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Capco 青山發電有限公司 Castle Peak Power Co. Ltd.

Landfill Gas Power Generation Project at the West New Territories (WENT) Landfill

Project Profile

February 2017

Castle Peak Power Company Limited

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1 Basic Information

1.1 Project Title

Landfill Gas Power Generation Project at the West New Territories (WENT) Landfill

1.2 Purpose and Nature of the Project

CLP Power Hong Kong Limited (CLP) is responsible for providing a safe, highly reliable and clean supply of electricity to over 80% of Hong Kong's population at reasonable cost. Within Hong Kong, CLP operates three power stations, namely Castle Peak Power Station (CPPS), Black Point Power Station (BPPS) and Penny's Bay Power Station (PBPS) owned by Castle Peak Power Company Limited (CAPCO), a joint venture between CLP and China Southern Power Grid Company International (HK) Co., Limited, of which CLP holds a 70% interest.

CAPCO has identified a renewable energy opportunity to develop landfill gas (LFG) electricity generation at WENT Landfill, the biggest landfill site in Hong Kong located in Nim Wan, Tuen Mun. Currently, the WENT Landfill produces approximately 9,000m^3 LFG per hour from its waste intake (approximately 7,300 tonnes/day[1]). Approximately 4,500m^3/hr of the LFG is used by SITA Waste Services Limited (SITA),[2] the operator of WENT Landfill, to generate electricity for on-site use and for leachate treatment.

This Project proposes to use the unutilised excess LFG, which is a valuable renewable energy source of Hong Kong, as fuel for electricity generation in support of renewable energy development locally. According to the latest LFG utilisation status of the WENT Landfill, the remaining 4,500m^3/hour of LFG, on top of SITA's own-use requirement, is sufficient to fuel power generators with a total capacity of approximately 10MW. The Project proposes to construct five containerized landfill gas power generation units (LFGPGUs) during Phase 1, each with a generating capacity of 2MW, utilising the 4,500m^3/hr excessive LFG. The five LFGPGUs in Phase 1 alone will be able to power over 17,000 four-person households for one year.

As the South East New Territories (SENT) Landfill has ceased to receive domestic, commercial and industrial waste from 6 January 2016, it is anticipated that some of these wastes will be diverted to WENT landfill. Therefore, it is expected that more unutilised excess LFG will be generated from this increase of waste intake. Subject to the level of LFG generation increase and Government's approval, two additional LFGPGUs with the same generating capacity may be installed at the proposed site in Phase 2.

The utilisation of LFG in the Project will decrease the use of coal to generate electricity, thereby reducing the emissions from coal burning. Moreover, the Project will contribute to the Government's aim in reducing emissions from the power generation sector and help further improve air quality in Hong Kong. The Project will also assist in achieving the emission allowances as specified in the Third Technical Memorandum for Allocation of Emission Allowances in Respect of Specified Licences.

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[1] 2014 figure, Environmental Protection Department, Problems and Solutions – West New Territories (WENT) Landfill, 24 December 2015 <http://www.epd.gov.hk/epd/english/environmentinhk/waste/prob_solutions/msw_went.html>.

[2] SITA Waste Services Limited (SITA) is the operator of WENT Landfill, under a Design, Build and Operate (DBO) contract with the Environmental Protection Department.

1.3 Name of Project Proponent

Castle Peak Power Company Limited

1.4 Location and Scale of Project and History of Site

1.4.1 Location

The proposed containerized LFGPGUs will be located in the north-western part of the existing WENT Landfill adjacent to the coastline. Two underground pipelines will run from the existing LFG-related facilities within the WENT Landfill to the proposed plant area to provide LFG for electricity generation and for discharge of condensate separated from gas dewatering process to SITA's existing treatment plant. Another underground cable will run from the proposed plant area along Nim Wan Road to the existing power grid near the WENT Landfill entrance/exit gate. The location of the Project and alignment of associated cable and pipelines, which are not covered by any statutory town plan, are shown in **Figure 1.1**. The layout of the proposed landfill gas utilization plant area and the typical layout of a LFGPGU are shown in **Figures 1.2** and **1.3** respectively.

1.4.2 Scale of Project

It involves the construction of a total of up to seven containerized LFGPGUs together with the following components:

- Approximately 1.2km of power cabling
- Total length of approximately 870m of about 350mm dia. gas pipeline and about 80mm dia. condensate pipe
- Three 20m high common stack
- Switch rooms
- Supervisory control and data acquisition (SCADA) system
- Package substation
- Storage rooms
- Scrubber / chiller and associated pumping facility under a 6.5m high shelter

The site area for the proposed plant area will be approximately 0.5ha, of which about 0.18ha is temporary works area. No permanent structure or building is required for this Project. The LFGPGUs will be installed in modified standard 40 foot containers, the typical cross-section of a containerized LFGPGU is shown in **Figure 1.4**.

The proposed cables will be laid via cable trench, where the trench width will be approximately 1.5m wide, with an additional of about 1.25m on each side as works area.

The Project will only involve land-based works, no marine works or construction of discharge outfall / water intake. Marine mode of transportation would not be required during the construction and operation phases of this Project.

1.4.3 History of Site

The construction of the WENT Landfill began in May 1993 and operation commenced in November 1993. Approximately 20ha of the existing landfill was formed by reclamation, including the proposed plant area and a section of the proposed cable.

1.5 Number and Types of Designated Projects covered by this Project Profile

As the proposed landfill gas power generation unit (LFGPGU) will generate electricity for connection to CLP's existing power grid, this project is classified as a designated project (DP) under Schedule 2, Part 1, Item D.1 Public Utility Electricity Power Plant of the Environmental Impact Assessment Ordinance (EIAO).

1.6 Name and Telephone Number of Contact Person

Name: FUNG, Francis Chung Wai (Director of Planning and Venture Support), CLP Power Hong Kong Limited

Tel.: 2678 4988

2 Outline of Planning and Implementation Programme

2.1 Project Planning and Implementation

CAPCO will be responsible for installing, operating and maintaining the new LFGPGUs, with electricity output connected into CLP's existing power grid. Construction of the Project will be undertaken by contractor to be appointed by CAPCO.

A total of up to seven LFGPGUs, each with a generation capacity of 2MW, will be constructed in two phases. Each LFGPGUs will be equipped with selective catalytic reaction (SCR) system to reduce the NO_x emission level. Phase 1 will be the construction and operation of five units with two additional units that can be added in Phase 2, subject to the supply of LFG from WENT Landfill and Government's approval.

2.2 Preliminary Project Time-table

The tentative schedule for construction of the Project is to commence in Q2 2017 for operation in Q3 2018.

2.3 Interactions with other Projects

The construction and operation phase of the proposed LFGPGU is expected to overlap with the implementation programme of several other projects in the vicinity. These potential interfacing projects are described below and their locations are shown in **Figure 2.1**.

2.3.1 Additional Gas-fired Generation Units Project

This project involves the construction and operation of up to two 600MW class additional gas-fired generation units in phases at the Black Point Power Station (BPPS) to increase local gas-fired electricity generating capacity and accommodate growth in electricity demand. The proposed additional gas-fired generation units will adopt combined cycle gas turbine (CCGT) configuration using natural gas as the primary fuel. In addition to the CCGT units, a cooling water intake facility and cooling water discharge facility will also be the key components of the project. According to the approved EIA (AEIAR – 197/2016), construction would commence from the second half of 2016 for completion by the end of 2019. Although the construction and operation phase will overlap, considering this project is located approximately 2km from the proposed LFGPGU in this Project Profile, cumulative impacts is expected to be insignificant and will not be assessed.

2.3.2 West New Territories (WENT) Landfill Extensions

The West New Territories (WENT) Landfill Extensions was proposed in order to maintain the continuity of landfill capacity of disposal of waste. According to the approved EIA (AEIAR – 147/2009), extensions would be implemented in six phases from 2016 to 2024, including the relocation of existing LFG-related facilities from 2016 to 2018. However, the programme of this landfill extension project has been changed and a revised programme is not yet available. Furthermore, a review of the approved EIA shows that no sensitive receivers had been identified

within the Project site. As such, potential impacts to this Project is not anticipated. It should be noted that the planned cable and pipelines in this Project Profile has been proposed to connect to the existing LFG-related facilities within the existing WENT Landfill that may potentially be relocated. Upon availability of a confirmed implementation programme of the landfill extension and details of the relocation of the LFG-related facilities, the proposed cable and pipelines in this Project Profile will also be repositioned accordingly. The necessary statutory EIAO requirements and process will also be followed to allow this potential realignment of cable and pipelines.

Associated with the landfill extension also is the "WENT Landfill – Study of Road Access (Upgrading of Nim Wan Road and Deep Bay Road) – Feasibility Study". This feasibility study was commenced in December 2015 and anticipated to be completed in December 2017. As this feasibility study is still in progress, the implementation programme is therefore not yet confirmed. Nevertheless, as the earliest completion date of this road upgrading feasibility study is December 2017, it could be reasonably assumed that the construction of the road upgrading works will only be commenced in 2019 the earliest taken the detailed design and relevant public funding application of the road upgrading works into account. As the construction of LFGPGU Project will be completed in the Q3 2018, therefore the potential cumulative environmental impacts arising from the road upgrading works while carrying out the construction of the proposed LFGPGU Project is not anticipated.

2.3.3 Sludge Treatment Facilities

The project is a facility for treatment of dewatered sludge generated from the sewage treatment process of existing sewage treatment works in Hong Kong. The Sludge Treatment Facilities (STF) comprises of four fluidized bed incinerators, two steam turbine generators, with ancillary facilities including a desalination plant using reverse osmosis technology, maintenance workshop, deodorisation system, vehicle washing facilities and other supporting infrastructure. The STF began construction in 2010, where Phase 1 and Phase 2 operation began in April 2015 and April 2016 respectively. Potential cumulative impacts during operation phase will be taken into consideration in this Project Profile.

2.3.4 Development of the Integrated Waste Management Facilities

The Integrated Waste Management Facilities (IWMF) Phase 1 has been proposed to manage municipal solid waste (MSW) through advanced thermal incineration technology. According to the approved EIA (AEIAR – 163/2012) for IWMF Phase 1, two sites have been identified for the development of the IWMF and one of which is located at Tsang Tsui Ash Lagoon in Tuen Mun and falls partially within the assessment area of this Project. As there is no programme for development at the Tsang Tsui Ash Lagoon site, no interfacing issues with the IWMF are expected.

2.3.5 Decommissioning of West Portion of the Middle Ash Lagoon at Tsang Tsui

This project involves the decommissioning works of the west portion and southern edge of the Middle Ash Lagoon in Tsang Tsui, followed by site formation works and construction of drainage and construction access road works. Upon completion of decommission works, the site will be used for the provision of columbarium and garden of remembrance, as described in **Section 2.3.6** below. Based on the latest monthly environmental monitoring and audit (EM&A) report of the project, decommissioning has commenced in October 2016 and is expected to continue through January 2017. Potential cumulative impacts from this Project has been considered in this Project Profile where appropriate.

2.3.6 Provision of Columbarium and Garden of Remembrance at Tsang Tsui, Tuen Mun

This project proposed to construct an 8-storey columbarium building to provide approximately 160,000 niches, a garden of remembrance of about 4,800m^2 with greenery, ancillary facilities and an access road. This project is located at the west portion of the Middle Ash Lagoon in Tsang Tsui where decommissioning works are currently underway as described in **Section 2.3.5** above. Based on information from the Architectural Services Department, the project is scheduled to start in 2016-17 for completion in 2019-20. Potential cumulative impacts from this Project has been considered in this Project Profile where appropriate.

