

Drainage Services Department

Agreement No. CE29/2001
Outlying Islands Sewerage Stage 1 Phase 1
Ngong Ping Sewage Treatment Works and Sewerage Investigation,
Design and Construction

Project Profile
Reuse of Treated Effluent from Ngong Ping Sewage Treatment Plant
for Toilet Flushing

February 2003

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Job number 23400

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1. BASIC INFORMATION

1.1 Project Title

Reuse of Treated Effluent from Ngong Ping Sewage Treatment Plant (STP) for Toilet Flushing.

1.2 Purpose and Nature of the Project

The Project involves the reuse of tertiary treated effluent from Ngong Ping STP for toilet flushing. The treated effluent from Ngong Ping STP will further undergo chlorination before being conveyed to the point of usage at the toilets, including Public Toilet 1, Public Toilet 2, and a future Public Toilet 3 to be constructed within the new Public Transport Interchange at Ngong Ping. In addition, the Government is discussing with the developer of the Ngong Ping Cable Car Project on the use of treated effluent for toilet flushing within the cable car premises. **Drawing No. 23400/R/001** shows the general layout. The treatment process for the effluent reuse scheme, which will be incorporated within the boundary of the Ngong Ping STP site, is as shown in **Drawing No.23400/R/002**.

1.3 Name of Project Proponent

Drainage Services Department

1.4 Location and Scale of Project

The effluent reuse system will consist of two buildings, namely the chlorination room and the treated effluent pumping station building, as well as other underground facilities including a chlorine contact tank and a treated effluent storage tank. The system also includes a back-up fresh water supply to augment the fluctuating treated effluent supply. It is estimated that the site for the effluent reuse facilities will cover an area of approximately 870m² (including 350m² of emergency storage tank which also serves as reuse effluent storage during normal operation). The height of the buildings within the site will be about 4 m. All treatment facilities will be installed within the buildings or located underground in order to minimize the visual impact. **Drawing No. 23400/R/003** shows the effluent reuse plant layout and **Drawing No. 23400/R/002** shows the schematic diagram of the effluent reuse system.

Drawing No. 23400/R/001 shows the distribution pipeline connecting the effluent reuse facilities to the public toilets at Ngong Ping, including Public Toilets 1, 2 and 3, and those toilets within the premises of the future cable car development. The size of the distribution pipeline will range from 150mm to 200mm. The total length of the pipeline will be about 600m.

1.5 Number and Type of Designated Project to be Covered

The reuse of treated effluent from Ngong Ping STP for toilet flushing is identified as a Designated Project under Schedule 2, Part I, Item F4 of the Environmental Impact Assessment Ordinance.

1.6 Name and Telephone Number of Contact Person(s)

Mr MAK Ka Wai, Senior Engineer/Consultants Management Division, Drainage Services Department (Tel. 2594 7255)

2. OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

The Consultants of Agreement No. CE29/2001 *Outlying Islands Sewerage Stage 1 Phase 1 Ngong Ping Sewage Treatment Works and Sewerage Investigation, Design and Construction* will carry out the design of the proposed effluent reuse facilities. They will also supervise the associated construction works by qualified contractors. The Drainage Services Department and Water Supplies Department will operate and maintain the proposed effluent reuse scheme.

The Project will be implemented in accordance with the tentative program for the Ngong Ping STP. The tender and construction of the STP project will commence in March 2003 and August 2003 respectively for completion of the construction works in July 2005.

3. POSSIBLE IMPACT ON THE ENVIRONMENT

3.1 Possible Environmental Impacts During Construction

3.1.1 Dust

The proposed effluent reuse system will be constructed together with the Ngong Ping STP and Sewerage Project. The major potential air quality impact during construction of this Project is dust arising from general construction activities, including land clearing, drilling and rock breaking, construction of foundation and superstructures, handling and transportation of construction and demolition material, and from wind erosion of open sites and stockpiling areas.

3.1.2 Noise

The construction activities involved in this Project will include excavation and general concreting works. Sources of noise during the construction phase would be associated with the use of powered mechanical equipment.

3.1.3 Water Quality

The proposed effluent reuse system will be constructed together with the Ngong Ping STP and Sewerage Project. Water quality impacts of the Project would be associated with site runoff and wastewater and sewage generated from construction activities. In view of the small scale of the Project, adverse water quality impact during the construction phase is not anticipated.

Water Supplies Department's requirements for working within water gathering ground would be observed during the construction phase of the Project.

3.1.4 Waste Management Implications

Excavation will be required for the construction of the proposed effluent reuse system. The volume of excavated material generated from the construction of the effluent reuse system would be about 1,300 m³ (excluding excavated material for emergency storage tank which has been taken into account in the EIA report for Ngong Ping STP). Construction waste used in formwork and temporary works will also be generated.

3.1.5 Ecology

The site for the effluent reuse facilities and the associated distribution system has been covered by the ecological field survey and ecological impact assessment conducted for Ngong Ping STP and Sewerage Environmental Impact Assessment (EIAO Register No. AEIAR-065/2002) approved in November 2002. The effluent reuse facilities would all be located within the boundary of the Ngong Ping STP site and the alignment of the associated distribution piping would be along existing roads. No habitat with ecological values was identified within the site for the effluent reuse facilities and the associated distribution

network. No adverse ecological impact is therefore anticipated for the proposed effluent reuse scheme.

