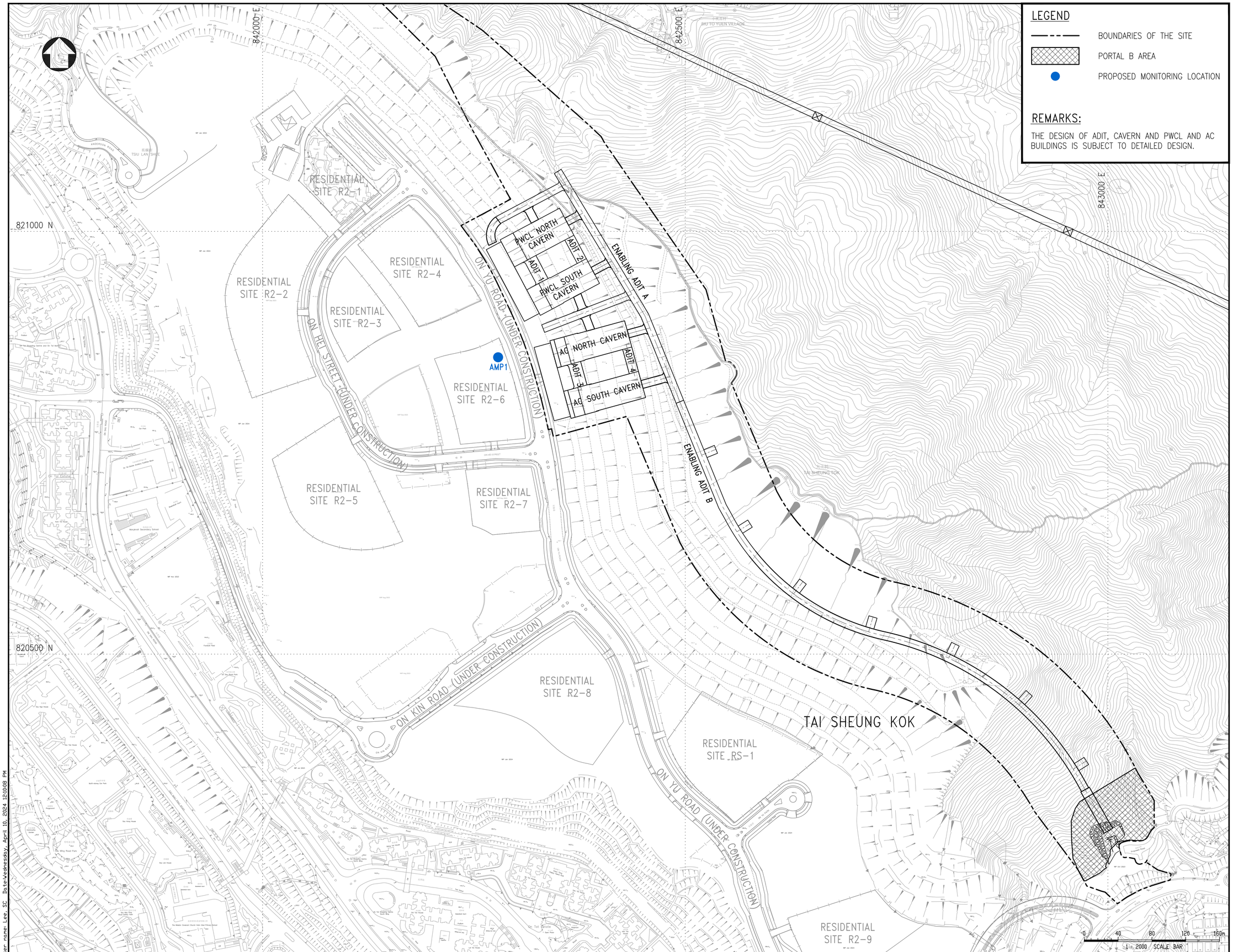
PROJECT 項目名稱
CONTRACT NO. GE/2022/14
JOINT CAVERN DEVELOPMENT
ANDERSON QUARRY SITE

DRAWING TITLE 標題
Layout of Extended Tunnel and Location of Nearby Building Structures and Slopes

SCALE 比例	DATE 日期
1:2000 @ A1	04/2024
DRAWN BY 製作人 HF	CHECKED BY 核查 HF
JOB NO. 工程項目 5225594	DRAWING NO. 圖號 Figure 6.1



LEGEND

- BOUNDARIES OF THE SITE
- PORTAL B AREA
- PROPOSED MONITORING LOCATION

REMARKS:

THE DESIGN OF ADIT, CAVERN AND PWCL AND AC BUILDINGS IS SUBJECT TO DETAILED DESIGN.

F.S.D. REFERENCE 消防處檔案
FSD xxxxxxxxx

W.W.O. REFERENCE 水務署檔案
WWO xxxxxxxxx

CAD FILE NAME 檔案編號
FIGURE 7.1

NOTES 注釋

NO. 修定號	REVISIONS 修定內容	DATE 日期	BY 經手人
–	FIRST ISSUE	06SEP23	WKC

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

PROJECT MANAGER
AECOM

MAIN CONTRACTOR
China State – Alchmex Joint Venture

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ARCHITECTURAL DESIGN CHECKER