3 Major Elements of the Surrounding Environment

3.1 Existing and Planned Sensitive Receivers and Sensitive Parts of the Natural Environment

3.1.1 Air Quality

During construction phase, there are three existing representative air sensitive receivers (ASRs) within 500m of the air quality impact assessment area from the construction site boundary. These include Sludge Treatment Facilities Office, EPD's office and SITA's office within the WENT Landfill. Locations of the representative ASRs during construction phase are shown in **Figure 3.1**.

Only one existing ASR has been identified within 500m assessment area from the operation site boundary, the Sludge Treatment Facilities Office, as shown in **Figure 3.2**.

There are no planned ASR within 500m from the construction and operation phase boundary. The identified ASRs during construction and operation phases are summarized in **Table 3.1**.

Table 3.1: Representative ASRs Identified

Description	Construction Phase		Operation Phase	
	Approximate Horizontal Distance to Construction Site Boundary (m)	Within Assessment Area (Yes/No)	Approximate Horizontal Distance to Operation Phase Boundary (m)	Within Assessment Area (Yes/No)
Sludge Treatment Facilities Office	250m	Yes	500m	Yes
EPD's office	31m	Yes	548m	No
SITA's office	63m	Yes	581m	No

3.1.2 Noise

The existing noise environment is dominated by heavy vehicles along Nim Wan Road and the operation of WENT Landfill. In accordance with the definition of noise sensitive receivers (NSRs) in Annex 5 and Annex 13 of the EIAO-TM, no existing and planned NSRs are identified within 300m from the construction and operation site boundary of the Project.

3.1.3 Water Quality

The Project site is located near the seawall on the existing reclaimed land next to the WENT Landfill. This area falls within the outer subzone of the Deep Bay Water Control Zone (WCZ). Water sensitive receivers (WSRs) located within 500m radius of the project boundary and further afield (>500m away) within the Deep Bay WCZ and nearby North Western WCZ are identified as follows and shown in **Figure 3.3**:

Within 500m of the Project

- Tsang Kok Stream
- Sludge Treatment Facilities Seawater Intake

Beyond 500m

- Black Point Power Station Seawater Intake
- Fisheries / Aquaculture – Deep Bay Oyster Production Area
- Ecologically Important Areas – Pak Nai Site of Special Scientific Interest
- Beaches – Lung Kwu Sheung Tan, Lung Kwu Tan
- Secondary Contact Recreation Subzone (Black Point and Lung Kwu Tan area)

3.1.4 Landfill Gas Hazard

Project site is located at the existing WENT Landfill but falls outside the waste boundary of the existing WENT Landfill, therefore, no landfill gas management system (i.e. capping system) of existing WENT Landfill will be affected. It should be noted that although part of Project site boundary (i.e. certain sections of underground cable, gas pipe and condensate pipe) falls within the waste boundary of the planned WENT Landfill extension, the implementation programme of WENT Landfill Extensions is unconfirmed. The boundaries of the Project site, the existing WENT Landfill and the planned WENT Landfill extension as well as the 250m consultation zone of the WENT Landfill and its extension are presented in **Figure 3.4**. The potential sensitive receivers to the LFG hazard are considered to be the construction workers during construction phase and the regular operation and maintenance staff during operation phase.

3.1.5 Ecology

Ecological baseline information of the Project site and surrounding areas has been gathered through desktop review and supplemented with field surveys in November and December 2016.

The Project site is located within the existing WENT Landfill and therefore surrounded by developed areas with constant human disturbance. Within the LFGPGUs Project site, there is a piece of unpaved vacant land temporarily used for parking and general storage with some common weeds, such as White Popinac *Leucaena leucocephala*; and a plantation area with mainly exotic tree species such as Norfolk Island Pine *Araucaria heterophylla* and India-rubber Trees *Ficus elastica*, and some common fruit trees including Papaya *Carica papaya*, Pomelo *Citrus maxima*, Lychee *Litchi chinensis*, Mango *Mangifera indica* and Guava *Psidium guajava*. In between the unpaved vacant land and the plantation area, there is a channel with sloped concrete embankment where the weedy tree species White Popinac *Leucaena leucocephala* dominates the upper part of the embankment. The alignment of the proposed cables and pipelines is mainly concrete paved with roadside planting present at some sections. No important habitat and no species of conservation interest have been recorded within the Project site and along the alignment during the ecological field surveys. Photographs showing the LFGPGUs Project site and the alignment of the proposed cables and pipelines are shown in **Figure 3.5**.

Within 500m from the Project site boundary, there is no Site of Special Scientific Interest (SSSI), but Pak Nai SSSI (as shown in **Figure 3.3**) is located approximately 2km from the Project site boundary. Pak Nai SSSI was designated in 1980 for its function as roost site for gulls and terns

in the Deep Bay area. Pak Nai is also one of the three confirmed horseshoe crab nursery site[3] and harbours the largest seagrass beds in Hong Kong[4].

Several major habitats are found within 500m from the Project site boundary, as illustrated in **Figure 3.6** and **Appendix A**. Among these habitats, the riparian zone of Tsang Kok Stream is considered an ecologically sensitive area because of the presence of at least three flora species of conservation interest (including Bamboo Orchid *Arundina graminifolia*[5], Ixonanthes *Ixonanthes reticulata*[5 6] and Pitcher Plant *Nepenthes mirabilis*[5 7]). These three species have been recorded on hillside slopes adjacent to Tsang Kok Stream. Another two flora species of conservation interest has also been recorded within 500m from the Project site boundary. Incense Tree *Aquilaria sinensis* has been observed in the shrubland habitat to the south of the Sludge Treatment Facilities close to Nim Wan Road[5 7 8]; several individuals of Small Persimmon *Diospyros vaccinioides* have been observed on the hillside slope within shrubland habitat during the ecological field surveys. Locations of flora species of conservation interest recorded within 500m from the Project site boundary are shown in **Figure 3.6**.

For fauna species of conservation interest, other than an unidentified bat species, numerous species of conservation interest have been recorded within 500m from the Project site boundary in previous EIA studies [5 6 7 8]. These records are summarized as in **Table 3.2** and **Table 3.3** while some of which were also observed during the ecological surveys for the Project. The locations where these species of conservation interest were recorded are shown in **Figure 3.6**.

It should be noted that individual records of several bird species were identified and illustrated in **Figure 3.6** in the developed Sludge Treatment Facility. These include Great Coucal, White-shouldered Starling, Zitting Cisticola, wetland associated birds Little Egret, Grey Heron, Little Grebe, Eurasian Wigeon and Pied Kingfisher. These species were identified in the ash lagoon before the Sludge Treatment Facility was developed and thus not of further concern in the current assessment.

According to the findings of the latest marine mammal monitoring report[9], important habitats for Chinese White Dolphin were identified along the west coast of Lantau and around Lung Kwu Chau; while a few sightings of dolphins in the Deep Bay waters were made near but outside the 500m Study Area, with only sightings at 2012 and 2013 made at the fringe of the Study Area to the west of the Project Site. No finless porpoise was recorded within the Study Area in previous studies.

Lists of species recorded during the ecological surveys in November and December 2016 are shown in **Appendix B**.

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3 Chiu, H. M. C. and Morton, B. 1999. The distribution of horseshoe crabs (*Tachypleus tridentatus* and *Carcinoscorpius rotundicauda*) in Hong Kong. *Asian Marine Biology* 16: 185 – 196.

4 Fong, T. C. W. 1998. *Distribution of Hong Kong Seagrasses*. Porcupine! 18: 10-12.

5 Allied Environmental Consultants Ltd. 2014. Decommissioning of West Portion of the Middle Ash Lagoon at Tsang Tsui, Tuen Mun. Environmental Impact Assessment Report.

6 AECOM 2012. Agreement No. CE 29/2008 (EP). Engineering Investigation and Environmental Studies for Integrated Waste Management Facilities Phase 1 – Feasibility Study. Environmental Impact Assessment Report

7 ARUP 2009. Agreement No. CE 43/2006 (EP) West New Territories (WENT) Landfill Extensions – Final Environmental Impact Assessment Report (Register No.: AEIAR-147/2009)

8 Metcalf & Eddy Ltd. 2008. Agreement No. CE28/2003 (EP). Sludge Treatment Facilities – Feasibility Study. Environmental Impact Assessment Report.

9 Agriculture, Fisheries and Conservation Department. 2016. Monitoring of Marine Mammals in Hong Kong Waters (2015-16) – Final Report (1April 2015 to 31 March 2016).

Table 3.2: Avifauna Species of Conservation Interest recorded within 500m from the Project site boundary (including the findings from previous EIA Studies)

No.	Common Name	Scientific Name	Commonness in Hong Kong	Level of Concern (1)	Protection Status (2)	China Red Data Book(3)	Reference(4)
1	Eurasian Wigeon	*Anas penelope*	Common	RC	-	-	2
2	Little Grebe	*Tachybaptus ruficollis*	Common	LC	-	-	1, 2, 4
3	Chinese Pond Heron	*Ardeola bacchus*	Common	PRC (RC)	-	-	1, 2, 3, 4
4	Great Egret	*Ardea alba*	Common	PRC (RC)	-	-	1, 2, 3, 4
5	Pacific Reef Egret	*Egretta sacra*	Uncommon	(LC)	PRC: Class II	Rare	4
6	Little Egret	*Egretta garzetta*	Common	PRC (RC)	-	-	1, 4, 5
7	Cattle Egret	*Bubulcus coromandus*	Common	(LC)	-	-	4
8	Grey Heron	*Ardea cinerea*	Common	PRC	-	-	1, 2, 3, 4, 5
9	Black-crowned Night Heron	*Nycticorax nycticorax*	Common	(LC)	-	-	1, 4
10	Bonelli's Eagle	*Aquila fasciata*	Scarce	RC	HK: Cap. 586	Rare	5
11	Black Kite	*Milvus migrans*	Common	(RC)	PRC: Class II	-	1, 2, 3, 5
12	White-bellied Sea Eagle	*Haliaeetus leucogaster*	Uncommon	(RC)	HK: Cap. 586	-	3
13	Common Buzzard	*Buteo japonicus*	Common	-	PRC: Class II	-	2
14	Collared Scops Owl	*Otus lettia*	Common	-	HK: Cap. 586		1
15	Little-ringed Plover	*Charadrius dubius*	Common	(LC)	-	-	1, 4
16	Kentish Plover	*Charadrius alexandrinus*	Abundant	RC	-	-	2
17	Black-winged Stilt	*Himantopus himantopus*	Common	RC	-	-	1
18	Wood Sandpiper	*Tringa glareola*	Common	LC	-	-	4
19	Greater Coucal	*Centropus sinensis*	Common	-	PRC: Class II	Vulnerable	4
20	Emerald Dove	*Chalcophaps indica*	Scarce	-	-	Vulnerable	1
21	Zitting Cisticola	*Cisticola juncidis*	Common	LC	-	-	2
22	White-throated Kingfisher	*Halcyon smyrnensis*	Common	(LC)	-	-	4
23	Pied Kingfisher	*Ceryle rudis*	Uncommon	(LC)	-	-	4
24	Black-capped Kingfisher	*Halcyon pileata*	Common	(LC)	-	-	4
25	Eurasian Hobby	*Falco subbuteo*	Uncommon	LC	-	-	5
26	Common Jay	*Garrulus glandarius*	Scarce	LC	-	-	4
27	Red-billed Starling	*Spodiopsar sericeus*	Common	GC	-	-	5
28	White-shouldered Starling	*Sturnia sinensis*	Common	(LC)	-	-	4

Note:

1) Level of concern based on Fellowes *et al.* (2002) *Wild animals to watch: terrestrial and freshwater fauna of conservation concern in Hong Kong*; LC = Local Concern, RC = Regional Concern, PRC = Potential Regional Concern, PGC = Potential Global Concern, GC = Global Concern, Letter in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.