3.1.6 Landscape and Visual

The effluent reuse facilities would all be located within the boundary of the Ngong Ping STP site and the alignment of the associated distribution piping would be along existing roads. In view of the small scale of the works, these impacts will be small, localised and short-term.

3.2 Possible Environmental Impacts During Operation

3.2.1 Natural Resources

The existing and future toilets in the area, including those in the premises of the cable car development, utilise potable water for flushing activities. The implementation of the effluent reuse scheme would reduce the fresh water demand at the existing and future toilets. It is anticipated that approximately 600 to 900 m³ of fresh water would be saved each day due to the proposed effluent reuse scheme.

3.2.2 Air Quality

There would be potential odour impact from the chlorination process if the operation is not enclosed. No other aerial emission from the treatment process of the effluent reuse scheme during the operational phase of the Project is anticipated.

3.2.3 Noise

The pumps and the ventilation system of the effluent reuse facilities would be the main potential noise sources during the operational phase of the Project.

3.2.4 Water Quality

Influent to the Effluent Reuse Facilities

The effluent reuse scheme will utilize the effluent from Ngong Ping STP. Thus, the water quality of influent to the effluent reuse facilities is the same as the effluent water quality from Ngong Ping STP as listed in **Table 3.1**.

Table 3.1 Effluent Standards for Ngong Ping STP

Parameter	Units	Effluent Water Quality
Colour	Hazen Unit	<=20
Ammonia N	mg/L	<=1
Odour	Threshold odour number	<=100
Dissolved Oxygen	mg/L	>=2
BOD ₅	mg/L	<=10
Total SS ^(Note 1)	mg/L	<=10
Turbidity	NTU	<=10
<i>E. coli</i>	cfu/100ml	<=100
Residual Chlorine	mg/L	0
Synthetic Detergents	mg/L	<=5

Note 1: Original effluent standard for the Ngong Ping STP as depicted in the EIA Report for Ngong Ping STP and Sewerage (EIAO Register No. AEIAR-065/2002) for Total SS is 15 mg/L. In a review on the sewage characteristics and the chosen tertiary treatment process, it is apparent that an effluent standard for SS of 10 mg/L will be achieved when the BOD₅ level is reduced to the required standard of 10 mg/L. This more stringent standard is therefore adopted.

Effluent from the Effluent Reuse Facilities

Since the influent water will further undergo chlorination process, the quality of the treated water to be used for toilet flushing will be in a better water quality in terms of *E.coli* with total residual chlorine of greater than or equal to 0.5 mg/L.

Impact of Ngong Ping Effluent Discharged to Marine Waters

The fresh water demand at the existing and future toilets in the area would be reduced due to the effluent reuse scheme. The volume of STP effluent requiring discharge to the marine waters would be reduced with the implementation of the effluent reuse scheme.

Without the effluent reuse scheme, all effluent generated from Ngong Ping STP would be discharged to the marine water at Tung Wan. After the implementation of the effluent reuse scheme for flushing at the existing and future toilets, it is anticipated that there would be approximately 600 to 900 m³ reduction, or around 30 to 40% of the effluent generated from the Ngong Ping STP that require disposal at Tung Wan, hence reducing the pollution loading to the environment.

Regarding the quality of effluent requiring discharge from the Ngong Ping STP to Tung Wan waters, it should remain the same and meet the discharge standards of Ngong Ping STP as shown in **Table 3.1**. With reference to the findings of the Environmental Assessment for the Project Profile of *Ngong Ping Sewage Treatment Works and Sewerage - Effluent Export Pipeline from Ngong Ping Sewage Treatment Plant to Tung Wan*, the discharge from Ngong Ping STP would not adversely affect the water quality and the areas with ecological importance in Tung Wan and the vicinity.

3.2.5 Waste

It is not expected that there would be any additional waste generated from the Ngong Ping STP due to the operation of the effluent reuse system.

3.2.6 Ecology

No ecological impact is expected during the operation of the effluent reuse system.

3.2.7 Health and Hygiene

Toilet flushing is a typical non-potable use in which water will not have direct contact with other living organisms. Thus, the impact on human health and hygiene is minimal. Besides, the effluent from Ngong Ping STP will be further processed with chlorination prior to use for toilet flushing in order to ensure no bacteria re-growth after UV disinfection and no bacteria contamination during the transmission of effluent to the toilets. A chlorine dosing system in the form of sodium hypochlorite with contact time of about 30 minutes will form part of the effluent reuse system. With the proposed chlorination system, the total residual chlorine will be greater than or equal to 0.5mg/l, which is a level recommended by the United States Environmental Protection Agency (USEPA) for reducing odours, slime, and bacterial growth in distribution system for effluent reuse. Having said that, potential health and hygiene problems might exist should there be incorrect connection of the potable water and treated effluent pipes at the toilets.

3.2.8 Hazard

The only chemical that will be stored on site is a small amount of sodium hypochlorite required for the chlorination process. It is anticipated that sodium hypochlorite solution of concentration of 11%-15% will be used to introduce the chlorine residual of 0.5mg/L to the effluent. The dosage is about 1mg/L to 5mg/L subject to effluent water quality.