WU CHI YUN FRANK : AP(A) 53/82

PROJECT 項目名稱

CONTRACT NO. GE/2022/14
JOINT CAVERN DEVELOPMENT
ANDERSON QUARRY SITE

DRAWING TITLE 標題

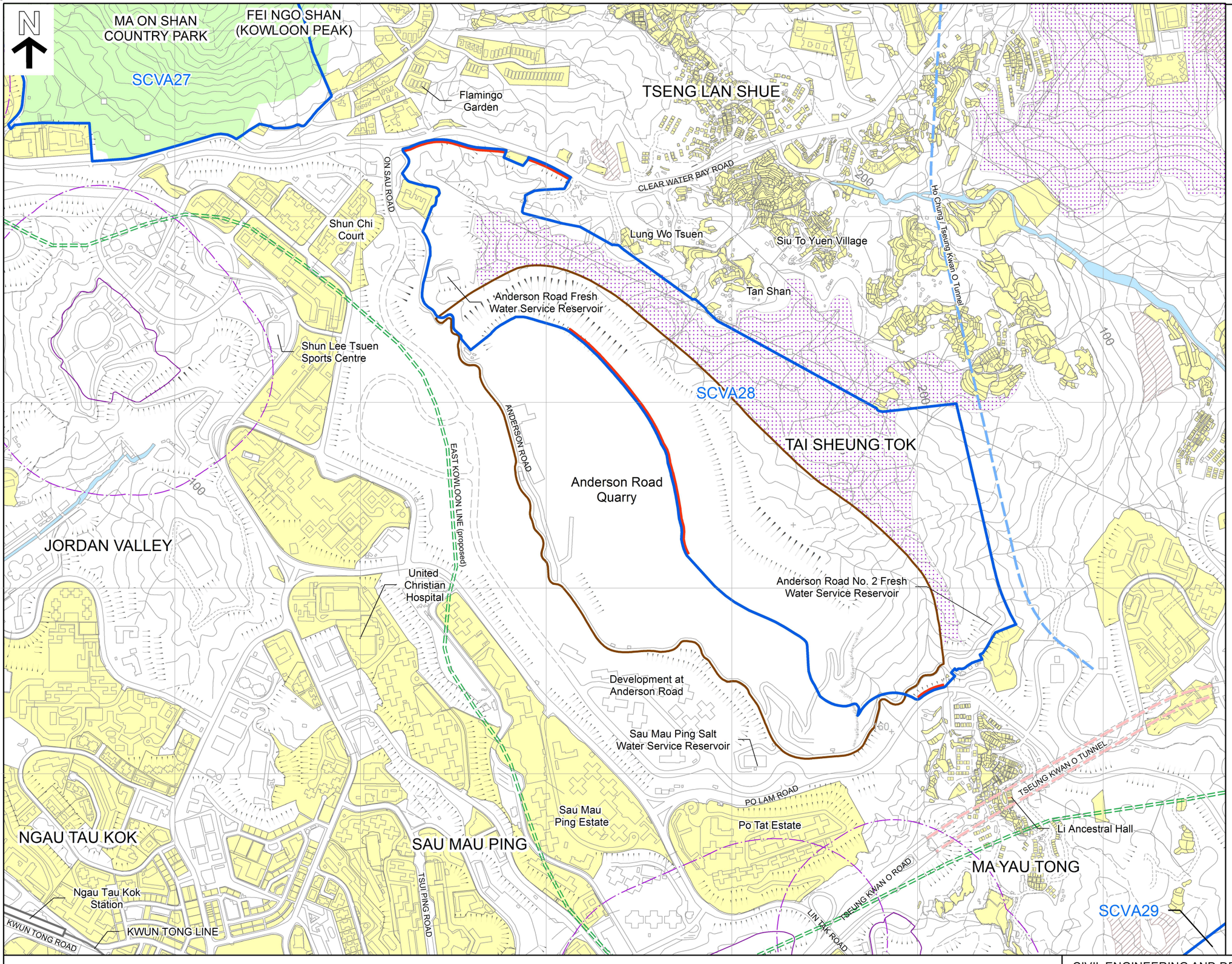
LOCATION OF PROPOSED MONITORING LOCATION

SCALE 比例	DATE 日期
1:2000 @ A1	04/2024
DRAWN BY 製作人	CHECKED BY 檢查
WMC	WKC
JOB NO. 工程項目	DRAWING NO. 圖號
N3209–H	FIGURE 7.1

User name: Lee, SC Date:Wednesday, April 10, 2024 12:10:08 PM
Filename: P:\CNHKA\Project\5225594_GE202214_Anderson DD\23.00 CAD\23.30 Sketch\ENV\VEP\FIGURE 7.1.dwg

Appendix 1.1
Location of SCVA No. 28

A3



Legend

- Strategic Cavern Area
- Extent of Potential Portal Locations
- Quarry
- Existing Railway Line
- Proposed Railway Line
- Vehicle Tunnel
- Water Supplies Department Tunnel
- River / Nullah
- Graded Historic Building
- Private Lot
- Burial Ground
- Closed Landfill Site
- Consultation Zone of Closed Landfill Site
- Major Conservation Area
- Country Park

Note: All private lots located inside the boundary of the Strategic Cavern Area have been excised. Project proponents shall check the latest land status with the Lands Department. Reference should be made to the Explanatory Statement of the Cavern Master Plan for the delineation criteria of Strategic Cavern Area.