2) Cap. 586 = Listed in the Protection of Endangered Species of Animals and Plants Ordinance; PRC: Class II = Listed as Class II Protected under the Wildlife Protection Law.

3) Listed in Zheng, G., Wang, Q. (1998) *China Red Data Book of Endangered Animals: Aves.* Science Press, Beijing.

4) References include the following studies: 1 = Decommissioning of West Portion of the Middle Ash Lagoon at Tsang Tsui, Tuen Mun EIA report; 2 = Engineering Investigation and Environmental Studies for Integrated Waste Management Facilities Phase 1 – Feasibility Study EIA; 3 = West New Territories (WENT) Landfill Extensions EIA; 4 = Sludge Treatment Facilities – Feasibility Study EIA; 5 = baseline data of the present study.

Table 3.3: Other Terrestrial Fauna Species of Conservation Interest recorded within 500m from the Project site boundary in previous EIA studies (including the findings from previous EIA Studies)

No.	Common Name	Scientific Name	Commonness in Hong Kong	Level of Concern (1)	Protection Status (2)	Reference (3)
	Mammal					
1	Small Asian Mongoose	*Herpestes javanicus*	Uncommon	-	Cap. 170	3
2	Short-nosed Fruit Bat	*Cynopterus sphinx*	Very common	-	Cap. 170	1
3	Japanese Pipistrelle	*Pipistrellus abramus*	Very common	(LC)	Cap. 170	1
4	Small Indian Civet	*Viverricula indica*	Very common	-	Cap. 170	2
	Dragonfly					
5	Coastal Glider	*Macrodiplax cora*	Common	LC	-	2
	Butterfly					
6	Red Lacewing	*Cethosia biblis phanaroia*	Uncommon	-	-	2
7	Glassy Bluebottle	*Graphium cloanthus clymenus*	Uncommon	LC	-	4
8	Danaid Eggfly	*Hypolimnas misippus*	Uncommon	LC	-	4
9	Little Branded Swift	*Pelopidas agna agna*	Uncommon	-	-	4
	Reptile					
10	Copperhead Racer	*Coelognathus radiatus*	Common	PRC	China Red Databook: Endangered	3, 4

Note:

1) Level of concern based on Fellowes *et al.* (2002) *Wild animals to watch: terrestrial and freshwater fauna of conservation concern in Hong Kong*; LC = Local Concern, RC = Regional Concern, PRC = Potential Regional Concern, PGC = Potential Global Concern, GC = Global Concern, Letter in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.

2) Cap. 170 = Listed in the Wild Animals Protection Ordinance. China Red Databook: Endangered = Listed under "Endangered" status in the Zheng, G., Wang, Q. (1998) *China Red Data Book of Endangered Animals*. Science Press, Beijing.

3) References include the following studies: 1 - Decommissioning of West Portion of the Middle Ash Lagoon at Tsang Tsui, Tuen Mun EIA report; 2 - Engineering Investigation and Environmental Studies for Integrated Waste Management Facilities Phase 1 – Feasibility Study EIA; 3 - West New Territories (WENT) Landfill Extensions EIA; 4 - Sludge Treatment Facilities – Feasibility Study EIA; 5 – baseline data of the present study.

3.1.6 Landscape and Visual

The area within 500m from the Project site boundary could be divided into several landscape character areas. The northern part is a coastal water landscape with oyster farms present; the WENT Landfill and Sludge Treatment Facilities are within an urbanized area dominated by waste treatment and related facilities; the southern part is a relatively natural hillside landscape. Key landscape resources identified include the open sea, the natural hillslopes, the watercourse Tsang Kok Stream, particularly the relatively natural section, and tree plantation areas.

There is no registered Old and Valuable Tree (OVT) within 500m from the Project site boundary. A cluster of India-rubber Trees *Ficus elastica* are located within the plantation area of the LFGPGUs Project site as described in **Section 3.1.5**. Although these India-rubber Trees *Ficus elastica* are relatively large in size, they are multiple trunks developed from aerial roots with irregular tree forms. The amenity value of the plantation area as described in **Section 3.1.5** is considered medium, and the sensitivity of this landscape resource is also considered medium.

Other than the plantation area, the only identified landscape resource within or in the vicinity of the Project site is a channel immediately adjacent to the plantation area as described in **Section 3.1.5**. The sensitivity of this landscape resource is considered low because it is an artificial channel with embankment dominated by the weedy tree species White Popinac *Leucaena leucocephala*.

In the vicinity of the Project site, places of high visual value include the open waters of Deep Bay and the vegetated hillslopes at Tsang Tsui. Five Visually Sensitive Receivers (VSRs) are identified as shown in **Figure 3.7**, and their visual sensitivity is considered low. The evaluation of sensitivities of individual VSRs is summarized in **Table 3.4**.

Table 3.4: Evaluation of Sensitivities of Identified Visually Sensitive Receivers

ID No.	Name	Type and No. of Receivers	Amenity Value of Existing View	Availability and Amenity of Alternative View	Duration and Frequency of View	Degree of Visibility	Sensitivity
VSR1.1	Workers in WENT Landfill	Workers / Small	Moderate	Yes / High	Long / High	Low	Low
VSR1.2	Workers in T-Park	Workers / Small	Moderate	Yes / High	Long / High	Low	Low
VSR2.1	Visitors in T-Park	Recreationists / Medium	Moderate	Yes / High	Medium / Low	Low	Low
VSR3.1	Traveller along Nim Wan Road	Travellers / Small	Low	Yes / Low	Short / High	High	Low
VSR3.2	Marine Travellers in Deep Bay	Travellers / Small	Moderate	Yes / High	Short / Low	High	Low

3.1.7 Cultural Heritage

There are no Sites of Archaeological Interest within 500m of the Project site boundary, nor are there any built heritage[10] and declared monuments[11]. The nearest heritage resource is the Tsang Tsui Site of Archaeological Interest and is located approximately 615m from the Project site. Within the Tsang Tsui Site of Archaeological Interest, there are two clan graves. Locations of the aforementioned resources are shown in **Figure 3.8**.

3.1.8 Land Contamination

The construction of the WENT Landfill began in May 1993 and operation commenced in November 1993. Approximately 20ha of the existing landfill was formed by reclamation, including the proposed Plant area and a section of the proposed cable.

[10] Antiquities Advisory Board, 1444 Historic Buildings and New Items in addition to 1444 Historic Buildings, 8 September 2016.

[11] Antiquities and Monuments Office, Declared Monuments in Hong Kong (as at 20 May 2016).

Selected historical aerial photographs between year 1988 and 2015 of the Project site have been reviewed, and no historical land uses with the potential for land contamination is observed. The review findings are summarized in the **Table 3.5**. The historical aerial photographs are shown in **Appendix C**.

Table 3.5: Summary of Aerial Photos Review

Year	Heights (feet)	Photo Ref No.	Description
1988	4,000	A13005	Mainly open sea area. Reclamation not yet started.
1995	3,500	CN10614	Open sea area had been reclaimed, and landfill site and associated vehicular roads with pedestrian walkway were formed. Vacant land was observed at the proposed Plant area.
2003	4,000	CW47935	The vacant land at the proposed Plant area became vegetated land. No change of the vehicular road/pedestrian walkway.
2009	6,000	CS25500	The western part of the Plant area was used as stockpiling area of crushed rock. The eastern part (i.e. vegetated land) of the proposed Plant area and the vehicular road/pedestrian walkway remain unchanged.
2015	2,500	CW116325	Some containers and vacant area were observed at the western part of the proposed Plant area. The eastern part (i.e. vegetated land) of the proposed Plant area and the vehicular road/pedestrian walkway remain unchanged.

Site inspection has been conducted in January 2017. The proposed Plant area is mainly vegetated land with few containers located at the western edge of the Plant area for storage of geotextile material and high-density polyethylene (HDPE) lining material, and for office purpose. No contaminative activity is observed. The alignment of the proposed underground cable and gas/condensate pipes is currently concrete paved pedestrian walkway and vehicular roads, so contamination along the alignment is unlikely. Photos showing the current land use of the Project site is given in **Figure 3.5**.

3.1.9 Hazard to Life

The closest Potentially Hazardous Installation (PHI) form the Project site is Tuen Mun Water Treatment Works (TMWTW). The Project site is outside the 1km consultation zone of TMWTW as the distance between the Project site and TMWTW is more than 5 km.

There is no existing and planned sensitive receivers near the Project site except the STF's office, EPD's office and SITA's office, but all offices are located at or more than 500m from the Project site. The traffic flow of vehicular road besides the Project site is considered minimum as it is restricted for internal use of landfill operation but not for public.

During the construction stage, only diesel fuel will be stored on site for the operation of diesel power generators. Maximum storage quantity will be limited to 2 standard-size barrels (i.e. 208L per barrel). No other chemicals, fuels/oils or dangerous goods (DG) will be stored on site during construction stage.

During operation stage, only small quantity of chemicals such as paint and thinner (i.e. less than 10 litres) and cleaning solvent (i.e. turpentine, less than 20 litres) will be stored on site. No other chemicals, fuels/oils or dangerous goods (DG) will be stored on site during operation stage.

Besides, using or storage of other hazardous materials as defined in *Section 4 of Chapter 12 of Hong Kong Planning Standards and Guidelines (HKPSG)* such as Chlorine, Liquefied Petroleum

Gas (LPG), Petrol or Naphtha, Liquid Oxygen and Explosive etc. is also not required during the construction and operation stages of the Project.

3.2 Major Elements of Surrounding Environment and Existing and/or Relevant Past Land Use(s) which affect the Project

The Project site is located within the existing WENT Landfill, largely on paved road and land. The paved area is currently partially used for storage with the remaining being vacant.

Located in the centre of the Project site is an open drainage channel leading to Deep Bay (**Figure 1.2**). The drainage channel is blocked off at Nim Wan Road by a dam structure to prevent drainage and runoff from the WENT Landfill from discharging into the sea. Except during heavy rainstorm events, when runoff overflows through the channel to the sea, all runoff from the adjacent WENT Landfill and Nim Wan Road area is collected in the storage area behind the dam and pumped to the existing leachate treatment works at WENT Landfill for treatment.

East and south-east of the Project site is the existing WENT Landfill, where to the west is the Sludge Treatment Facilities. Adjacent to the Sludge Treatment Facilities is the Tsang Tsui Ash Lagoon currently occupied by CAPCO for storage of coal ash. The west portion of the Middle Ash Lagoon is currently undergoing decommissioning works in preparation for the construction of Columbarium and Garden of Remembrance (**Figure 2.1**).

As the Project does not involve environmentally sensitive uses (e.g., residential development), the surrounding environment and land uses will not affect the Project.

4 Possible Impact on the Environment

4.1 Outline of Process Involved

LFG will be collected and transported to the proposed LFGPGU via the proposed approximately 350mm dia. gas pipe. Once the LFG has reached the proposed facilities, it will be dewatered and filtered prior to entering the containerized internal combustion engine generators (i.e., LFGPGUs). Condensate separated from the dewatering process will be transported to the existing leachate treatment works in WENT Landfill for proper treatment before discharge. Electricity generated from the LFGPGUs will be connected to the CLP power grid via the proposed cable.

Some key technical parameters of the process are given below:

- The pressure at the gas pipe from the landfill site is at minimum 62.3mbar, and the gas pressure is gradually dropped until the Gas Blower of CAPCO gas pre-treatment system.
- There are 3 Gas Blowers with Variable-frequency drive (VFD) control (i.e. 2 duties, 1 standby) for transfer the LFG to the plant by suction, and also increase the gas pressure up to maximum of 450mbar, while the normal genset LFG pressure operating range is 50mbar to 200mbar.
- Gas leakage detector will be installed in each containerized LFG genset. Besides, 2 gas leakage detectors will also be installed at the gas pre-treatment system area.
- There is no container for buffer storage of landfill gas in this project.