Sodium hypochlorite solution is a poisonous substance classified as Category 4 dangerous goods item. The solution can be transported to Ngong Ping STP in liquid and would be stored

in tanks fabricated from fibreglass or rubber lined steel. Fire Services Department's requirements for bulk storage would be properly observed. However, the use of sodium hypochlorite for the chlorination process of the proposed effluent reuse system would not constitute a potentially hazardous installation (PHI) and no hazard impact is anticipated from the effluent reuse scheme.

3.2.9 Landscape and Visual

The above ground structure for the effluent reuse facilities may induce visual impacts.

4. MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

The effluent reuse facilities will be located within the boundary of Ngong Ping STP site which is located at the western side of Ngong Ping adjacent to Ngong Ping Road (**Drawing No. 23400/R/001**). The distribution network will be along the existing Ngong Ping Road. The air and noise sensitive receivers in the vicinity of the Project include the village houses near the bus terminal on Ngong Ping Road, the Tin Tan Buddha Statue and the Lin Chi Monastery. The locations of the relevant sensitive receivers are shown in **Drawing No. 23400/R/004**.

5. ENVIRONMENTAL PROTECTION MEASURES TO BE INCORPORATED

5.1 Environmental Protection Measures During Construction Stage

The Ngong Ping STP and Sewerage EIA (EIAO Register No. AEIAR-065/2002) approved in November 2002 recommended the implementation of proper environmental mitigation measures during the construction of Ngong Ping STP and the pipe laying works for the proposed Ngong Ping sewerage system and the effluent export pipeline. The effluent reuse facilities will be constructed together with the construction of the Ngong Ping STP and Sewerage Project. The mitigation measures proposed in the Ngong Ping STP and Sewerage EIA will be adopted for the effluent reuse scheme where appropriate. The mitigation measures for dust, noise, water quality, waste and landscape and visual aspects are discussed below.

5.1.1 Dust

The Ngong Ping STP and Sewerage EIA assessed the cumulative dust impacts during the construction of Ngong Ping STP and the associated pipeworks. Section 3.6 of the Ngong Ping STP and Sewerage EIA recommended the implementation of proper dust control and suppression measures stipulated in the *Air Pollution Control (Construction Dust) Regulation* during the construction phase of the Project. Relevant clauses will be incorporated into the contract documents of the proposed effluent reuse scheme in this regard. In view of the small scale of the effluent reuse scheme, adverse dust impact is not anticipated.

5.1.2 Noise

The Ngong Ping STP and Sewerage EIA assessed the cumulative noise impacts during the construction of Ngong Ping STP and the associated pipeworks. Section 4.5 of the Ngong Ping STP and Sewerage EIA recommended the construction phase mitigation measures. The construction noise impacts could be reduced with the use of quiet plant, temporary noise barriers, etc. Clauses will be incorporated into the contract documents requiring the contractors to comply with the Noise Control Ordinance and its subsidiary regulations so as to control the noise level within acceptable limit during the construction stage. In view of the small scale of the effluent reuse scheme, adverse noise impact during the construction phase of the Project is not anticipated.

5.1.3 Water Quality

The Ngong Ping STP and Sewerage EIA assessed the water quality impacts during the construction of the proposed STP and the associated pipeworks. Section 5.4 of the Ngong Ping STP and Sewerage EIA recommended the adoption of the practices outlined in *ProPECC PN 1/94 Construction Site Drainage* to minimise site runoff and potential water pollution. Water quality impact will be further minimised during the construction stage of this Project with the adoption of good site arrangement and management practices. Clauses will be incorporated into the contract documents requiring the contractors to comply with the Water Pollution Control Ordinance and its subsidiary regulations and the relevant measures recommended in the Ngong Ping STP and Sewerage EIA. In view of the small scale of this Project, adverse water quality impact during the construction phase is not anticipated.

5.1.4 Waste Management Implications

The volume of additional excavated material generated from the effluent reuse scheme would be about 1,300 m³. About 213 m³ of this excavated spoil could be reused on-site and the remaining surplus of 1,088 m³ will be transported to the Public Fill Stockpiling Area at Mui Wo for reuse in suitable public filling areas or land formation projects. The mitigation measures proposed in Section 6.5 of the Ngong Ping STP and Sewerage EIA report will be adopted for the effluent reuse scheme. No adverse waste impact is anticipated with proper mitigation measures in place. Clauses will be incorporated into the contract documents requiring the contractors to comply with the Waste Control Ordinance and its subsidiary regulations as well as the relevant measures recommended in the Ngong Ping STP and Sewerage EIA.

5.1.5 Landscape and Visual

In view of the small scale of this Project, no adverse landscape and visual impacts are expected during the construction phase.

5.2 Environmental Protection Measures During Operational Stage

The proposed effluent reuse facilities will be enclosed within buildings or located underground to minimise the potential noise and odour impacts. The proposed effluent reuse system will ensure no bacteria re-growth along the effluent reuse distribution system and hence minimising the potential health and hygiene impact. The proposed scheme in fact has the advantage of decreasing wastewater discharges and thus reducing pollution loading to the environment, and reducing the fresh water demand at the toilets.

5.2.1 Air Quality

The chlorination process of the effluent reuse system will be enclosed within buildings or located underground to contain any potential odour emission from the treatment process. Adverse odour impact on nearby sensitive receivers during the operational phase of the Project is not expected.

5.2.2 Noise

The pumps of the effluent reuse system will be enclosed within buildings or located underground to contain the noise emissions from the effluent reuse system. Silenced ventilation system incorporating silencers at the air intakes and discharge openings of the effluent reuse facilities would also be employed to further reduce the noise impact. With these mitigation measures in place, adverse noise impact is not anticipated during the operational phase of the Project.