Scale : 1:10,000

0 100 200 300 400 500

Meters

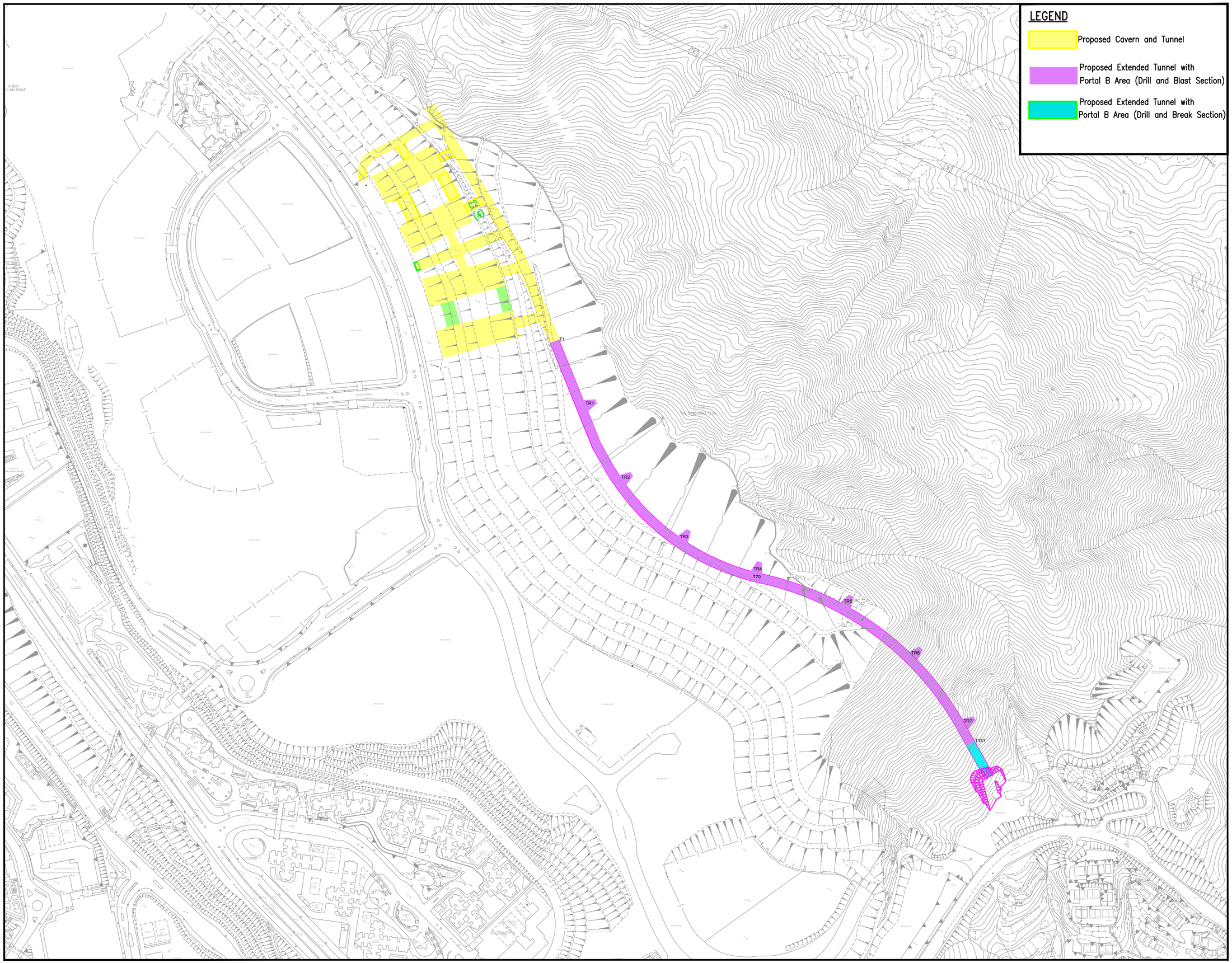
REFERENCE DRAWING OF STRATEGIC CAVERN AREA NO. 28 - TAI SHEUNG TOK

CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT
PLANNING DEPARTMENT

DATE: NOVEMBER 2017
VERSION: 1

SCVA 28

Appendix 2.1
Extent of Construction Method



F.S.D. REFERENCE 消防處檔案	-
W.W.O. REFERENCE 水務署檔案	-
CAD FILE NAME 檔案編號	-
NOTES 注釋	

NO. 修定號	REVISIONS 修定內容	DATE 日期	BY 經手人
A	FIRST ISSUE	5MAR24	HF

CLIENT

土木工程拓展署
Civil Engineering and Development Department

PROJECT MANAGER

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ARCHITECTURAL DESIGN CHECKER

PROJECT 項目名稱

CONTRACT NO. GE/2022/14
JOINT CAVERN DEVELOPMENT
ANDERSON QUARRY SITE

DRAWING TITLE 標題

GENERAL LAYOUT PLAN AND BLASTING EXTENT

SCALE 比例	DATE 日期
1:4000	03/2024
DRAWN BY 製作人	CHECKED BY 檢查
NM	KC
JOB NO. 工程項目	DRAWING NO. 圖號
5225594	Appendix 2.1

Appendix 4.1
Unmitigated Construction Plant Inventory

Contract No. GE/2022/14 Joint Cavern Development at Anderson Road Quarry Site
Appendix 4.1

Construction Plant Inventory
Unmitigated Scenario

PME		No. of PME	SWL dB(A)/unit	% on time	Noise Mitigation Measures	Screening Effect dB(A)	Total SWL dB(A) [2]	
Description	TM or other ref.							
Portal B Site Formation Works								
Backhoe	BS D3/97	2	105	70%			106	
Drill rig, rotary type (diesel)	OCUPME-012	4	110	70%			114	
Dump truck, with grab, 5.5 tonne < gross vehicle weight < 38 tonne	CNP 069	5	105	50%			109	
Concrete mixer (petrol)	CNP 046	2	96	70%			97	
Concrete pump, stationary/lorry mounted	CNP 047	2	109	70%			110	
Grout mixer	OCUPME-014	2	90	70%			91	123
Grout pump	OCUPME-015	2	105	70%			106	
Crane, mobile/barge mounted (diesel)	CNP 048	1	112	100%			112	
Breaker, excavator mounted (hydraulic)	CNP 028	1	122	70%			120	
Generator, standard	CNP 101	1	108	100%			108	
Air Compressor, air flow < 10m3/min	CNP 001	2	100	100%			103	
Soft Ground Tunnelling Works								
Drill rig, rotary type (diesel)	OCUPME-012	2	110	70%			111	
Backhoe	BS D3/97	1	105	70%			103	
Dump truck, with grab, 5.5 tonne < gross vehicle weight < 38 tonne	CNP 069	3	105	50%			107	
Breaker, excavator mounted (hydraulic)	CNP 028	1	122	70%			120	
Crane, mobile/barge mounted (diesel)	CNP 048	3	112	100%			117	
Concrete pump, stationary/lorry mounted	CNP 047	1	109	70%			107	123
Water pump (electric)	CNP 281	2	88	100%			91	
Grout mixer	OCUPME-014	1	90	70%			88	
Grout pump	OCUPME-015	1	105	70%			103	
Generator, standard	CNP 101	1	108	100%			108	

Appendix 4.2
Unmitigated Construction Noise Level

Contract No. GE/2022/14 Joint Cavern Development at Anderson Road Quarry Site
Appendix 4.2

Unmitigated Scenario

N01 - Village House No. 1, Anderson Road

	SWL, dB(A)	Dist, m	Dist. Corr, dB(A)	Fac. Corr, dB(A)	SPL, dB(A)	Criteria, dB(A)	Exceedance, dB(A)
Portal B Site Formation Works	123	90	-47	3	79	75	4
Soft Ground Tunnelling Works	123	90	-47	3	79	75	4

N02 - Heave of Hope Sunnyside School

	SWL, dB(A)	Dist, m	Dist. Corr, dB(A)	Fac. Corr, dB(A)	SPL, dB(A)	Criteria, dB(A)	Exceedance, dB(A)
Portal B Site Formation Works	123	182	-53	3	73	70 (65)	3 (8)
Soft Ground Tunnelling Works	123	182	-53	3	73	70 (65)	3 (8)

N03 - Star Legend Terrace

	SWL, dB(A)	Dist, m	Dist. Corr, dB(A)	Fac. Corr, dB(A)	SPL, dB(A)	Criteria, dB(A)	Exceedance, dB(A)
Portal B Site Formation Works	123	121	-50	3	76	75	1
Soft Ground Tunnelling Works	123	121	-50	3	76	75	1

Appendix 4.3
Mitigated Construction Plant Inventory

Contract No. GE/2022/14 Joint Cavern Development at Anderson Road Quarry Site
Appendix 4.3

Construction Plant Inventory
Mitigated Scenario

PME		No. of PME	SWL dB(A)/unit	% on time	Noise Mitigation Measures	Screening Effect dB(A)	Total SWL dB(A) [2]	
Description	TM or other ref.							
Portal B Site Formation Works								
Backhoe	BS D3/97	2	105	70%	Movable noise barrier	-5	101	110
Drill rig, rotary type (diesel)	OCUPME-012	4	110	70%	Noise Fabric	-10	104	
Dump truck, with grab, 5.5 tonne < gross vehicle weight < 38 tonne	CNP 069	5	105	50%	Movable noise barrier	-5	104	
Concrete mixer (petrol)	CNP 046	2	96	70%	Movable noise barrier	-5	92	
Concrete pump, stationary/lorry mounted	CNP 047	2	109	70%	Movable noise barrier	-10	100	
Grout mixer	OCUPME-014	2	90	70%	Movable noise barrier	-5	86	
Grout pump	OCUPME-015	2	105	70%	Movable noise barrier	-5	101	
Tracked Crane (62kW)	BS D7/114	1	101	100%	Movable noise barrier	-5	96	
Wheeled Excavator/Loader fitted with Hydraulic Rock Breaker	BS D8/12	1	106	70%	Movable noise barrier	-5	99	
Generator, super silenced, 70dB(A) at 7m	CNP 103	1	95	100%	Movable noise barrier	-10	85	
Air Compressor (AIRMAN, PDS100S-5C5)	EPD-09607	2	93	100%	Movable noise barrier	-10	86	
Soft Ground Tunnelling Works								
Drill rig, rotary type (diesel)	OCUPME-012	2	110	70%	Noise Fabric	-10	101	108
Backhoe	BS D3/97	1	105	70%	Movable noise barrier	-5	98	
Dump truck, with grab, 5.5 tonne < gross vehicle weight < 38 tonne	CNP 069	3	105	50%	Movable noise barrier	-5	102	
Wheeled Excavator/Loader fitted with Hydraulic Rock Breaker	BS D8/12	1	106	70%	Movable noise barrier	-5	99	
Tracked Crane (62kW)	BS D7/114	3	101	100%	Movable noise barrier	-5	101	
Concrete pump, stationary/lorry mounted	CNP 047	1	109	70%	Movable noise barrier	-10	97	
Water pump (electric)	CNP 281	2	88	100%	Movable noise barrier	-10	81	
Grout mixer	OCUPME-014	1	90	70%	Movable noise barrier	-5	83	
Grout pump	OCUPME-015	1	105	70%	Movable noise barrier	-5	98	
Generator, super silenced, 70dB(A) at 7m	CNP 103	1	95	100%	Movable noise barrier	-10	85	