A flow diagram showing the overall process is illustrated in **Figure 4.1**. The description of gas pre-treatment process for gas purification, dehumidification and adjust the gas pressure and temperature before entering the LFGPGUs is given below:

1. When the Gas Blower is turned on, the LFG will be sucked from the delivery point and enter the Knockout Pot (Liquid Separator Tank) to remove the solid impurities in the liquid and large volume liquid impurity deposition. The waste liquid is mainly landfill leachate, and will be directly discharged into the existing Leachate Treatment Plant.
2. The LFG will then enter the Ammonia Scrubber and Pre-filter for removing the ammonia content and particles (i.e. diameter bigger than 30µm) in the LFG.
3. The LFG will then be cooled down by Chillers to suitable temperature range for the operation of LFGPGUs, and the cooled LFG will enter the Moisture Separator Tank for removing the condensate from the chiller.
4. The LFG will then pass through Activated Carbon Filter to adsorb siloxane, then to the Fine Filter to remove small particles (i.e. 1 – 10 µm size).
5. Lastly, LFG will pass through flow gas monitoring system (i.e. methane content, oxygen level, gas pressure, gas flow rate, gas temperature and humidity will be monitored) and finally enter the LFGPGUs.

4.2 Potential Environmental Impacts during Construction and Operation Phases

4.2.1 Air Quality

4.2.1.1 Construction Phase

The construction and installation of the LFGPGUs and associated facilities will not involve any significant dust generating activities such as foundation and excavation works. Construction activities of gas pipeline, condensate pipeline and cable installation will also be minor. Although open trench method has been proposed for laying the cable and pipelines, the trench width will only be about 1.5m and works are expected to be carried out by portions. As such, potential dust impacts are expected to be localised and minimal from open trench excavation. Furthermore, regular water spraying along Nim Wan Road within the WENT Landfill is carried out as part of the landfill's existing dust suppression measure. Therefore, potential fugitive dust impact to identified ASRs due to the Project is expected to be minimal.

With proper implementation of relevant dust control practices stipulated in the *Air Pollution Control (Construction Dust) Regulation*, as described in **Section 5.1.1.1**, significant dust impact to ASRs is not expected during construction phase.

Furthermore, the Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation regulates the emission from non-road mobile machinery (NRMM) powered by internal combustion engines used primarily off-road, which includes non-road vehicle and regulated machines. The regulated machines must comply with the emission standards of Stage IIIA of the European Union (EU) or the equivalent, while non-road vehicles must comply with the prevailing emission standards for newly registered road vehicles, which is Euro V. Upon confirmation of their compliance with emission requirement, EPD will issue the NRMM with an approval label.

According to the regulation, regulated machines refer to any mobile machine or transportable industrial equipment with a rated engine power output that is greater than 19 kW but not greater than 560 kW, which include crawler cranes, excavators, mobile generator, air compressor, etc. Non-road vehicles include private cars, goods vehicles, buses, light buses, motor cycles, motor tricycles or special purpose vehicle that are not licensed under the Road Traffic (Registration and Licensing of Vehicles) Regulations. Therefore, this regulation is applicable to the NRMM to be deployed for construction activities of the Project. As such, significant emissions from the NRMM to ASRs are not expected during construction phase.

4.2.1.2 Operation Phase

AQO Pollutants

Nitrogen Dioxide (NO_2), Respirable Suspended Particulates (RSP) and Fine Suspended Particulates (FSP) may be generated in the process of power generation and therefore they are the key air pollutants of concern during operation phase.

Nitrogen Dioxide (NO_2)

As mentioned in **Section 2.2**, the operation year of the Project is 2018. The 19th highest hourly and annual NO_2 of future background concentration for year 2018 from PATH-2016 model at Grid (15,44) are **112.6µg/m^3** and **22.5µg/m^3**. Grid (15,44) of the PATH-2016 model is used because the identified ASR is located within this grid. The future 19th highest hourly and annual NO_2 background concentrations for year 2018 are below the corresponding AQO standards (i.e. 19th highest hourly NO_2 is **200µg/m^3** and annual NO_2 is **40µg/m^3**).

To address the potential impact of NOx emission on the identified ASR, emission control measure has been incorporated within the proposed facility. Selective catalytic reduction (SCR) system, which specifically removes NOx, will be used to reduce NOx concentration in flue gas before emitting to the atmosphere. The NOx emission rate of each LFGPGU with SCR is **0.12g/s**, which is provided by the LFGPGU supplier. Moreover, the LFGPGUs are located at 500m away from the only one ASR. As such, the air quality impact due to the Project is anticipated to be small. Nevertheless, the potential NO_2 contribution from this Project and the cumulative impact to the only one ASR (described in **Section 3.1.1),** the Sludge Treatment Facilities (STF) Office, has been estimated as detail below.

The cumulative 19th highest hourly and annual NO_2 concentrations at the STF Office are estimated with the following formula:

$$[NO_2]_{total} = [NO_2]_{Chimney} + [NO_2]_{PATH}$$

where

$[NO_2]_{total}$ is the total hourly NO_2 concentration;

$[NO_2]_{Chimney}$ is the hourly NO_2 concentration which is NO_x and then converted to NO_2 by using OLM, and;

$[NO_2]_{PATH}$ is the hourly NO_2 concentrations as extracted from the aforementioned grid of the PATH-2016 model for year 2018.

To derive the $[NO_2]_{Chimney}$, EPD's *Guidelines on Choice of Models and Model Parameters* are referenced where an initial ratio with 10% NO_2 in NOx in the chimney emissions from the LFGPGUs is assumed. The Ozone Limiting Method (OLM) in the *Guidelines* is also used for estimating the NOx to NO_2 conversion in the remaining NOx portion in the chimney emissions based on the future hourly background ozone concentrations for year 2018 as extracted from the Grid (15,44) in the PATH-2016 model. The conversion is as follows

$$[NO_2]_{Chimney} = 0.1 \times [NO_x]_{Chimney} + \text{minimum of } \{0.9 \times [NO_x]_{Chimney} \text{ or } (46/48) \times [O_3]_{PATH\text{-}2016}\}$$

where

$[NO_2]_{Chimney}$ is the estimated hourly NO_2 concentration;

$[NO_x]_{Chimney}$ is the hourly NOx concentration as estimated for the LFGPGUs emissions at the receptor; and

$[O_3]_{PATH\text{-}2016}$ is the hourly ozone concentrations as extracted from the aforementioned grid in the PATH-2016 model for year 2018.

Estimation of $[NO_x]_{Chimney}$ due to Plume Dispersion

The hourly NOx concentration at the receptor due to the LFGPGUs emissions, $[NOx]_{Chimney}$, are estimated based on the following plume dispersion assumptions. The shortest horizontal distance from the STF Office to the LFGPGUs is **500m**. The slowest wind speed **1m/s** has been adopted in this estimation as a conservative approach. The LFGPGUs are located at northeast of the STF Office (i.e. approximately **70 degrees** from north). As such, the wind blow from northeast direction would carry pollutants from the LFGPGUs to the STF Office. As a reasonably conservative approach, wind blow from **70 degrees ± 22.5 degrees** (i.e. **47.5 to 92.5 degrees**) are considered in the calculations.

An elliptic cone with **6-degree** horizontal plume spread (one-sided) and **3-degree** vertical plume spread is considered as a reasonable conservative representation of the plume shape for this case. Based on this plume shape, the major and minor axis cross-sectional area of pollution plume, **r1** and **r2**, are approximately **53m** and **26m** respectively for approximately 500m downwind from source. The resulting NOx concentration at STF Office (i.e. 500m downwind from the LFGPGUs) as estimated based on this plume shape is **194µg/m^3**.

The details of the estimation of NOx concentration at STF Office (i.e. **194µg/m^3**) from the above plume shape are given below**. Figure 4.2** shows the conceptual diagram of pollution plume on the STF Office.

The radius of major axis cross-sectional area of pollution plume, r_1, of the LFGPGU to the STF Office is calculated as follow:

$$r_1 = \text{Tan}(\theta_1) \times d = \underline{53m}$$

where

r_1 is radius of major axis cross-sectional area of pollution plume;

θ_1, is angle of lateral diffusion of pollution plume; **6 degrees**; and

d is the shortest horizontal distance from the STF Office, **500m**.

The radius of minor axis cross-sectional area of pollution plume, r_2, of the LFGPGU to the STF Office is calculated as follow:

$$r_2 = \text{Tan}(\theta_2) \times d = \underline{26m}$$

where

r_2 is radius of minor axis cross-sectional area of pollution plume;

θ_2, is angle of vertical diffusion of pollution plume; **3 degree**; and

d is the shortest horizontal distance from the STF Office, **500m**.

The cross-sectional area of pollution plume, **A**, at the STF Office is calculated by:

$$A = \pi r_1 r_2 = \underline{4{,}329m^2}$$

where

A is the cross-sectional area of pollution plume at the STF Office;

r_1 is radius of major axis of cross-sectional area of pollution plume, **53m**;

r_2 is radius of minor axis cross-sectional area of pollution plume, **26m**; and

π is pi = **3.1416**.

The volume of the pollution plume, V, at 500m downwind when the plume travelled at the slowest wind speed 1m/s is calculated by:

$$V = D \times A = \underline{4{,}329m^3}$$

where

V is the volume of the pollution plume at 500m downwind;

A is cross-sectional area of pollution plume, **4,329m^2**; and

D is the distance of the plume travelled in 1 second = **1 meter**.

It is assumed that all seven (7) LFGPGUs (i.e. each with NOx emission rate of **0.12g/s**) will be operated simultaneously as a conservative approach. The total NOx emission rate of the seven LFGPGUs, E_{NOx}, is:

$$E_{NOx} = 0.12g/s \times 7 = \underline{0.84g/s}$$

The NOx concentration at the 500m downwind is calculated by:

$$C_{NOx} = E_{NOx} / V = \underline{194\mu g/m^3}$$

where

C_{NOx} is NOx concentration at the 500m downwind;

E_{NOx} is NOx emission of seven LFGPGUs in 1 second = **0.84g**;

V is volume of pollution plume, **4,329m^3.**

The NOx concentration at the STF Office, which is 500m downwind from the LFGPGUs, is estimated as **194µg/m^3.**

Estimation of $[NO_2]_{Chimney}$ due to Ozone Conversion

As retrieved from the PATH-2016 model at Grid (15,44), the maximum ozone concentration with wind blow from 47.5 to 92.5 degrees is **176.4µg/m^3**. The 19th highest hourly ozone concentration is **134.9µg/m^3**. From the above estimation, NOx concentration at the STF Office is **194µg/m^3**, which is larger than the maximum ozone concentration of **176.4µg/m^3**.

Under the ozone-limiting scenario where NOx to NO_2 is limited by the presence of ozone in atmosphere, the maximum concentration of NO_2 generated from the LFGPGUs at STF Office is limited at **176.4µg/m^3**.

Estimation of Cumulative 19th highest hourly and annual NO_2 concentrations at the STF Office

As aforementioned, the LFGPGUs are located at northeast of the STF Office (i.e. approximately **70 degrees** from north). As such, only the wind blow from northeast direction would hit onto the STF Office, and the wind blows from other directions is considered no impact on STF Office. As a reasonably conservative approach, wind blow from **70 degrees ± 22.5 degrees** (i.e. **47.5 to 92.5 degrees**) are considered to hit onto the STF Office. Therefore, the cumulative 19th highest hourly and annual NO_2 concentrations at the STF Office are calculated by NOx contribution of **194µg/m^3** from the LFGPGUs at those hours with wind direction between **47.5 to 92.5 degrees**, and **zero** NOx contribution from the LFGPGUs at hours with wind blow **from other directions**.