5.2.3 Health and Hygiene

The effluent from Ngong Ping STP will be further processed with chlorination to ensure no bacteria re-growth after UV disinfection and no bacteria contamination during the transmission of effluent to the toilets. A chlorine dosing system in the form of sodium hypochlorite with contact time of about 30 minutes will be installed within Ngong Ping STP. With the proposed disinfection system, the residual chlorine will meet the 0.5mg/l level recommended by the United States Environmental Protection Agency (USEPA) for reducing odours, slime, and bacterial growth in distribution system for effluent reuse. In order to avoid the potential health and hygiene problems associated with the incorrect connection of the potable water and treated effluent pipes at the toilets, the pipes for the treated effluent would be colour coded (for example, yellow pipes) and with different pipe size as that of the potable water pipes so that physical connection of the treated effluent pipes with the potable water fittings would not be possible. Appropriate provisions will be incorporated in the construction contract and the operation and maintenance manual for the effluent reuse facilities to test for and ensure no incorrect connection.

5.2.4 Landscape and Visual

The Ngong Ping STP and Sewerage EIA assessed the landscape and visual impacts during the operation of Ngong Ping STP and the associated pipeworks. Section 7.12 of the Ngong Ping STP and Sewerage EIA recommended the operation phase mitigation measures. The same landscape and architectural measures as that employed in the Ngong Ping STP will be adopted for the effluent reuse facilities so as to form a unified and harmonious single compound.

6. USE OF PREVIOUSLY APPROVED EIA REPORTS

Most of the potential environmental impacts arising from this Project have been assessed in the approved EIA Report for Ngong Ping STP and Sewerage (EIAO Register No. AEIAR-065/2002) and the Environmental Assessment for the Project Profile of *Ngong Ping Sewage Treatment Works and Sewerage - Effluent Export Pipeline from Ngong Ping Sewage Treatment Plant to Tung Wan*, including air quality impact, noise impact, water quality impact, waste management implications, cultural heritage impact, ecological impact, landscape and visual impact, and environmental monitoring and audit.

7. SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The potential environmental impacts and the proposed environmental mitigation measures to be incorporated into the design and construction contract of the proposed effluent reuse scheme are summarised in the following table.

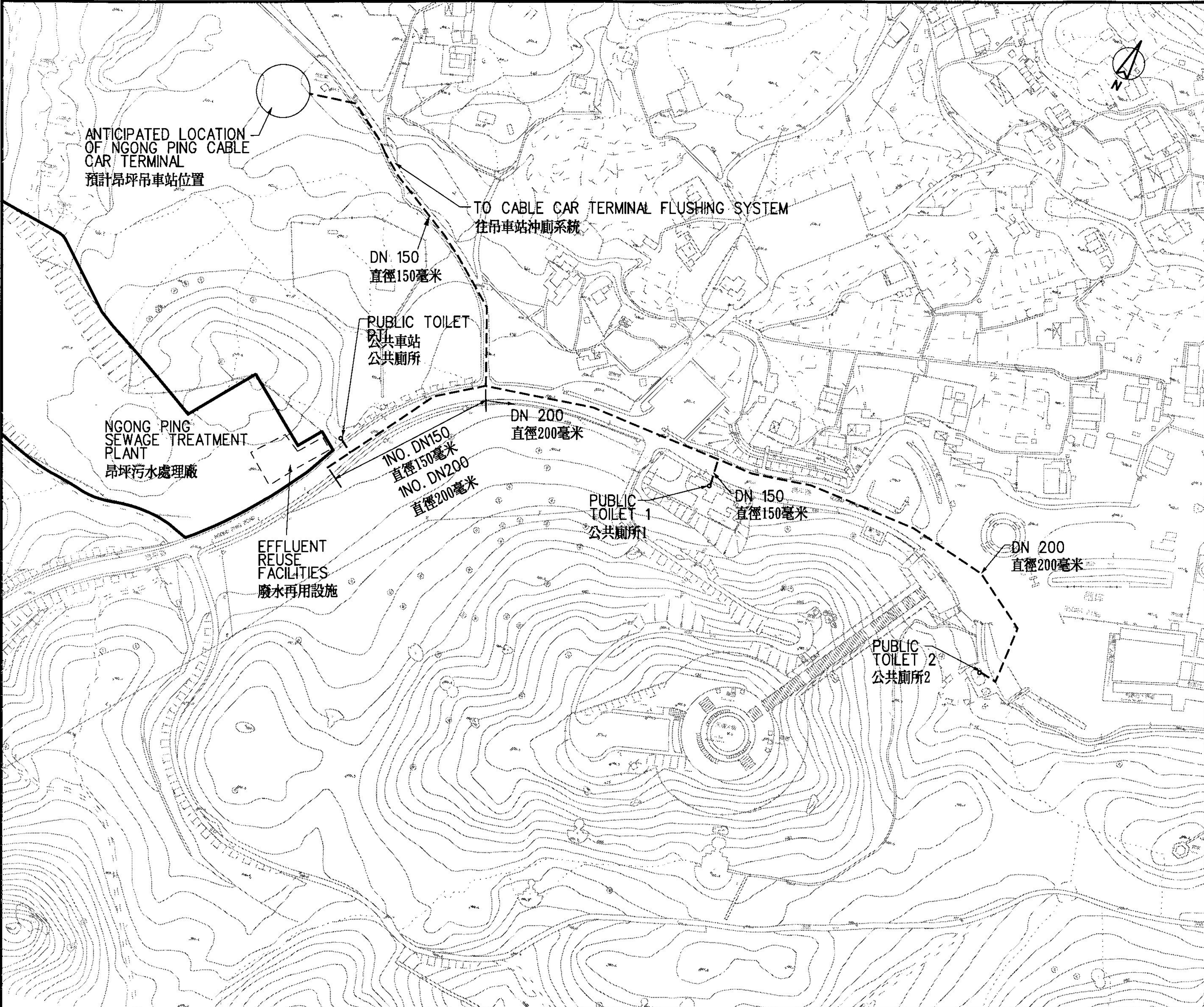
Project Stage	Potential Environmental Impact	Mitigation Measures	Relevant Section in this Project Profile
Construction	Minor dust nuisance	Control by contract specifications.	3.1.1 & 5.1.1
	Minor noise impact	Control by contract specifications.	3.1.2 & 5.1.2
	Minor water quality impact	Control by contract specifications.	3.1.3 & 5.1.3
	Minor waste impact	Control by contract specifications.	3.1.4 & 5.1.4
	Ecological impact	No adverse impact is identified; no mitigation measure is required.	3.1.5
	Landscape and Visual	No adverse impact is identified; no mitigation measure is required.	3.1.6 & 5.1.5