Appendix 4.4
Mitigated Construction Noise Level

Contract No. GE/2022/14 Joint Cavern Development at Anderson Road Quarry Site
Appendix 4.4

Mitigated Scenario

N01 - Village House No. 1, Anderson Road

	SWL, dB(A)	Dist, m	Dist. Corr, dB(A)	Fac. Corr, dB(A)	SPL, dB(A)	Criteria, dB(A)	Exceedance, dB(A)
Portal B Site Formation Works	110	90	-47	3	66	75	0
Soft Ground Tunnelling Works	108	90	-47	3	64	75	0

N02 - Heave of Hope Sunnyside School

	SWL, dB(A)	Dist, m	Dist. Corr, dB(A)	Fac. Corr, dB(A)	SPL, dB(A)	Criteria, dB(A)	Exceedance, dB(A)
Portal B Site Formation Works	110	182	-53	3	60	70 (65)	0
Soft Ground Tunnelling Works	108	182	-53	3	58	70 (65)	0

N03 - Star Legend Terrace

	SWL, dB(A)	Dist, m	Dist. Corr, dB(A)	Fac. Corr, dB(A)	SPL, dB(A)	Criteria, dB(A)	Exceedance, dB(A)
Portal B Site Formation Works	110	121	-50	3	64	75	0
Soft Ground Tunnelling Works	108	121	-50	3	62	75	0

Appendix 5.1
Lists of Flora and Fauna Species Recorded during Ecological Baseline Survey (September 2023)

Appendix 5.1 Lists of Flora and Fauna Species Recorded during Ecological Baseline Survey (September 2023)

Table 1. List of plant species recorded during survey

Scientific Name	Chinese Name	Origin	Growth Form	Conservation Status	Relative abundance			
					Above-ground Works Area		Survey Extent	
					Proposed Portal Extent	Proposed Soil Nail Extent	Woodland	Agricultural area/ Open Space
Lindsaea ensifolia	劍葉鱗始蕨, 雙唇蕨	Native	Fern		++++	++++	++++	+
Lygodium japonicum	海金沙	Native	Fern		++++	++++	++++	++
Litsea rotundifolia var. oblongifolia	豺皮樟	Native	Shrub		++++	++++	++++	
Machilus chekiangensis	浙江潤楠、長序潤楠	Native	Tree		++++	++++	++++	
Liriope spicata	山麥冬、麥門冬	Native	Herb		++++	++++	++++	+
Acronychia pedunculata	山油柑、降真香	Native	Tree		++++	+++	++	
Adiantum flabellulatum	扇葉鐵線蕨	Native	Fern		+++	+++	+++	
Desmos chinensis	假鷹爪、酒餅葉	Native	Shrub		+++	++	++	
Schefflera heptaphylla	鵝掌柴、鴨腳木	Native	Tree		+++	+++	++++	
Tetracera asiatica	錫葉藤	Native	Climber		+++	+++	+++	+
Phyllanthus cochinchinensis	越南葉下珠、鐵包金	Native	Shrub		+++	+++	+++	
Hedyotis acutangula	金草、方骨草	Native	Herb		+++	++	++	
Psychotria serpens	蔓九節、穿根藤	Native	Climber		+++	+++	++++	
Dicranopteris pedata	芒萁	Native	Fern		++	++	+++	+
Sarcandra glabra	草珊瑚、雞爪蘭、九節楓	Native	Shrub		++	++	++	
Garcinia oblongifolia	嶺南山竹子、黃牙果	Native	Tree		++	+	+++	
Scleria ciliaris	緣毛珍珠茅、華珍珠茅	Native	Herb		++	++	++	
Glochidion eriocarpum	毛果算盤子、毛漆、漆大姑	Native	Shrub		++	++	+	
Pueraria phaseoloides	三裂葉野葛	Native	Climber		++	++	++++	++
Melastoma sanguineum	毛蕊	Native	Shrub		++	++	++	
Rubus reflexus	鏽毛莓、蛇泡筋	Native	Climber		++	++	++	+
Zanthoxylum avicennae	簕欓花椒、簕欓	Native	Tree		++	+	+++	

Scientific Name	Chinese Name	Origin	Growth Form	Conservation Status	Relative abundance			
					Above-ground Works Area		Survey Extent	
Polyspora axillaris	大頭茶	Native	Tree		++	+++	++++	
Aquilaria sinensis	土沉香、牙香樹、白木香	Native	Tree	Cap. 586; NT in IUCN; VU in China Red Data Book; AFCD (2003)	++		+	
Gnetum luofuense	羅浮買麻藤	Native	Climber		+		+	
Rhus succedanea	木蠟樹、野漆樹	Native	Tree		+	+	+	
Ilex pubescens	毛冬青	Native	Shrub		+	++	++	
Alocasia macrorrhizos	海芋	Native	Herb		+	+	++	+
Tylophora ovata	娃兒藤	Native	Climber		+	+	+	
Euonymus nitidus	中華衛矛	Native	Shrub		+	+	+	
Cratoxylum cochinchinense	黃牛木	Native	Tree		+	+	+	
Dioscorea fordii	山薯、福氏薯蕷	Native	Climber		+	+	+	
Diospyros morrisiana	羅浮柿	Native	Tree		+	+	+	
Diospyros vaccinioides	小果柿	Native	Shrub	CR in IUCN	+		+	
Elaeocarpus chinensis	中華杜英、野杜英	Native	Tree		+	+	+	
Aporosa dioica	銀柴、大沙葉	Native	Tree		+	+++	++++	
Breynia fruticosa	黑面神、鬼畫符	Native	Shrub		+	+	++	
Glochidion wrightii	白背算盤子	Native	Shrub		+	+	+	
Macaranga tanarius var. tomentosa	血桐	Native	Tree		+	+	+	+
Dalbergia benthamii	兩廣黃檀	Native	Climber		+	+++	+++	
Millettia nitida	亮葉崖豆藤、亮葉雞血藤	Native	Climber		+	+	+	
Cinnamomum parthenoxylon	黃樟	Native	Tree		+	+	+	
Litsea cubeba	木薑子、山蒼樹	Native	Tree		+	+	+	
Machilus velutina	絨毛潤楠	Native	Tree		+	+	+	
Dianella ensifolia	山菅蘭	Native	Herb		+	+	+	+
Melastoma malabathricum	野牡丹	Native	Shrub		+	+	+	