The cumulative 19th highest hourly and annual NO_2 concentrations at the STF Office are summarized in **Table 4.1**. Even with very conservative assumption of wind speed as **1 m/s** at all time, it can be seen from the table that the estimated cumulative results of 19th highest hourly and annual NO_2 still complied with the corresponding AQO standards. The calculation of the 19th highest hourly NO_2 is as follow.

$$[NO_2]_{Chimney} = 0.1 \times [NO_x]_{Chimney} + \text{minimum of } \{0.9 \times [NO_x]_{Chimney} \text{ or } (46/48) \times [O_3]_{PATH\text{-}2016}\}$$

$$= (0.1 \times 194) + \text{minimum of } \{(0.9 \times 194) \text{ or } [(46/48) \times 134.9]\}$$

$$= 148.7\ \mu g/m^3$$

$$[NO_2]_{total} = [NO_2]_{Chimney} + [NO_2]_{PATH}$$
$$= 148.7\ \mu g/m^3 + 5.7\ \mu g/m^3$$
$$= \underline{154.4\ \mu g/m^3}$$

Table 4.1: Summary of Estimated Cumulative NO_2 Concentration during Operation Phase

Averaging Time	AQO ($\mu g/m^3$)	Allowable Exceedance in a year	Cumulative Concentration ($\mu g/m^3$)	Project Contribution ($\mu g/m^3$) (% of Cumulative Concentration)	Background Contribution ($\mu g/m^3$) (% of Cumulative Concentration)	Remarks
1-hour	200	18	154.4	148.7 (96%)	5.7 (4%)	19th Maximum values (calculated by hours with wind direction between 47.5 to 92.5 degree)
Annual	40	Not applicable	37.8	15.3 (40%)	22.5 (60%)	Not applicable

Respirable Suspended Particulates (RSP)

The 10th highest daily and annual RSP of future background concentration for year 2018 from PATH-2016 model at Grid (15,44) are **60.7µg/m³** and **20.5µg/m³** respectively, and both of them are below corresponding AQO standards (i.e. daily RSP is **100µg/m³** and annual RSP is **50µg/m³**). The potential RSP contribution from this Project to the only one ASR STF Office has been estimated as detail below.

The RSP emission of each LFGPGUs is **0.0119g/s**, which is provided by the LFGPGUs supplier. It is assumed that all seven (7) LFGPGUs (i.e. each with RSP emission rate of **0.0119g/s**) will be operated simultaneously as a conservative approach. The RSP emission rate of the seven LFGPGUs, $\mathbf{E_{RSP}}$, is:

$$E_{RSP} = 0.0119g/s \times 7 = \underline{0.0833g/s}$$

The RSP concentration at the 500m downwind is calculated by:

$$C_{RSP} = E_{RSP} / V = \underline{19.2\mu g/m^3}$$

where

$\mathbf{C_{RSP}}$ is RSP concentration at the 500m downwind;

$\mathbf{E_{RSP}}$ is RSP emission of seven LFGPGUs in 1 second = **0.0833g**;

V is volume of pollution plume, **4,329m³** (as presented in NO_2 section above)**.**

The RSP concentration at the STF Office, which is 500m downwind from the LFGPGUs, is estimated as **19.2µg/m³.**

As mentioned in NO_2 section above, wind blow from **70 degrees ± 22.5 degrees** (i.e. **47.5 to 92.5 degrees**) are considered to hit onto the STF Office as reasonably conservative approach. Therefore, the cumulative 10th highest daily and annual RSP concentration at the STF Office are calculated by RSP contribution of **19.2µg/m³** from the LFGPGUs at the hours with wind direction

between **47.5 to 92.5 degrees** and **zero** RSP contribution from the LFGPGUs at hours with wind blow **from other directions**.

The cumulative 10th highest daily and annual RSP concentration at the STF Office are summarized in **Table 4.2**. It can be seen from the table that the estimated cumulative results of both the 10th highest daily and annual RSP have complied with the corresponding AQO standards.

Table 4.2: Summary of Estimated Cumulative RSP Concentration during Operation Phase

Averaging Time	AQO (µg/m³)	Allowable Exceedance in a year	Cumulative Concentration (µg/m³)	Project Contribution (µg/m³) (% of Cumulative Concentration)	Background Contribution (µg/m³) (% of Cumulative Concentration)	Remarks
24-hour	100	9	92.8	5.6 (6%)	87.2 (94%)	10th Maximum values
Annual	50	Not applicable	39.5	3.4 (9%)	36.1 (91%)	Not applicable

Fine Suspended Particulates (FSP)

The hourly RSP level as predicted by PATH is multiplied by the factors of **0.75** for daily FSP and **0.71** for annual FSP to conservatively estimate the corresponding FSP levels in accordance with EPD's *Guidelines on the Estimation of PM2.5 for Air Quality Assessment in Hong Kong*. The 10th highest daily and annual FSP of future background concentration for year 2018 from PATH-2016 model at Grid (15,44) are predicted to be **45.5µg/m³** and **14.6µg/m³** respectively, and both of them are below corresponding AQO standards (i.e. daily FSP is **75µg/m³** and annual RSP is **35µg/m³**). The potential FSP contribution from this Project to the only one ASR STF Office has been estimated as detail below.

The FSP emission of each LFGPGUs is assumed **100%** from RSP as a conservative approach. It is assumed that all seven (7) LFGPGUs (i.e. each with FSP emission rate of **0.0119g/s**) will be operated simultaneously as a conservative approach. The FSP emission rate of the seven LFGPGUs, E_{FSP}, is:

$$E_{FSP} = 0.0119g/s \times 7 = 0.0833g/s$$

The FSP concentration at the 500m downwind is calculated by:

$$C_{FSP} = E_{FSP} / V = 19.2\mu g/m^3$$

where

C_{FSP} is FSP concentration at the 500m downwind;

E_{FSP} is FSP emission of seven LFGPGUs in 1 second = **0.0833g**;

V is volume of pollution plume, **4,329m³** (as presented in NO_2 section above)**.**

The FSP concentration at the STF Office, which is 500m downwind from the LFGPGUs, is estimated as **19.2µg/m³.**

As mentioned in NO_2 section above, wind blow from **70 degrees ± 22.5 degrees** (i.e. **47.5 to 92.5 degrees**) are considered to hit onto the STF Office as reasonably conservative approach. Therefore, the cumulative 10th highest daily and annual FSP concentration at the STF Office are calculated by FSP contribution of **19.2µg/m³** from the LFGPGUs at the hours with wind direction

between **47.5 to 92.5 degrees** and **zero** FSP contribution from the LFGPGUs at hours with wind blow **from other directions**.

The cumulative 10th highest daily and annual FSP concentration at the STF Office are summarized in **Table 4.3**. It can be seen from the table that the estimated cumulative results of 10th highest daily and annual FSP have complied with the corresponding AQO standards.

Table 4.3: Summary of Estimated Cumulative FSP Concentration during Operation Phase

Averaging Time	AQO (µg/m³)	Allowable Exceedance in a year	Cumulative Concentration (µg/m³)	Project Contribution (µg/m³) (% of Cumulative Concentration)	Background Contribution (µg/m³) (% of Cumulative Concentration)	Remarks
24-hour	75	9	71.0	4.2 (6%)	66.8 (94%)	10th Maximum values
Annual	35	Not applicable	29.0	2.4 (20%)	26.6 (80%)	Not applicable

Plume Rise Estimation of LFGPGU Chimney

The stack height of the proposed LFGPGUs is 20m, which is of the same height of the flaring (19m) and thermal oxidizer (20m) at the WENT Landfill. The proposed LFGPGUs stack height will maintain the same dispersion effect of the flaring and thermal oxidizer. The plume rise of the proposed LFGPGUs' stack, **Δh**, is calculated with reference to the text book *Environmental Engineering* (Howard S. Peavy, 1985) published by McGraw-Hill Book Company, which also suggested that the plume rise Δh should be decreased by a factor 0.8 under the stable condition. The calculation of plume rise is detailed below:

$$\Delta h = 0.8 \times (Vs \times d/u) \times \{1.5 + [(2.68 \times 10^{-3}) \times p \times (\Delta T \times d)/Ts] = \underline{26.7m}$$

where

Vs is stack gas velocity, **34m/s** (i.e. provided by LFGPGU supplier);

d is inside stack diameter, **0.5m** (i.e. provided by LFGPGU supplier);

u is slowest wind speed, **1m/s**;

p is atmospheric pressure, **1012.9hPa**, which is normal mean atmospheric pressure from 1981 to 2010 extracted from Hong Kong Observatory;

Ts is stack gas temperature, **453K** (i.e. provided by LFGPGU supplier); and

ΔT is stack gas temperature minus air temperature, 453K – 298.15K = **154.85K**

The effective stack height, H, of the LFGPGUs' stack, which is calculated as follows:

$$H = h + \Delta h = \underline{46.7m}$$

where

h is stack height, **20m**

Δh is plume rise of LFGPGUs' stack, **26.7m**

Although the plume of the LGHPGU will be directly impinged to the east evaluation of STF Office as shown in **Figure 4.2**, the effective stack height (i.e. 46.7m) is higher than the height of ASR

(i.e. the maximum height of fresh air intake in east elevation of the STF Office is at 40.5m above ground), and the ASR is located at 500m away from the LFGPGUs, the effect of the pollution plume impingement from LFGPGUs to the ASR can be minimized.

Non-AQO Pollutants

As mentioned in the approved EIA report of West New Territories (WENT) Landfill Extensions (Register No.: AEIAR-147/2009), **Benzene** and **Vinyl Chloride** are two key non-AQO air pollutants of concern during operation phase of the LFGPGUs. With reference to the Appendix 3.5 of the approved EIA report, the emission concentration of these 2 non-AQO air pollutants from either LFG Flaring System or LFG power generator should be no difference. As the unutilised excess LFG is flared currently, therefore, the emission concentration of Benzene and Vinyl Chloride from the proposed LFGPGUs will remain the same as the emission concentration of the existing LFG Flaring System of WENT Landfill. No extra Benzene and Vinyl Chloride would be generated from the proposed LFGPGUs. As such, estimation of Benzene and Vinyl Chloride emission from the proposed LFGPGUs is considered not require.

4.2.2 Noise

4.2.2.1 Construction Phase

The key noise source during construction phase will be the operation of powered mechanical equipment (PME). As no permanent structures are allowed within the WENT Landfill, no major works is required. The cable / pipelines trench construction will be carried out in sections and all the works area along the trench is not expected to be active for the entire constructing period. Therefore, PME used for construction will be minimal and are expected to be used intermittently. All construction activities will be land-based and are expected to be small scale and short-term. Construction works are expected to be carried within the statutory non-restricted hours (0700 to 1900 of any day not being a Sunday or general holiday). Should construction activities involving the use of any PME within the restricted hours (1900 to 0700 or at any time on a general holiday, including Sunday) is required, a Construction Noise Permit (CNP) will be applied for in accordance with the Noise Control Ordinance (Cap. 400).

As mentioned in **Section 3.1.2**, there are no existing / planned NSRs within 300m from the construction site boundary, potential construction noise impacts are not anticipated. Nevertheless, good site practices and mitigation measures as detailed in **Section 5.1.2.1**, should be carried out as far as practicable to minimize construction noise .

4.2.2.2 Operation Phase

As mentioned in **Section 3.1.2**, there are no existing / planned sensitive uses within 300m from the operation site boundary. As such, potential noise impacts during operation phase are not anticipated.

4.2.3 Water Quality

4.2.3.1 Construction Phase

All construction works are relatively small-scale land-based works associated with site formation, cable and pipe laying, and utilities installation. No marine-based works or dredging works are required.

Potential water quality impacts are limited to construction site runoff and sewage generated by the construction workforce. Construction site runoff can be readily controlled by adopting relevant measures outlined in the ProPECC PN1/94 ‘Practice Note for Professional Persons on

Construction Site Drainage'. The sewage generated by the approximately 25 workers on site will be collected by portable toilets. Sewage from the portable toilets will be collected and disposed regularly by a licensed contractor.