Project Stage	Potential Environmental Impact	Mitigation Measures	Relevant Section in this Project Profile
Operation	Impact on natural resources	Beneficial impact; no mitigation measure is required.	3.2.1
	Odour impact from chlorine dosing	Enclose odour sources.	3.2.2 & 5.2.1
	Minor noise impact	Locate pumps underground or enclose within buildings, use silenced ventilation system.	3.2.3 & 5.2.2
	Impact on marine water quality	Beneficial impact; no mitigation measure is required.	3.2.4
	Ecological impact	No adverse impact is identified; no mitigation measure is required.	3.2.5
	Waste impact	No adverse impact is identified; no mitigation measure is required.	3.2.6
	Impact on health and hygiene	Provide chlorination to ensure no bacteria re-growth along the effluent reuse distribution system. Colour coding and different sizing of treated effluent pipes to avoid incorrect connection with potable water fittings.	3.2.7 & 5.2.3
	Hazard impact	No adverse impact is identified; no mitigation measure is required.	3.2.8
	Landscape and Visual	Same landscape and architectural measures as that employed in the Ngong Pin STP would be adopted so as to form a unified and harmonious single compound.	3.2.9 & 5.2.4

With proper implementation of the above environmental mitigation measures that will be incorporated into the design and construction contracts of the proposed effluent reuse scheme, insurmountable environmental impact during the construction and operational stages of the proposed scheme is not expected.

To conclude, reuse of treated effluent has the advantage of decreasing wastewater discharges thereby reducing pollution loading to the environment and reducing the demand on raw water, which is a scarce natural resource deserved for preservation to the maximum extent practicable.