Scientific Name	Chinese Name	Origin	Growth Form	Conservation Status	Relative abundance			
					Above-ground Works Area		Survey Extent	
Albizia corniculata	天香藤	Native	Climber		+	+	+	
Archidendron clypearia	猴耳環	Native	Tree		+	+	+	
Ficus hirta	粗葉榕、牛奶仔	Native	Tree		+	+	+	
Ficus hispida	對葉榕、牛乳樹	Native	Tree		+	+	+	+
Rhodomyrtus tomentosa	桃金娘、崗棯	Native	Shrub		+	+	+	
Ligustrum sinense	山指甲	Exotic	Shrub		+	+	++	
Lophatherum gracile	淡竹葉	Native	Herb		+	+	+++	
Miscanthus sinensis	芒、茅丁	Native	Herb		+	+	+	+
Carallia brachiata	竹節樹	Native	Tree		+	+	+	
Diplospora dubia	狗骨柴、三萼木	Native	Shrub		+	+	++	
Mussaenda pubescens	玉葉金花	Native	Climber		+	++	++	
Psychotria asiatica	九節、山大刀	Native	Shrub		+	++	+++	
Melicope pteleifolia	蜜茱萸、三桠苦	Native	Shrub		+	+	+	
Zanthoxylum scandens	花椒簕	Native	Climber		+	++	+	
Dendrotrophe varians	寄生藤	Native	Climber		+	+	+	
Smilax china	菝葜、金剛藤	Native	Climber		+	+	+	
Smilax lanceifolia var. opaca	暗色菝葜	Native	Climber		+	++	++	
Sterculia lanceolata	假蘋婆	Native	Tree		+	++	+++	+
Eurya nitida	細齒葉柃	Native	Shrub		+	+	++	
Schima superba	木荷、荷樹	Native	Tree		+	+	++	
Celtis sinensis	朴樹	Native	Tree		+	+	++	
Trema tomentosa	山黃麻	Native	Tree		+	+	+	
Osmunda angustifolia	狹葉紫萁	Native	Fern				+	
Lemmaphyllum microphyllum	伏石蕨	Native	Fern				++	
Pteris semipinnata	半邊旗	Native	Fern				+	+
Pteris vittata	蜈蚣草	Native	Fern				+	

Scientific Name	Chinese Name	Origin	Growth Form	Conservation Status	Relative abundance			
					Above-ground Works Area		Survey Extent	
Cyclosorus parasiticus	華南毛蕨	Native	Fern				++	++
Macrothelypteris torresiana	普通針毛蕨	Native	Fern					+
Dracaena fragrans	巴西鐵樹	Exotic	Shrub				+	+
Alangium chinense	八角楓	Native	Tree				+	
Mangifera indica	杧果	Exotic	Tree				+	+
Uvaria macrophylla	紫玉盤	Native	Climber				+	
Ilex asprella	梅葉冬青、秤星樹	Native	Shrub			+	+	
Ilex memecylifolia	谷木葉冬青、谷木冬青	Native	Shrub				+	
Pothos chinensis	石柑、石柑子	Native	Climber				++	
Livistona chinensis	蒲葵	Exotic	Tree				+	
Roystonea regia	大王椰子、王棕	Exotic	Tree				+	
Ageratum conyzoides	藿香薊、勝紅薊	Exotic	Herb					++
Bidens alba	白花鬼針草	Exotic	Herb				++	++++
Wedelia trilobata	三裂葉蟛蜞菊	Exotic	Climber				++++	
Opuntia stricta var. dillenii	仙人掌	Exotic	Herb					+
Bauhinia glauca	粉葉羊蹄甲、羊蹄甲藤	Native	Climber				++	++++
Delonix regia	鳳凰木	Exotic	Tree				+	
Carica papaya	番木瓜	Exotic	Tree					+
Casuarina equisetifolia	木麻黃、牛尾松	Exotic	Tree				+	
Celastrus monospermus	獨子藤、單子南蛇藤	Native	Climber				+	
Benincasa hispida var. chieh-qua	節瓜	Exotic	Climber					++
Gahnia tristis	黑莎草	Native	Herb			++	++	
Kyllinga nemoralis	單穗水蜈蚣	Native	Herb				+++	
Mariscus cyperoides	磚子苗	Native	Herb				+	
Daphniphyllum calycinum	牛耳楓	Native	Shrub			+	+	
Rhododendron simsii	紅杜鵑	Native	Shrub	Cap. 96A			+	

Scientific Name	Chinese Name	Origin	Growth Form	Conservation Status	Relative abundance			
					Above-ground Works Area		Survey Extent	
Aleurites moluccana	石栗	Exotic	Tree				+	
Euphorbia hirta	飛揚草	Exotic	Herb				+	
Mallotus paniculatus	白楸	Native	Tree				++	
Phyllanthus tenellus	纖梗葉下珠	Exotic	Shrub				+	
Vernicia montana	木油樹、千年桐	Exotic	Tree					+
Desmodium triflorum	三點金	Native	Herb				+	+
Ormosia pachycarpa	茸莢紅豆	Native	Tree	EN in China Red Data Book; AFCD (2003)			+	
Chirita sinensis	唇柱苣苔	Native	Herb				++	
Litsea glutinosa	潺槁樹	Native	Tree				+	
Taxillus chinensis	廣寄生	Native	Parasite			+	+	
Michelia × alba	白蘭	Exotic	Tree				+	
Sida acuta	黃花稔	Native	Shrub				+	
Melia azedarach	楝、苦楝、森樹	Exotic	Tree				+	
Acacia confusa	台灣相思	Exotic	Tree				+++	
Calliandra haematocephala	朱纓花、紅絨球	Exotic	Shrub				+	
Leucaena leucocephala	銀合歡	Exotic	Tree				+++	+
Artocarpus heterophyllus	菠蘿蜜	Exotic	Tree					+
Ficus elastica	印度榕、印度橡樹	Exotic	Tree				+	
Ficus fistulosa	水同木	Native	Tree			+	+	
Ficus pumila	薜荔、文頭郎	Native	Climber				++	
Ficus subpisocarpa	筆管榕	Native	Tree				+	
Ficus variegata	青果榕	Native	Tree				+	
Ficus virens	黃葛樹、大葉榕	Native	Tree				+	
Ardisia crenata	朱砂根	Native	Shrub				+	