With implementation of good site practices and the recommended control measures as described in **Section 5.1.3.1**, no adverse water quality impacts associated with construction of the Project is anticipated.

4.2.3.2 Operation Phase

During operation phase of the LFGPGUs, no wastewater will be discharged. Condensate separated from the gas treatment (dewatering) system will be diverted to the existing leachate treatment works at WENT Landfill for treatment.

The LFGPGUs will be containerised and bunded for spill containment, hence no contamination of stormwater (e.g. due to fuel/oil spillage or leakage) is anticipated. Given the small size of the site, minimal runoff will be generated during typical rainstorm events. Nevertheless, use of permeable paving materials is proposed which will further reduce the potential for stormwater runoff. To cater for extreme rainstorm events and prevent potential flooding onsite (which may damage the containerised LFGPGUs), the site formation level will adopt a shallow gradient towards the adjacent sloping seawall. With these measures in place, potential water quality impacts due to contaminated stormwater runoff from the site or flooding would be avoided.

Sewerage generated by the regular workers at the site of the LFGPGUs will be collected by portable toilets, which will be collected and disposed regularly by a licensed contractor. Hence there will be no direct discharge of sewage from the site during operation phase.

Recommended control measures during operation phase are described in **Section 5.1.3.2**.

4.2.4 Waste Management

4.2.4.1 Construction Phase

It is anticipated that approximately 1,500m^3 of construction and demolition (C&D) materials will be generated from site clearance, site formation, excavation, foundation work and installation of landfill gas generator. The majority of the C&D materials generated will be inert C&D materials which will be either reused on-site or reused by the operator of WENT Landfill beneficially on their day to day operation. The remaining minor non-inert C&D materials generated will be reused and recycled on-site as far as possible before disposal at designated landfill site. Considering the small amount of C&D waste generated, the number of dump trucks required for transportation of C&D waste will be minimal and therefore the environmental impact due to transportation of C&D waste is considered negligible.

Chemical waste generated due to maintenance of powered mechanical equipment is considered minimal and will be temporarily stored at the designated chemical waste storage area prior to transportation and disposal by a licensed collector.

A minimal amount of general refuse will be generated by the construction workers and will be removed from the site at the end of each working day.

Table 4.4 summarises all key types of waste arising during the construction phase of the Project.

Table 4.4: Summary of Waste Arising during Construction Phase

Waste Type	Key Sources of Waste Generation	Estimated Quantity	Handling Procedures
C&D Materials	Site clearance, site formation, excavation, foundation work and installation of landfill gas generator	About 1,500m^3 in total, with majority being inert C&D materials	Inert C&D materials will be either reused on-site or reused by the operator of WENT Landfill beneficially on their day to day operation. The remaining minor non-inert C&D materials will be reused and recycled on-site as far as possible before disposal at designated landfill site.
Chemical Waste	Used cleansing fluids, solvents, lubricating oil, waste fuel, etc., from maintenance of powered mechanical equipment	Anticipated as minimal quantity.	The chemical waste will be temporarily stored at the designated chemical waste storage area prior to transportation and disposal by a licensed contractor.
General Refuse	Food scarps, waste paper, empty containers, etc. generated from construction workers	Anticipated as minimal quantity	The general refuse will be removed from the site at the end of each working day.

4.2.4.2 Operation Phase

During operation of the LFGPGUs, lube oil replacement will be regularly conducted for maintenance purpose. It is anticipated that approximately 4,000L of lube oil will be replaced every 2 months. Used lube oil will be temporarily stored in the designated area prior to transportation and disposal by a licensed collector.

Since the LFGPGUs will be installed with the SCRs, chemical reducing agents will be used to reduce the NOx emission level and will require regular replacement around every two years, subject to the condition of the SCRs, to ensure NO_x removal efficiency is maintained. The amount of chemical waste generated from the regular replacement of chemical reducing agents is anticipated to be negligible considering the frequency of replacement. The used chemical reducing agents will be temporarily stored in the designated area prior to transportation and disposal by a licensed collector.

Only regular operation and maintenance staff will be working at the Project site during operation phase because the LFGPGUs will be remotely controlled by the SCADA system. Operation and maintenance staff will visit the Project site regularly but will only stay for a short period of time for lube oil or chemical reducing agents replacement and regular checking. Therefore, the amount of general refuse generated during operation phase is considered to be negligible.

4.2.5 Landfill Gas Hazard

4.2.5.1 Construction Phase

The LFG hazard assessment is conducted in accordance with Landfill Gas Hazard Assessment Guidance Note (1997) (EPD/TR8/97). "Source-Pathway-Target" model is used to assess qualitatively the risk category of the LFG hazard during construction phase as detailed below. The proposed LFGPGUs is located at the existing WENT Landfill which falls within its 250m consultation zone. According to the approved EIA report of West New Territories (WENT) Landfill Extensions (Register No.: AEIAR-147/2009), the source of the LFG at the WENT Landfill is categorised as "Medium" because of the presence of active gas extraction system and effective

gas control system. Categorising the source of the LFG at the WENT Landfill as "Medium" is consistent with the relevant classification criteria listed in the Landfill Gas Hazard Assessment Guidance Note – landfill site where comprehensive monitoring has demonstrated that there is no migration of gas beyond the landfill boundary but where the control of gas relies solely on an active gas extraction system or any single control system which is vulnerable to failure. Since the active gas extraction system and effective gas control system are currently in place and proven to be effective by comprehensive monitoring, keeping the category of the LFG source at the existing WENT Landfill as "Medium" is considered appropriate.

Since the proposed LFGPGUs will be located at the existing WENT Landfill, the pathway is less than 50m and therefore classified as "Very Short / Direct".

The target sensitive to the LFG hazard during construction phase will be the construction workers. As defined in the Landfill Gas Hazard Assessment Guidance Note, shallow excavation corresponds to low target sensitivity. Since the Project will only involve shallow excavations for underground gas pipeline and power cable installation, the target sensitivity is categorised as "Low".

The assessment results are summarised in **Table 4.5**.

Table 4.5: Qualitative Risk Assessment of LFG Hazard during Construction Phase

Source	Pathway	Target Sensitivity	Risk Category
LFG from the existing WENT Landfill: **Medium**	**Very short/direct**	Construction workers: **Low**	**Low**

Therefore, the risk category during construction phase is "Low" (Category D). Nevertheless, precautionary measures as mentioned in **Section 5.1.5** are recommended to further reduce the risk during construction phase.

As mentioned in **Section 2.3.2**, the implementation programme of WENT Landfill Extensions is unconfirmed, therefore the assessment of LFG hazard during construction phase due to WENT Landfill Extensions is considered not required.

4.2.5.2 Operation Phase

Similar to construction phase, "Source-Pathway-Target" model is used to assess qualitatively the risk category of the LFG hazard during operation phase as detailed below. The LFG source from the existing WENT Landfill is categorised as "Medium" and the pathway is classified as "Very Short/Direct" as explained in **Section 4.2.5.1**, which is considered the same during operation phase.

During operation phase, as the LFGPGUs will be remotely controlled by the SCADA system, only regular operation and maintenance staff will be working at the Project site to conduct regular checking and replacement of lube oil and chemical reducing agents as mentioned in **Section 4.2.4.2**. The regular operation and maintenance staff will be the target sensitive receiver to the LFG hazard. The target sensitivity is categorised as "Medium" because the LFGPGUs will only allow access by authorised and well-trained personnel who have been briefed on the potential hazards relating to landfill gas and the specific safety procedures to be followed.

Therefore, the risk category during operation phase is "Medium" (Category C). The assessment results are summarised in **Table 4.6**.

Table 4.6: Qualitative Risk Assessment of LFG Hazard during Operation Phase

Source	Pathway	Target Sensitivity	Risk Category
LFG from the existing WENT Landfill: **Medium**	**Very short/direct**	Regular operation and maintenance staff to conduct regular checking and replacement of lube oil and chemical reducing agents: **Medium**	**Medium**

Engineering measures will be required to protect the proposed Project. Although the operation and maintenance staff will visit the Project site regularly, they will only stay for a short period of time, with implementation of the engineering measures proposed in **Section 5.1.5.2**, the LFG hazard on the regular operation and maintenance staff during operation phase is considered acceptable.

4.2.6 Ecology

4.2.6.1 Construction Phase

Direct Impact due to Loss of Habitat

Construction of the Project will be limited to the existing unpaved storage area and the tree plantation surrounding the existing fire services pump room at north of Nim Wan Road within the WENT Landfill. Tree plantation could be permanently affected during site formation. Due to the small size of the isolated tree plantation dominated by exotic species, in addition to the impact will be mitigated by compensatory planting, the ecological impact is expected to be low and minor. Since no flora species of conservation interest is found within the Project site, no direct impact to flora species of conservation interest is anticipated.

No construction activities will be carried out in the channel between the unpaved storage area and the tree plantation. Direct impact on this channel is therefore not anticipated.

Construction of the proposed power cable and gas pipelines will be within developed area along Nim Wan Road. Adverse ecological impact is therefore not anticipated.

Direct Impact to Species of Conservation Interest

Red-billed Starling is recorded flying over the Developed Area within the Project Site during the ecological field survey. This bird species is a common winter visitor in Hong Kong and categorized as “Least Concern” in the IUCN Red List[12], but regarded as of “Global Concern” in another literature[13]. Since the favourable habitat for this species is open country areas in agricultural fields, orchards and shallow wetlands, plus the developed area is not a favourable foraging ground to this species, no adverse ecological impact to this bird species of conservation interest is anticipated.

No other faunal and flora species of conservation interest is recorded within the Project Area and thus no adverse ecological impact would be anticipated due to construction and operation of this Project.

[12] The IUCN Red List of Threatened Species. Version 2016-3. http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22710867A94264668.en

[13] Listed as of Global Concern in Fellowes et al. 2002. Wildlife to Watch: Terrestrial and Freshwater Fauna of Conservation Concern in Hong Kong. Memoirs of Hong Kong Natural History Society.

Indirect Impact to Species of Conservation Interest

For fauna species of conservation interest recorded within 500m from the Project site boundary, the Project will not cause direct habitat loss to them. Bird species, for instance, Black Kite and Little-ringed Plover and bats are highly mobile and utilize a wide range of natural and disturbed habitats. Indirect disturbance due to construction activities of the Project will be negligible provided that air and noise precautionary / protection measures are properly implemented. Marine transportation in both construction and operation phase would not be required for this Project and thus no indirect disturbance impact to the fauna community associated with the coastal habitat is anticipated. Ecological impact on the marine species of conservation interest is also not anticipated.

Indirect Impact to Offsite Habitats

Two adjacent aquatic habitats including channel and coastal waters are subjected to potential indirect impacts due to the construction of the Project Area. The channel supports a low biodiversity. All construction works are relatively small-scale land-based works associated with site formation, cable and pipe laying, and utilities installation. No marine-based works or dredging works are required. Potential indirect impacts are therefore limited to disturbance by construction site runoff and sewage generated by the construction workforce during site formation. No irreversible impact would be anticipated. With good site practices and adopting relevant measures outlined in the ProPECC PN1/94 (as in **Section 5.1.3.1**), the impact due to the construction site runoff would be reversible, short term and negligible. Sewage from the portable toilets will be collected and disposed regularly by a licensed contractor. No adverse indirect ecological impact to adjacent aquatic habitats including channel and coastal waters is anticipated.

4.2.6.2 Operation Phase

During operation, the LFGPGUs and associated facilities will only operate within the Project site. No direct or indirect adverse ecological impact is expected to any of the habitats and species of conservation interest. No specific mitigation measures would be required.