LEGENDS :
 --- EFFLUENT REUSE DISTRIBUTION PIPE
 廢水再用分佈水管

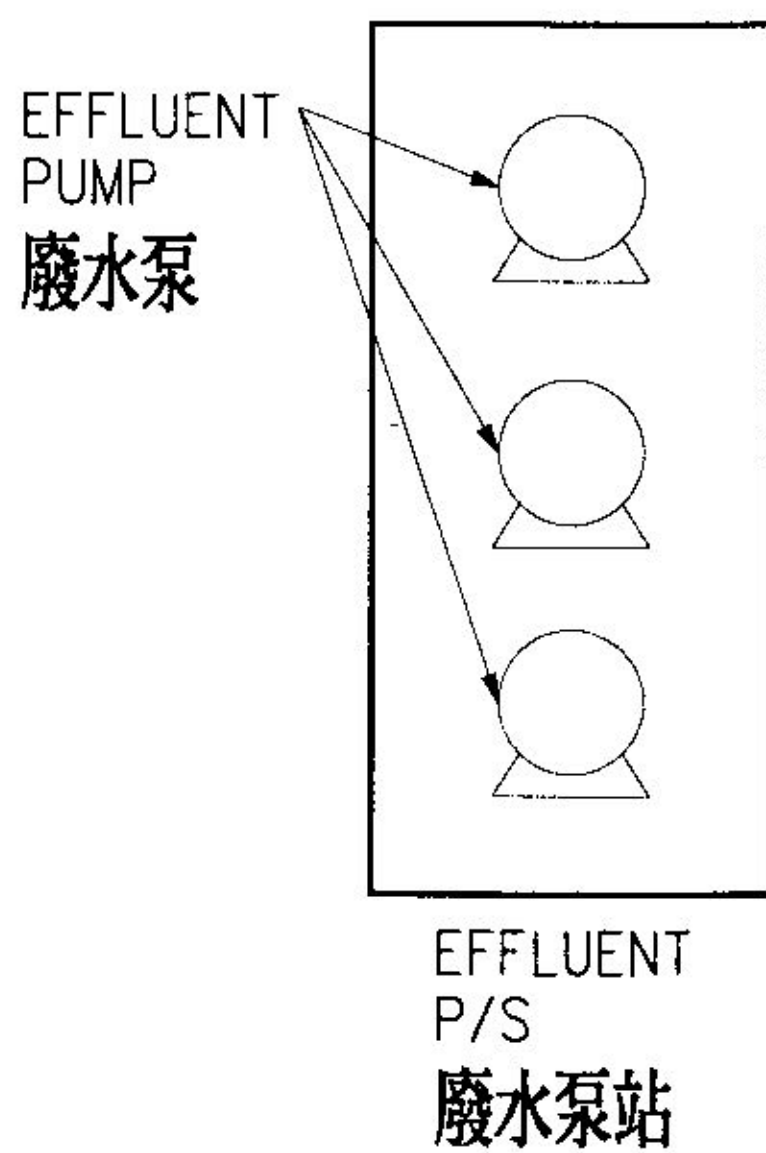


Rev	Description	By	Date
Consultants			
ARUP		Ove Arup & Partners Hong Kong Limited	
Project title			
合約編號 CE29/01 離島污水收集整體計劃第一階段第一期 昂坪污水處理廠及污水渠系統			
Drawing title			
GENERAL LAYOUT OF THE EFFLUENT REUSE SCHEME 廢水循環再用設施設計圖			
Drawing no.		Rev.	
23400/R/001			
Drawn	Date	Checked	Approved
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HORIZ 1:2000 VERT 1:1000 AT A3		PRELIMINARY	

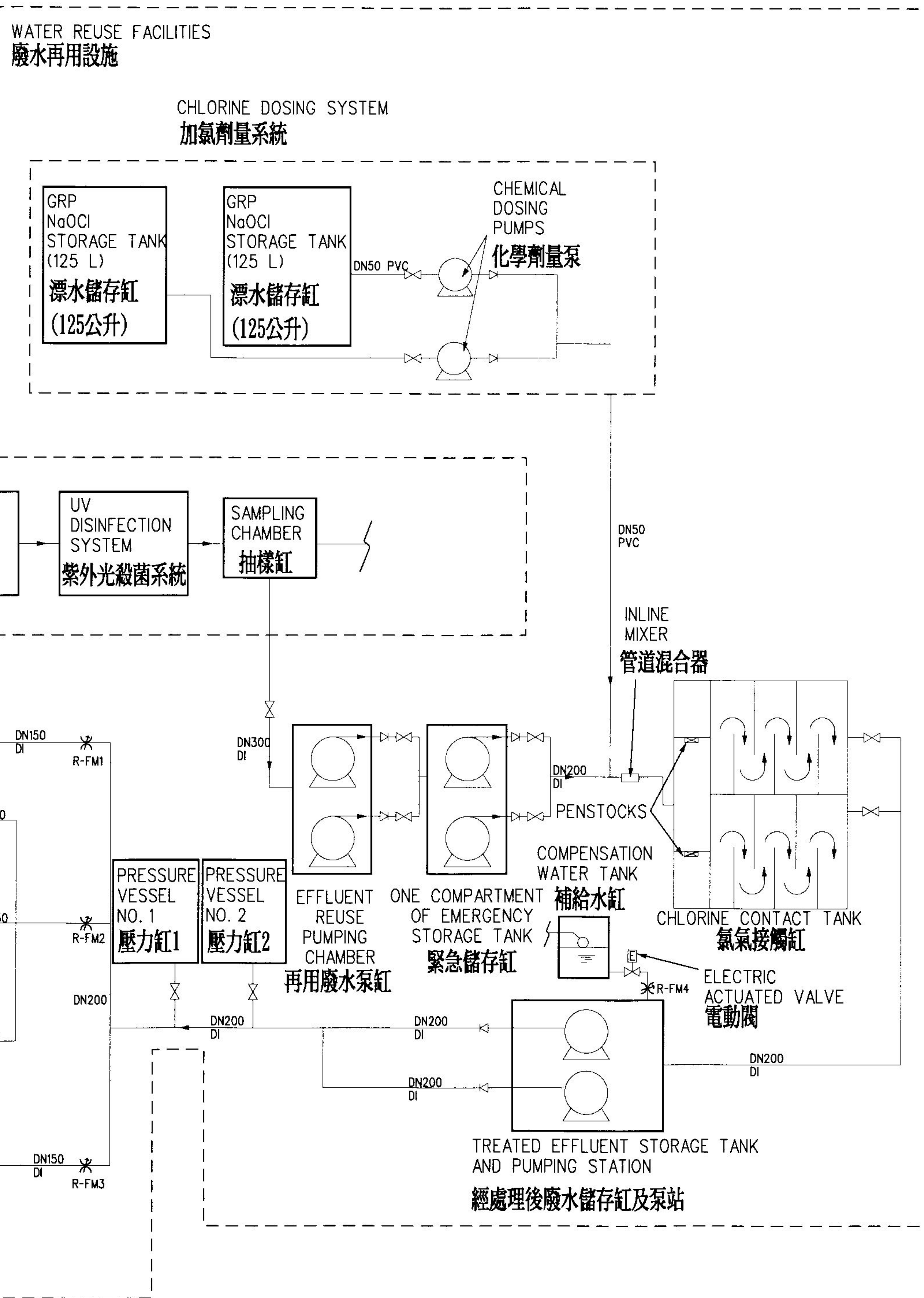
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EFFLUENT P/S
廢水泵站