Scientific Name	Chinese Name	Origin	Growth Form	Conservation Status	Relative abundance			
					Above-ground Works Area		Survey Extent	
Embelia ribes	白花酸藤子	Native	Climber			+	+	
Cleistocalyx nervosum	水翁	Native	Tree				+	+
Melaleuca cajuputi subsp. cumingiana	白千層	Exotic	Tree				+	+
Syzygium buxifolium	赤楠	Native	Shrub			+	+	
Syzygium jambos	蒲桃	Exotic	Tree			+	+	
Oxalis corniculata	酢漿草	Native	Herb				+	+
Pandanus austrosinensis	露兜草	Native	Herb			+	+	
Piper hancei	山蔴	Native	Climber				+	
Eleusine indica	牛筋草、蟋蟀草	Native	Herb				++	++++
Paspalum conjugatum	兩耳草	Native	Herb				+++	
Pogonatherum crinitum	金絲草	Native	Herb				++	++
Persicaria chinensis	火炭母	Native	Climber					+
Berchemia floribunda	多花勾兒茶	Native	Climber				+	
Sageretia thea	雀梅藤	Native	Climber				+	
Rhaphiolepis indica	石斑木、車輪梅、春花	Native	Shrub				+	
Rubus leucanthus	白花懸鉤子	Native	Climber			+	+	
Adina pilulifera	水團花	Native	Tree				+	
Antirhea chinensis	毛茶	Native	Tree			+	+	
Gardenia jasminoides	梔子、水橫枝	Native	Shrub				+	
Hedyotis corymbosa	傘房花耳草、繖房花耳草	Native	Herb				++	
Spermacoce stricta	豐花草、波利亞草	Native	Herb				+	+
Tetradium glabrifolium	楝葉吳茱萸	Native	Tree				+	
Dimocarpus longan	龍眼	Exotic	Tree				+	+
Byttneria grandifolia	刺果藤	Native	Climber				+	
Eurya macartneyi	黑柃	Native	Shrub				+	
Boehmeria nivea	苧麻	Exotic	Shrub			+	++	

Scientific Name	Chinese Name	Origin	Growth Form	Conservation Status	Relative abundance			
					Above-ground Works Area		Survey Extent	
Clerodendrum japonicum	赪桐	Exotic	Herb				+	
Hedychium coronarium	薑花	Exotic	Herb					+

Notes:

1. Conservation and protection status refers to:
   a. IUCN Red List of Threatened Species (2022): CR = Critically Endangered; VU = Vulnerable, EN = Endangered; NT = Near Threatened.
   b. Threatened Species List of China's Higher Plants (TSLCHP): VU = Vulnerable, EN = Endangered.
   c. China Plant Red Data Book (CPRDB): V = Vulnerable.
   d. Rare and Precious Plants of Hong Kong (AFCD 2003): NT = Near Threatened; CR = Critically Endangered.
   e. Cap. 96 = Forests and Countryside Ordinance
   f. Cap. 586 = Protection of Endangered Species of Animals and Plants Ordinance
   g. China State Major Protection Status (CSMPS): II = Class II Protected Species in China.
2. Status in HK follows Corlett *et al*. (2000).

Table 2. List of fauna species recorded during survey

Scientific Name	Common Name	Chinese Name	Conservation Status*	Abundance				
				Above-ground Works Area		Survey Extent		
				Proposed Portal Extent	Proposed Soil Nail Extent	Woodland	Stream	Agricultural area/ Open Space
Bird								
Orthotomus sutorius	Common Tailorbird	長尾縫葉鶯				4		
Parus minor	Japanese Tit	遠東山雀				2		
Zosterops simplex	Swinhoe's White-Eye	暗綠繡眼鳥				6		
Pterorhinus pectoralis	Greater Necklaced Laughingthrush	黑領噪鶥				2		
Spilopelia chinensis	Spotted Dove	珠頸斑鳩				4		
Motacilla alba	White Wagtail	白鶺鴒				3		
Passer montanus	Eurasian Tree Sparrow	樹麻雀				2		
Pycnonotus sinensis	Chinese Bulbul	白頭鵯		5	2	5		
Pycnonotus jocosus	Red-Whiskered Bulbul	紅耳鵯		7				
Urocissa erythroryncha	Red-Billed Blue Magpie	紅嘴藍鵲				1		
Copsychus saularis	Oriental Magpie-Robin	鵲鴝				1		
Corvus macrorhynchos	Large-Billed Crow	大嘴烏鴉				1		
Milvus migrans	Black Kite	黑鳶	(RC); CITES(II); CSMPS(II); Cap.586			2		
Centropus sinensis	Greater Coucal	褐翅鴉鵑	CSMPS(II)			1		
Myophonus caeruleus	Blue Whistling Thrush	紫嘯鶇					1	
Ixos mcclellandii	Mountain Bulbul	綠翅短腳鵯		4				
Actinodura cyanouroptera	Blue-Winged Minla	藍翅希鶥		2				
Butterfly								
Delias pasithoe	Red-Base Jezebel	報喜斑粉蝶		2				
Catopsilia pomona pomona	Lemon Emigrant	遷粉蝶		6				
Pelopidas mathias	Small Branded Swift	隱紋穀弄蝶		4				
Cupha erymanthis erymanthis	Rustic	黃襟蛺蝶		2				
Junonia lemonias lemonias	Lemon Pansy	蛇眼蛺蝶						1
Symbrenthia lilaea	Common Jester	散紋盛蛺蝶		1				

Scientific Name	Common Name	Chinese Name	Conservation Status*	Abundance				
				Above-ground Works Area		Survey Extent		
lunica								
Hypolimnas bolina kezia	Great Egg-Fly	幻紫斑蛱蝶		1				
Junonia iphita iphita	Chocolate Pansy	鉤翅眼蛱蝶		1				
Graphium sarpedon	Common Bluebottle	青鳳蝶		2				
Papilio protenor	Spangle	藍鳳蝶		1				
Graphium doson axion	Common Jay	木蘭青鳳蝶		1				
Papilio polytes polytes	Common Mormon	玉帶鳳蝶		2				
Papilio memnon	Great Mormon	美鳳蝶		1				
Papilio xuthus	Swallowtail	柑橘鳳蝶		1				
Artipe eryx eryx	Green Flash	綠灰蝶		1				
Nacaduba kurava euplea	Transparent Six-line Blue	古樓娜灰蝶		1				
Megisba malaya	Malayan	美姬灰蝶	LC					1
Faunis eumeus	Large Faun	串珠環蝶		1				
Odonates								
Orthetrum triangulare triangulare	Lesser Blue Skimmer	鼎異色灰蜻				2		
Euphaea decorata	Black-banded Gossamerwing	方帶幽蟌					1	
Herpetofauna								
Sylvirana guentheri	Gunther's Frog	沼蛙					2	
Gekko chinensis	Chinese Gecko	中國壁虎					2	
Opisthotropis andersonii	Anderson's Stream Snake	香港後稜蛇	PGC; RLCV(NT); IUCN(NT)				1	
Quasipaa exilispinosa	Lesser Spiny Frog	小棘蛙	PGC; RLCV(VU); IUCN(VU)				20	
Xenophrys brachykolos	Short-legged Toad	短腳角蟾					1	
Polypedates megacephalus	Brown Tree Frog	斑腿泛樹蛙				2		
Duttaphrynus melanostictus	Asian Common Toad	黑眶蟾蜍						1
Oreonectes platycephalus	Flat-headed Loach	平頭嶺鰍					Many	