4.2.7 Landscape and Visual

Before construction of the Project, the tree plantation surrounding the existing fire services pump room would be affected. Mitigation measures as recommended in **Section 5.1.7** will be undertaken to control the potential impact to within acceptable levels. Other than the plantation, no other existing landscape resource is anticipated to be affected by the Project.

In terms of visual impact, since all identified VSRs are of low sensitivity, and the scale of Project is small and well within an urbanized setting with adjacent features acting as visual barriers, the visual impacts during both construction and operation phases are expected to range from insubstantial to slight adverse for all VSRs. **Figure 4.4** shows a photomontage with the proposed above-ground structures viewed from T-Park.

4.2.8 Cultural Heritage

The proposed temporary works area and the footprint of the proposed plant area will not encroach onto any cultural heritage resources. As mentioned in **Section 3.1.7**, the nearest cultural heritage resource is the Tsang Tsui Site of Archaeological Interest, which is located approximately 615m from the Project site, therefore no direct impact is anticipated. Given the construction works involved and operation mode of the Project, indirect impact (i.e., vibration from operation of plants) to surrounding cultural heritage resources is not anticipated.

4.2.9 Land Contamination

As mentioned in **Section 3.1.8**, both historical aerial photos review results and recent site inspection findings retrieved that land contamination activity at the Project site is unlikely, and therefore no land contamination issue is anticipated at the Project site.

4.2.10 Hazard to Life

As mentioned in **Section 3.1.9**, the Project site is outside the 1km consultation zone of the closest Potentially Hazardous Installation (PHI), the Tuen Mun Water Treatment Works (TMWTW). On the other hand, only limited quantity of diesel fuel (i.e. 2 standard-size 208L barrels) and small quantity of chemicals such as paint and thinner (i.e. less than 10 litres) and cleaning solvent (i.e. turpentine, less than 20 litres) will be stored on site during construction stage and operation stage respectively. In view of the nature and minimal quantity of the fuel and chemicals to be stored on site, off-site impact caused by these materials is not anticipated.Besides, using or storage of other azardous materials as defined in *Section 4 of Chapter 12 of Hong Kong Planning Standards and Guidelines (HKPSG)* such as Chlorine, Liquefied Petroleum Gas (LPG), Petrol or Naphtha, Liquid Oxygen and Explosive etc. is also not required during the construction and operation stages of the Project. Therefore, the potential hazard to life impacts during the construction and operation stages of the Project is not anticipated.

5 Environmental Protection Measures to be Incorporated in the Design and Further Environmental Implications

5.1 Environmental Measures

5.1.1 Air Quality

5.1.1.1 Construction Phase

To mitigate the dust impact during construction phase, dust control requirements stipulated in the *Air Pollution Control (Construction Dust) Regulation* should be implemented to further reduce the construction dust impacts of the Project. These practices include:

Good Site Management

- Good site management is important to help reduce potential air quality impact down to a minimal level. As a general guide, the Contractor should maintain high standards of housekeeping to prevent emissions of fugitive dust. Loading, unloading, handling and storage of raw materials, wastes or by-products should be carried out in a manner so as to minimise the release of visible dust emission. Any piles of materials accumulated on or around the work areas should be cleaned up regularly. Cleaning, repair and maintenance of all plant facilities within the work areas should be carried out in a manner minimising generation of fugitive dust emissions. The material should be handled properly to prevent fugitive dust emission before cleaning.

Disturbed Parts of the Roads

- Main temporary access points should be paved with concrete, bituminous hardcore materials or metal plates and be kept clear of dusty materials; or
- Unpaved parts of the road should be sprayed with water or a dust suppression chemical so as to keep the entire road surface wet.

Exposed Earth

- Exposed earth should be properly treated by compaction, hydroseeding, vegetation planting or seating with latex, vinyl, bitumen within six months after the last construction activity on the site or part of the site where the exposed earth lies.

Loading, Unloading or Transfer of Dusty Materials

- All dusty materials should be sprayed with water immediately prior to any loading or transfer operation so as to keep the dusty material wet.

Debris Handling

- Any debris should be covered entirely by impervious sheeting or stored in a debris collection area sheltered on the top and the three sides.

- Before debris is dumped into a chute, water should be sprayed onto the debris so that it remains wet when it is dumped.

Transport of Dusty Materials

- Vehicles used for transporting dusty materials/ spoils should be covered with tarpaulin or similar material. The cover should extend over the edges of the sides and tailboards.

Wheel washing

- Vehicle wheel washing facilities should be provided at each construction site exit. Immediately before leaving the construction site, every vehicle should be washed to remove any dusty materials from its body and wheels.

5.1.1.2 Operation Phase

It has been estimated that the cumulative 19th highest hourly and annual NO_2, 10th highest daily and annual RSP, and 10th highest daily and annual FSP on the only one ASR Sludge Treatment Facilities (STF) due to the LFGPGUs would comply with the corresponding AQO standards. Therefore, no further mitigation measures for NO_2, RSP and FSP emissions during operation phase are required.

5.1.2 Noise

5.1.2.1 Construction Phase

Practical mitigation measures should be implemented during construction phase to alleviate potential noise impact. The following measures are recommended:

Good site practice to limit noise emissions at source

Good site practice and noise management can significantly reduce the impact of construction site activities on nearby NSRs. The following measures should be followed:

- Only well-maintained plant should be operated on-site and the plant should be serviced regularly over the course of construction period
- Machines and plant that may be intermittent in use should be shut down between work periods or should be throttled back to a minimum
- Plant known to emit noise strongly in one direction, should, where possible, be oriented so that the noise is directed away from nearby NSRs
- Silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction period
- Mobile plant should be sited as far away from NSRs as possible
- Material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities
- The Contractor shall at all times comply with all current statutory environmental legislation.

Selection of Quieter Plant

The contractor should be requested, as far as possible, to use quiet PME, which has a lower sound power level. This is one of the most effective measures to reduce noise emission at source and is increasingly practicable.

Use of Movable Noise Barrier

Movable noise barriers can be very effective in screening noise from particular items of plant during construction. Noise barriers located along the active works area close to the noise generating component of a PME could produce at least 10dB(A) screening for stationary plant and 5 dB(A) for mobile plant provided the direct line of sight between the PME and the NSRs is blocked.

Use of Noise Enclosure / Acoustic Shed

The use of noise enclosure or acoustic shed is to cover stationary PME such as air compressor and generator. With the adoption of noise enclosure, the PME could be completely screened, and noise reduction of 15 dB(A) can be achieved.

5.1.2.2 Operation Phase

Since potential noise impacts during operation phase is not anticipated, no mitigation measures are required.

5.1.3 Water Quality

5.1.3.1 Construction Phase

Implementation of good site practices and site runoff control measures will prevent adverse water quality impacts to WSRs and ensure compliance with *Water Pollution Control Ordinance (WPCO)* requirements. Details of the recommended measures are listed below:

For Construction Site Runoff and Drainage;

- Surface runoff should be diverted to sand/silt removal facilities such as sand/silt traps. Channels, earth bunds or sand bag barriers should be provided on site to properly direct stormwater to the silt removal facilities.
- Perimeter channels at site boundaries should be provided to intercept storm runoff from outside the site so that it will not wash across the site
- Silt removal facilities, channels and manholes should be maintained and the deposited silt and grit will be removed regularly, at the onset of and after each rainstorm to ensure that these facilities are functioning properly at all times.
- Intercepting channels should be provided (e.g. along the crest/edge of excavation) to prevent storm runoff from washing across exposed soil surfaces.
- Open stockpiles should be covered with tarpaulin or similar fabric during rainstorms.
- Measures should be taken to minimize the ingress of rainwater into trenches. Rainwater pumped out from trenches should be discharged into storm drains via silt removal facilities.
- All discharges from the construction site should comply with the discharge license issued by EPD.

For General Good Site Practices;

- Sewage from the construction workers should be collected by portable chemical toilets and regularly disposed offsite by a licenced contractor.
- Chemicals, fuels/oils and chemical waste storage areas should be surrounded by bunds with a capacity equal to 110% of the storage capacity of the largest container.
- Oil leakage or spillage should be contained and cleaned up immediately. Waste oil should be collected and stored for recycling or disposal in accordance with the Waste Disposal Ordinance.

5.1.3.2 Operation Phase

During operation phase of the LFGPGUs, no wastewater will be discharged. The LFGPGUs will be containerised and bunded for spill containment. Permeable paving will be adopted within the site to limit stormwater runoff. The site formation level will adopt a shallow gradient towards the adjacent sloping seawall to prevent onsite flooding during extreme rainstorm events. Site and equipment conditions will be regularly checked and maintained to ensure no contamination of the site and nearby water bodies.

Condensate separated from the gas treatment (dewatering) system will be diverted to the existing leachate treatment works at WENT Landfill for treatment. Such arrangements has been agreed with the WENT Landfill operator.

Sewerage generated by the regular workers at the site of the LFGPGUs will be collected by portable toilets, which will be collected and disposed regularly by a licensed contractor.

5.1.4 Waste Management

5.1.4.1 Construction Phase

Good site practices and waste reduction and management measures should be implemented during construction phase to mitigate the waste management impacts. These include:

Good Site Practices

- Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site.
- Provision of sufficient waste disposal points and regular collection of waste.
- Appropriate measures to minimise windblown litter and dust/odour during transportation of waste by either covering trucks or by transporting wastes in enclosed containers.
- Stockpiles of C&D materials should be kept covered by impervious sheets to avoid wind-blown dust.
- All dusty materials including C&D materials should be sprayed with water immediately prior to any loading transfer operation so as to keep the dusty material wet during material handling at the stockpile areas.

Waste Reduction Measures

- Sort non-inert C&D materials to recover any recyclable portions.
- Segregation and storage of different types of waste in different containers or skips or stockpiles to enhance reuse or recycling of materials and their proper disposal.
- Encourage collection of recyclable waste such as waste paper and aluminium cans by providing separate labelled bins to enable such waste to be segregated from other general refuse generated by the work force.
- Proper site practices to minimise the potential for damage or contamination of inert C&D materials.
- Plan the use of construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste.

Inert and Non-inert C&D Materials

- The inert C&D materials should be reused on-site as fill material as far as practicable.

- The surplus inert C&D materials will be disposed of at the Government's PFRFs for beneficial use by other projects in Hong Kong.
- The non-inert materials should be reused and recycled on-site as far as possible before disposal at the designated landfill site.

Chemical Waste

- The Contractor will be required to register with the EPD as a chemical waste producer and to follow the guidelines stated in the "Code of Practice on the Packaging Labelling and Storage of Chemical Wastes".
- Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately.
- Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidising, irritant, toxic, harmful, corrosive, etc.
- The Contractor should use a licensed collector to transport and dispose of the chemical wastes at the approved Chemical Waste Treatment Centre or other licensed recycling facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

General Refuse

- General refuse should be stored in enclosed bins or compaction units separated from C&D materials.
- A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from C&D materials.

5.1.4.2 Operation Phase

Since used lube oil and chemical reducing agents are anticipated to be generated during operation phase, the Project Proponent should register with the EPD as a chemical waste producer and follow the guidelines stated in the "Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes". Good quality containers compatible with the used lube oil and chemical reducing agents should be used where appropriate. Appropriate labels should be securely attached on each used lube oil and chemical reducing agent container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidising, irritant, toxic, harmful, corrosive, etc. Licensed collector shall be engaged to transport and dispose of the used lube oil and chemical reducing agents at the approved Chemical Waste Treatment Centre or other licensed recycling facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

5.1.5 Landfill Gas Hazard

5.1.5.1 Construction Phase

The Contractor will be required to appoint a Safety Officer, trained in the use of gas detection equipment and landfill gas-related hazards, to be present on-site throughout the groundworks phase. The Safety Officer should be provided with an intrinsically safe portable gas detector, appropriately calibrated and capable of measuring the following gases in the ranges indicated:

- Methane (CH_4) 0-100% Lower Explosion Limit (LEL) and 0-100% by volume
- Carbon Dioxide (CO_2) 0-100%; and
- Oxygen (O_2) 0-21%

The Safety Officer will be responsible for proposing the monitoring frequency and locations prior to commencement of groundworks.