- TO CABLE CAR TERMINAL FLUSHING SYSTEM
往吊車站沖廁系統
- TO FLUSHING SYSTEM FOR PUBLIC TOILET 1
往公共廁所1沖廁系統
- TO FLUSHING SYSTEM FOR PUBLIC TOILET 2
往公共廁所2沖廁系統
- TO FLUSHING SYSTEM FOR PTI
往公共車站沖廁系統
- TO FLUSHING SYSTEM FOR SEWAGE TREATMENT PLANT TOILET
往污水處理廠沖廁系統

- LEGENDS :
- X— GATE VALVE 閘閥
 - ▷— CHECK VALVE 止回流閥
 - PUMP 泵
 - PENSTOCK 水閥
 - ⊗ FLOWMETER 流量計

Rev	Description	By	Date

Consultants
ARUP Ove Arup & Partners Hong Kong Limited

Project title
合約編號 CE29/01
離島污水收集整體計劃第一階段第一期
昂坪污水處理廠及污水渠系統

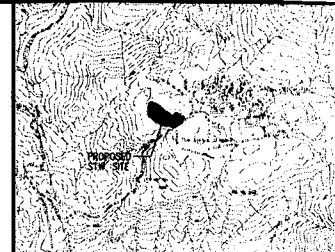
Drawing title
SCHEMATIC DIAGRAM OF THE EFFLUENT REUSE SYSTEM
廢水循環再用系統流程示意圖

Drawing no.	23400/R/002	Rev.	
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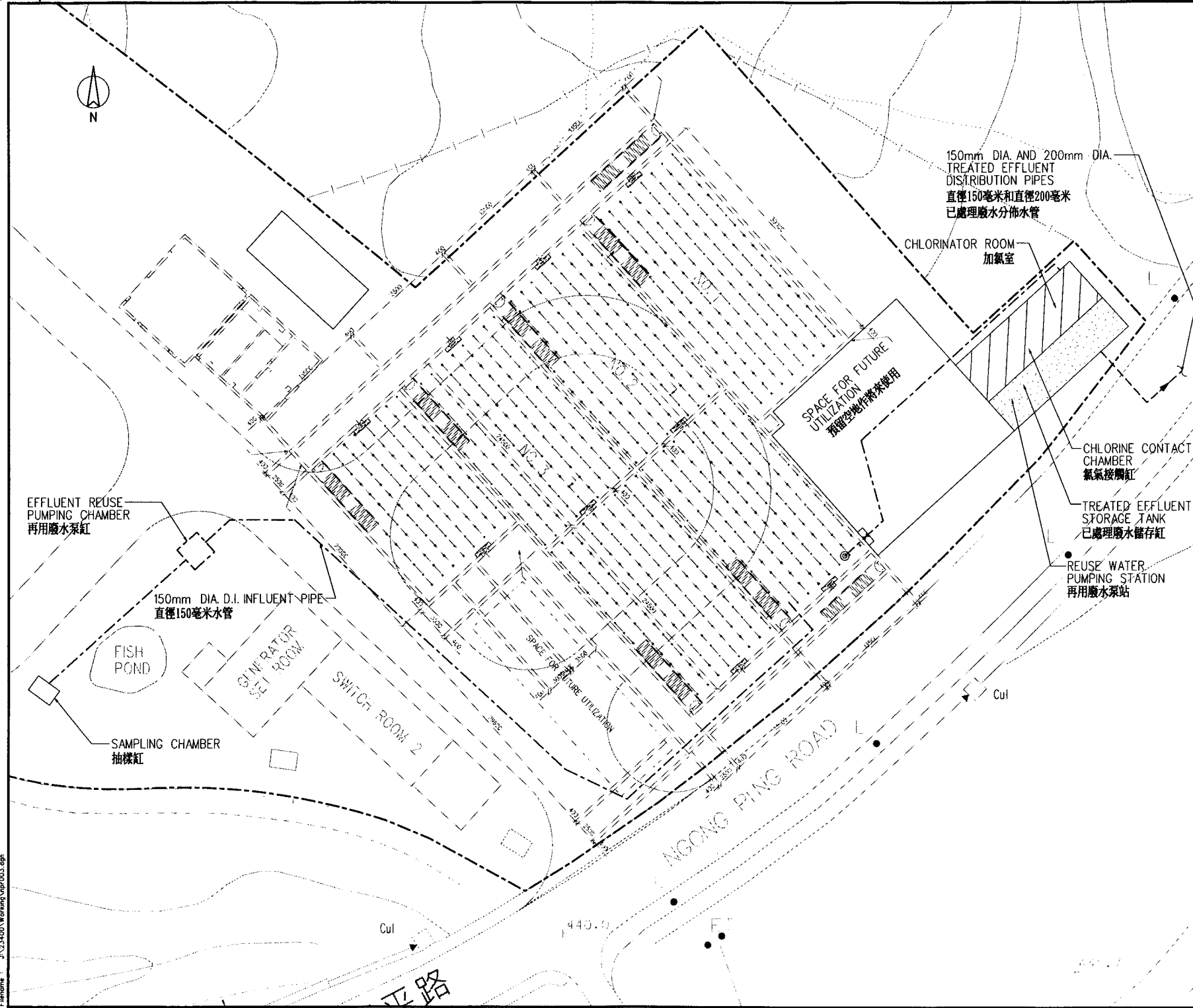
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KEY PLAN
位置圖