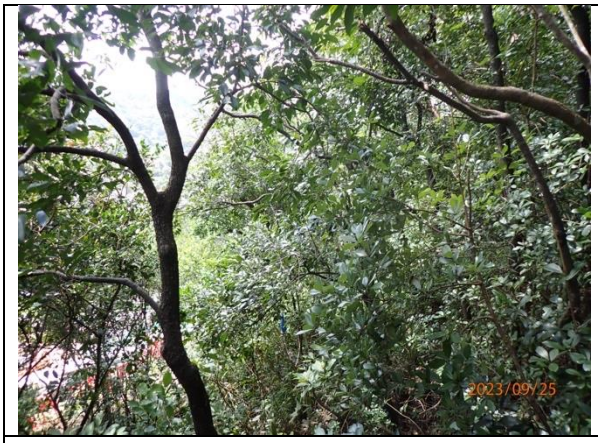
Scientific Name	Common Name	Chinese Name	Conservation Status*	Abundance				
				Above-ground Works Area		Survey Extent		
Caridina cantonensis	Freshwater Shrimp	廣東米蝦					Many	
Cryptopotamon anacoluthon	Freshwater Crab	鰓刺溪蟹	PGC, IUCN(VU)				30	
Nanhaipotamon hongkongense	Freshwater Crab	香港南海溪蟹	PGC				3	

*Note: Conservation and Protection Status Refers to Fellowes et al. (2002), Red List of China's Vertebrates (Jiang Et Al. 2016), IUCN (2023), China State Major Protection Status, CITES (2019), Cap. 170 and Cap. 586.

A. Conservation Status by Fellowes et al. (2002): LC = Local Concern; PRC = Potential Regional Concern; RC = Regional Concern; PGC = Potential Global Concern; GC = Global Concern. Letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.
B. Conservation status by Red List of China's Vertebrates (RLCV) (Jiang et al. 2016): NT = Near Threatened; VU = Vulnerable; EN = Endangered; CR = Critically Endangered.
C. Conservation status by IUCN (2023): NT = Near Threatened; VU = Vulnerable; EN = Endangered; CR = Critically Endangered.
D. Protection status by China State Major Protection Status (CSMPS): II = Class II Protected Species in China.
E. Protection status by CITES (2019): I = Listed in CITES Appendix I; II = Listed in CITES Appendix II; III = Listed in CITES Appendix III.
F. Cap. 170 = Wild Animals Protection Ordinance.
G. Cap. 586 = Protection of Endangered Species of Animals and Plants Ordinance

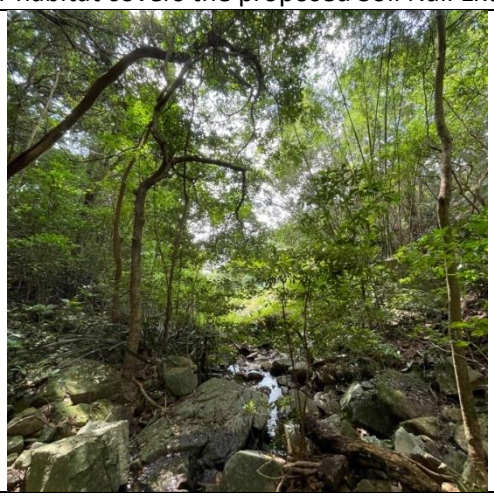
Appendix 5.2
Photographic Records of Habitats and Recorded Species of Conservation Importance (September 2023)

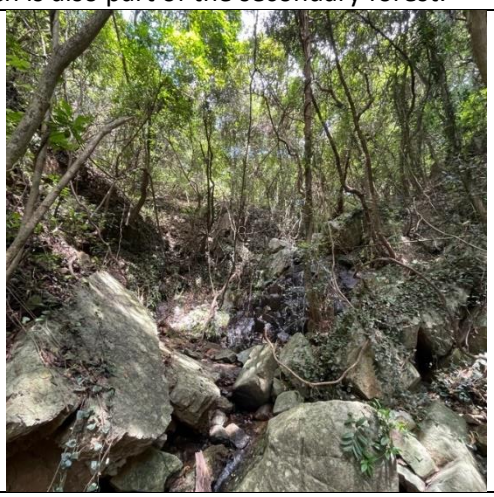
Appendix 5.2A Photographic Records of Habitats within Proposed Above-ground Works Area and Survey Extent



The proposed Portal Extent is situated at an edge of secondary forest where the canopy is moderately dense, reaching 8 to 10 m tall.

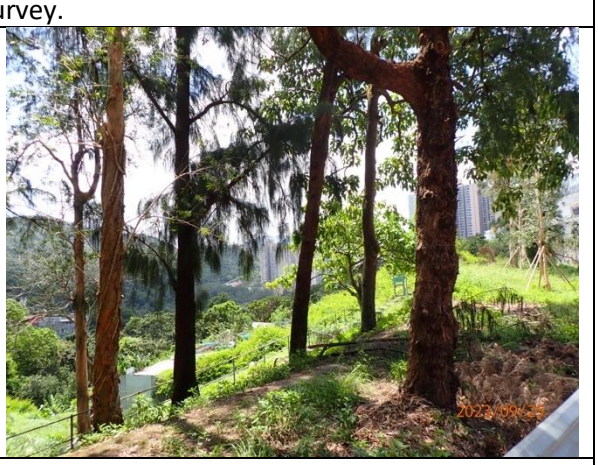
Similar habitat covers the proposed Soil Nail Extent, which is also part of the secondary forest.





A natural stream course runs north-south to the east of the proposed Above-ground Works Area. The secondary forest forms the major stream bank vegetation. Terrestrial plants are scarce along the stream course as it largely consists of boulders.

Another stream is located along the western periphery of the Survey Extent. The water flow and volumn was observed to be very low during the survey.



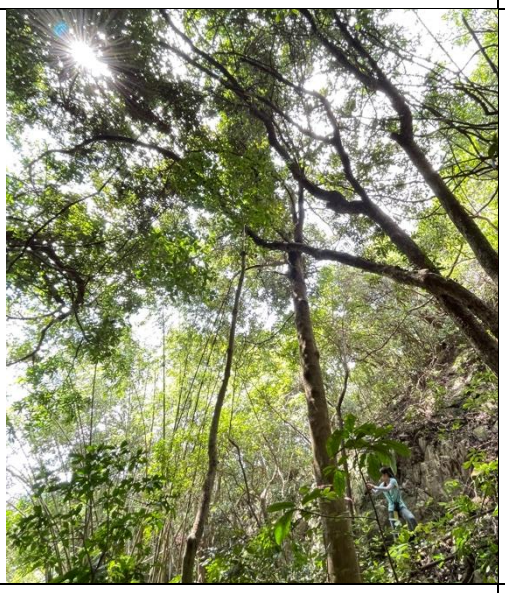
A patch of abandoned agricultural land is situated to the east of the proposed Above-ground Works Area and adjacent to the natural stream course. A larger open space with sign of agriculture is also present south of Po Lam Road.