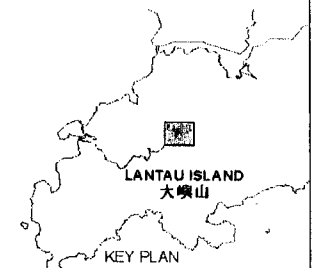
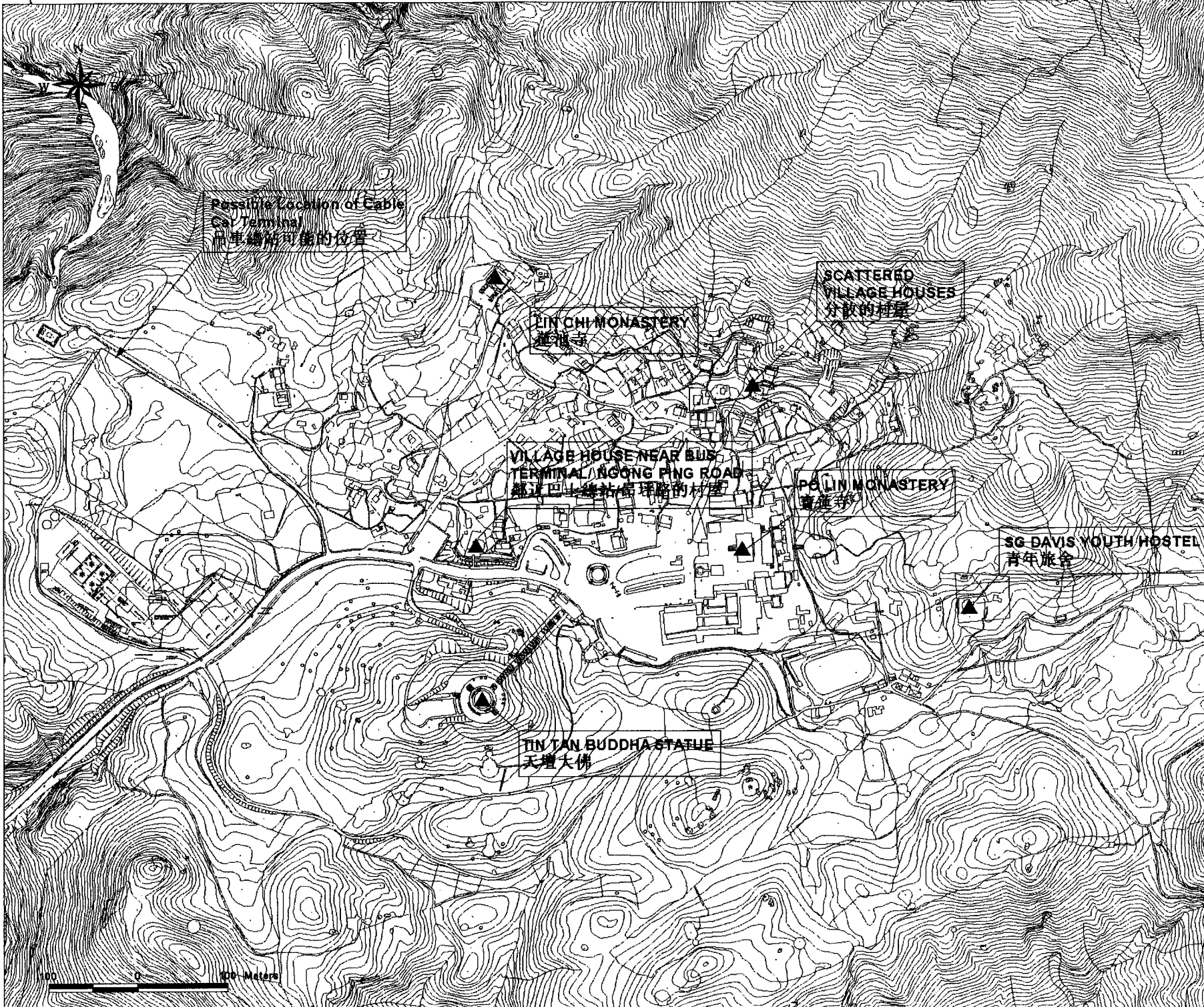


Rev	Description	By	Date
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ARUP		Ove Arup & Partners Hong Kong Limited	
Project title			
合約編號 CE29/01 離島污水收集整體計劃第一階段第一期 昂坪污水處理廠及污水集系統			
Drawing title			
NGONG PING SEWAGE TREATMENT PLANT AND EFFLUENT REUSE PLANT LAYOUT 昂坪污水處理廠 水循環再用設施佈局設計圖			
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Legend

▲ Sensitive Receivers

No.	Description	By	Date
<p>Contractor ARUP One A / ip & Partners Hong Kong Ltd</p>			
<p>Project Title 合約編號 CE28/01 離島污水收集總體計劃第一階段第一期 昂坪污水處理廠及污水渠系統</p>			
<p>Drawing Title AIR & NOISE SENSITIVE RECEIVERS AROUND NGONG PING AREA 昂坪地區附近的空氣和噪音敏感受體</p>			
Drawing No.	23400/R/004		No.
Drawn By	JS	DATE	FEB 03
Checked By	CTL	APPROVED By	CTL
Scale	1:4,000 Preliminary		
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