Appendix 5.2B Photographs of Species of Conservation Importance Recorded during Survey in September 2023

Flora

Aquilaria sinensis 土沉香

Diospyros vaccinioides 小果柿



Ormosia pachycarpa 茸莢紅豆

Rhododendron simsii 紅杜鵑

Fauna

Cryptopotamon anacoluthon 鰓刺溪蟹

Nanhaipotamon hongkongense 香港南海溪蟹

Xenophrys brachykolos 短腳角蟾

Tadpole of *Xenophrys brachykolos* 短腳角蟾

Opisthotropis andersonii 香港後棱蛇

Quasipaa exilispinosa 小棘蛙

Appendix 6.1
Coordinate for Building Structure, Slope and Extended Tunnel

Building Structure

Identification	Easting	Northing	Elevation
Village House near Anderson Road	843094	820276	180
Residential Site R2-6	842274	820850	192
Residential Site RS-1	842584	820420	191

Slope

Identification Number	Easting	Northing	Elevation
11 NE-D/C 872	842521	820729	335
11 NE-D/C 948	842488	820673	310
11 NE-D/C 949	842544	820551	270
11 NE-D/C 981	842527	820535	251
11 NE-D/C 982	842388	820633	212
11 NE-D/C1005	842366	820622	191
11 NE-D/C871	842611	820591	335
11 NE-D/C947	842670	820531	330
11 NE-D/C976	842649	820476	252
11 NE-D/C978	842646	820453	232
11 NE-D/C988	842635	820430	213
11 NE-D/C1004	842631	820416	200
11 NE-D/C977	842703	820474	289
11 NE-D/C986	842690	820452	251
11 NE-D/C999	842677	820432	233
11 NE-D/C1003	842665	820411	215
11 NE-D/C998	842657	820400	205
11 NE-D/C979	842850	820404	310
11 NE-D/C980	842828	820340	290
11 NE-D/C987	842843	820270	251
11 NE-D/C1006	842856	820244	231

Tunnel

Identification Number	Easting	Northing	Elevation
Portal near On Yu Road	842332	820885	194
T1	842494	820799	208
T2	842496	820794	208
T3	842498	820788	208
T4	842500	820783	208
T5	842502	820778	208
T6	842504	820773	208
T7	842506	820768	208
T8	842508	820763	208
T9	842510	820758	207
T10	842512	820753	207
T11	842514	820748	207
T12	842517	820743	207
T13	842519	820737	207
T14	842521	820732	207
T15	842523	820727	207
T16	842525	820722	207
T17	842527	820717	206
T18	842529	820712	206
T19	842531	820707	206
T20	842533	820702	206
T21	842535	820697	206
T22	842537	820692	206
T23	842539	820687	206
T24	842541	820681	206
T25	842543	820676	205
T26	842546	820672	205
T27	842549	820667	205
T28	842551	820662	205

Identification Number	Easting	Northing	Elevation
T29	842554	820657	205
T30	842557	820652	205
T31	842560	820648	205
T32	842563	820643	205
T33	842566	820638	204
T34	842569	820634	204
T35	842572	820629	204
T36	842575	820625	204
T37	842578	820621	204
T38	842582	820616	204
T39	842585	820612	204
T40	842589	820608	204
T41	842593	820604	203
T42	842597	820600	203
T43	842600	820596	203
T44	842604	820592	203
T45	842608	820589	203
T46	842612	820585	203
T47	842617	820581	203
T48	842621	820578	203
T49	842625	820574	202
T50	842630	820571	202
T51	842634	820568	202
T52	842638	820565	202
T53	842643	820562	202
T54	842648	820559	202
T55	842652	820556	202
T56	842657	820553	201
T57	842662	820550	201

Identification Number	Easting	Northing	Elevation
T58	842667	820548	201
T59	842672	820545	201
T60	842677	820543	201
T61	842682	820541	201
T62	842687	820538	201
T63	842692	820536	201
T64	842697	820534	200
T65	842702	820532	200
T66	842707	820531	200
T67	842712	820529	200
T68	842718	820527	200
T69	842723	820526	200
T70	842728	820524	200
T71	842734	820523	199
T72	842739	820522	199
T73	842744	820521	199
T74	842750	820519	199
T75	842755	820518	199
T76	842760	820516	199
T77	842765	820515	199
T78	842771	820513	199
T79	842776	820511	198
T80	842781	820509	198
T81	842786	820507	198
T82	842791	820505	198
T83	842796	820503	198
T84	842801	820501	198
T85	842806	820499	198
T86	842811	820496	197

Identification Number	Easting	Northing	Elevation
T87	842816	820494	197
T88	842821	820491	197
T89	842826	820489	197
T90	842831	820486	197
T91	842836	820483	197
T92	842841	820481	197
T93	842845	820478	196
T94	842850	820475	196
T95	842854	820472	196
T96	842859	820469	196
T97	842864	820466	196
T98	842868	820462	196
T99	842872	820459	196
T100	842877	820456	196
T101	842881	820452	195
T102	842885	820449	195
T103	842890	820445	195
T104	842894	820442	195
T105	842898	820438	195
T106	842902	820434	195
T107	842906	820430	195
T108	842910	820427	194
T109	842914	820423	194
T110	842917	820419	194
T111	842921	820415	194
T112	842925	820410	194
T113	842928	820406	194
T114	842932	820402	194
T115	842935	820398	194

Identification Number	Easting	Northing	Elevation
T116	842939	820393	193
T117	842942	820389	193
T118	842945	820385	193
T119	842949	820380	193
T120	842952	820376	193
T121	842955	820371	193
T122	842958	820366	193
T123	842961	820362	192
T124	842963	820357	192
T125	842966	820352	192
T126	842969	820347	192
T127	842972	820343	192
T128	842974	820338	192
T129	842977	820333	192
T130	842980	820328	192
T131	842982	820324	191
TR1	842542	820728	207
TR2	842584	820644	204
TR3	842651	820578	202
TR4	842733	820541	200
TR5	842839	820502	197
TR6	842921	820441	195
TR7	842984	820359	192

Appendix 6.2
PPVc of Slope

Slope Number	Description	PPVc (mm/s)
SF01	11 NE-D/C 872	25
SF02	11 NE-D/C 948	25
SF03	11 NE-D/C 949	25
SF04	11 NE-D/C 981	25
SF05	11 NE-D/C 982	25
SF06	11 NE-D/C1005	25
SF07	11 NE-D/C871	25
SF08	11 NE-D/C947	25
SF09	11 NE-D/C976	25
SF10	11 NE-D/C978	25
SF11	11 NE-D/C988	25
SF12	11 NE-D/C1004	25
SF13	11 NE-D/C977	25
SF14	11 NE-D/C986	25
SF15	11 NE-D/C999	25
SF16	11 NE-D/C1003	25
SF17	11 NE-D/C998	25
SF18	11 NE-D/C979	25
SF19	11 NE-D/C980	25
SF20	11 NE-D/C987	25
SF21	11 NE-D/C1006	25