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

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

Monitoring of excavations should be undertaken as follows:

(a) For excavations deeper than 1m, measurements should be conducted:

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

(b) For excavations between 300mm and 1m, measurements should be conducted:

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

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

Depending on the results of the monitoring, actions required will vary and should be set down by the Safety Officer or other appropriately qualified person. As a minimum these should encompass those actions specified in **Table 5.1**.

Table 5.1: Actions in the Event of Gas Being Detected in Excavations

Parameter	Monitoring Result	Action
O_2	<19%	Ventilate trench/ void to restore O_2 level to >19%
	<18%	Stop works, evacuate personnel/ prohibit entry, and increase ventilation to restore O_2 level to >19%
CH_4	>10% LEL	Post 'No smoking' signs, prohibit hot works, and ventilate to attenuate CH_4 level to <10% LEL
	>20% LEL	Stop works, evacuate personnel/ prohibit entry, and ventilate to attenuate CH_4 level to <10% LEL
CO_2	>0.5%	Ventilate to attenuate CO_2 level to <0.5%
	>1.5%	Stop works, evacuate personnel/ prohibit entry, and ventilate to attenuate CO_2 level to <0.5%

The Contractor will also be required to implement appropriate safety measures during construction phase, as recommended in Chapter 8 of the Landfill Gas Hazard Assessment Guidance Note. For example, no workers should be allowed to work alone at any time in excavated trenches or confined areas on-site.

With the implementation of appropriate LFG monitoring and safety measures, there is no adverse LFG hazard anticipated to the construction workers.

5.1.5.2 Operation Phase

Engineering measures will be required to mitigate the risk of LFG hazard as mentioned in **Section 4.2.5.2**.

All the proposed underground power cable, gas pipe and condensate pipe will be penetrating to above-ground before reaching the plant area. This will provide a discontinuity in the potential gas migration pathway. The above-ground cable and pipes will be laid using either trench or cable/gas ladder within the plant area. In fact, the entire plant area is a sheltered open area without permanent structure, so accumulation of landfill gas at the plant area is unlikely.

Each containerised LFG generator will be equipped with axial ventilation fans which will be turned on while the generator is in operation. Ventilation fans will also be installed at store rooms, if any, to prevent LFG accumulation.

Gas detection system will be installed at each containerised LFG generator to monitor any leakage of LFG. Depending on the results of the monitoring, actions required will vary and should be set down by the Safety Officer or other appropriately qualified person. As a minimum these should encompass those actions specified in **Table 5.2**.

Table 5.2: Actions in the Event of Gas Being Detected in Each Containerised LFG Generator

Parameter	Monitoring Result	Action
O_2	<19%	Ventilate to restore O_2 level to >19%
	<18%	Stop operation, prohibit entry, and increase ventilation to restore O_2 level to >19%
CH_4	>10% LEL	Prohibit hot works, and ventilate to attenuate CH_4 level to <10% LEL
	>20% LEL	Stop operation, prohibit entry, and ventilate to attenuate CH_4 level to <10% LEL
CO_2	>0.5%	Ventilate to attenuate CO_2 level to <0.5%
	>1.5%	Stop operation, prohibit entry, and ventilate to attenuate CO_2 level to <0.5%

Although engineering measures will be in place to mitigate the risk of LFG hazard, the regular operation and maintenance staff should be an authorised and well-trained personnel who have been briefed on the potential hazards relating to landfill gas and the specific safety procedures to be followed. Also, the regular operation and maintenance staff should reduce their time of work at the Project site as much as practicable during each lube oil and chemical reducing agents replacement and regular checking.

With the implementation of the above recommended engineering measures, there is no adverse LFG hazard anticipated to the regular operation and maintenance staff.

5.1.6 Ecology

Mitigation measures proposed for air, noise, water, waste and landscape could act as precautionary measures to prevent and minimize any indirect disturbance or pollution arisen from construction activities on local ecology and offsite habitat. Other than these, no other precautionary or enhancement measure for potential ecological impacts is considered necessary.

5.1.7 Landscape and Visual

To minimize the impact on tree plantation, standard good site practices and sensitive design harmonizing with the surrounding environment would be adopted to minimise potential landscape and visual impacts as far as practicable. These good site practices and landscape and visual protection measures include the following:

- Extent of works areas will be minimised as far as practicable.
- Construction period will be minimised and construction phasing carefully considered to minimise potential landscape and visual impacts.
- Sensitive hoarding, canvas and / or screens will be used to visually screen the construction activities and works areas.
- Sensitive design of above-ground structures in terms of scale, height and bulk will be adopted to minimise visual impacts.
- Appropriate colours and tones will be used for all hard elements to avoid unnecessary visual intrusion.
- Trees to be retained on-site, if any, will be carefully protected during construction. Detailed Tree Protection Specification should be provided in the Contract Specification, under which the Contractor should be required to submit, for approval, a detailed working method statement for the protection of trees prior to undertaking any works adjacent to all retained trees.
- Trees unavoidably affected will be transplanted where practicable. Where possible, trees should be transplanted directly from existing locations to their final recipient locations without being held in a temporary nursery site. Detailed Tree Transplanting Specification should be provided in the Contract Specification and sufficient time for preparation should be allowed in the construction programme. Should trees be unavoidably affected, a Tree Preservation and Removal Proposal will be submitted to Lands Department for approval in accordance with Lands Department's Lands Administration Office Practice Note No. 7/2007 or any other relevant guidelines.
- Compensatory tree planting will be provided if trees are affected due to the Project. Native species, such as *Celtis sinensis*, *Ficus microcarpa*, *Litsea glutinosa*, *Sterculia lanceolata* and any other appropriate native tree species should be considered.

The funding, implementation, management and maintenance agents of the above measures are summarized in **Table 5.3**.

Table 5.3: Funding, Implementation, Management and Maintenance Agents of Landscape and Visual Protection Measures

Measure	Funding Agent	Implementation Agent	Management Agent	Maintenance Agent
Minimization of Works Area	CAPCO	Contractor	Contractor	Contractor
Minimization and Phasing of Construction Period	CAPCO	Contractor	Contractor	Contractor
Use of visual screening	CAPCO	Contractor	Contractor	Contractor
Sensitive design of above-ground structures	CAPCO	Design Consultant	CAPCO	CAPCO
Protection of trees to be retained	CAPCO	Contractor	CAPCO	CAPCO
Transplantation of affected trees	CAPCO	Contractor	CAPCO	CAPCO
Compensatory tree planting	CAPCO	Contractor	CAPCO	CAPCO

With the implementation of the recommended measures, the residual landscape impact on this landscape resource will be at least partially mitigated. The landscape impact on the tree plantation will be moderate adverse during construction due to temporary loss of the plantation, and slight adverse in operation phase due to compensation of large trees by smaller compensatory trees.

5.1.8 Cultural Heritage

As neither direct nor indirect impact to cultural heritage resources is anticipated, no mitigation measures are required.

5.1.9 Land Contamination

As land contamination issue is not anticipated at the Project site, no mitigation measures are required.

5.1.10 Hazard to Life

As hazard to life impact is not anticipated, no mitigation measures are required.

5.2 Severity, Distribution and Duration of Environmental Effects

The proposed LFGPGUs and associated cable and pipelines will better utilise the excessive LFG from WENT Landfill which is currently being flared. In view of the nature and small scale of the Project, potential environmental impacts are expected to be minimal and localised.

With the implementation of the recommended mitigation measures as detailed in **Section 5.1**, adverse environmental impact is not anticipated.

5.3 Further Implications

With the implementation of recommended mitigation measures, no further environmental implication is anticipated.

5.3.1 History of Similar Projects

There is no project of similar nature under the EIAO in the past.

6 Use of Previously Approved EIA Reports

No previous approved EIA report prepared for a project of similar nature has been referred to in this Project Profile.

The English version of this Project Profile shall prevail wherever there is a discrepancy between the English version and the Chinese version.

Appendices

Appendix A Photographs of Habitats and Species of Conservation Interest

A.1 Representative Photographs of Habitats

	
Woodland	Plantation (within Project site)
	
Plantation (outside Project site)	Shrubland
	
Wasteland	Watercourse (relatively natural)
	
Watercourse (channelized)	Coastal Water

	
Developed Area (within Project site)	Developed Area (outside Project site)

A.2 Photographs of Species of Conservation Interest

	
Small Persimmon *Diospyros vaccinioides*	

Appendix B List of Species Recorded during Ecological Surveys

B1. List of Flora Species Recorded during the Confirmatory Ecological Surveys

B1. List of Flora Species Recorded during the Confirmatory Ecological Surveys

			Habitat Type						
Botanical Name	**Chinese Name**	**Growth Form**	**WL**	**PL**	**SL**	**WC**	**DA**	**PL-PS**	**DA-PS**
Acacia auriculiformis	耳果相思	Tree					+		
Acacia concinna	籐金合歡	Climber	+		+				
Acacia confusa	台灣相思	Tree		++	+		+		
Acacia mangium	馬占相思	Tree	+	+	+				
Acanthus ilicifolius	老鼠簕	Shrub				+			
Adiantum flabellulatum	扇葉鐵線蕨	Herb			+				
Adina pilulifera	水團花	Shrub / Tree				+			
Ageratum conyzoides	勝紅薊	Herb	+				+		
Alocasia macrorrhizos	海芋	Herb	+				+	+	+
Aloe vera	蘆薈	Herb					+		
Alternanthera dentata	紅龍莧	Herb					+		
Alternanthera philoxeroides	空心莧	Herb					+		
Amaranthus viridis	野莧	Herb					+		
Ampelopsis cantoniensis	廣東蛇葡萄	Climber	++						
Apluda mutica	水蔗草	Herb		+	+				
Aporusa dioica	銀柴	Shrub / Tree		+	+				
Araucaria heterophylla	異葉南洋杉	Tree	+	+			+	+	
Archidendron lucidum	亮葉猴耳環	Tree	+		+				
Ardisia lindleyana	山血丹	Shrub			+				
Aster baccharoides	白舌紫菀	Herb			+				
Aster subulatus	鑽形紫菀	Herb			+				
Averrhoa carambola	楊桃	Tree			+				
Baeckea frutescens	崗松	Shrub		+	+				
Bambusa sp.	簕竹屬	Bamboo	+	+					
Bauhinia sp.	羊蹄甲屬	Tree	+						
Bauhinia variegata	宮粉羊蹄甲	Tree					+		
Bidens alba	白花鬼針草	Herb	+	+	+	+	+	+	+
Blechnum orientale	烏毛蕨	Herb	+	+	+				
Bombax ceiba	木棉	Tree					+		+
Bougainvillea spectabilis	簕杜鵑	Climber	+				+		
Breynia fruticosa	黑面神	Shrub	+	+	+				
Bridelia tomentosa	土蜜樹	Shrub / Tree	+	+	+		+	+	
Broussonetia papyrifera	構樹	Tree		+					
Brucea javanica	鴉膽子	Shrub	+	+	++		+		

			Habitat Type						
Botanical Name	**Chinese Name**	**Growth Form**	**WL**	**PL**	**SL**	**WC**	**DA**	**PL-PS**	**DA-PS**
Bruguiera gymnorhiza	木欖	Shrub / Tree				+			
Calliandra haematocephala	紅絨球	Shrub					++		
Canna x generalis	大花美人蕉	Herb					+		
Carica papaya	番木瓜	Tree			+		+	+	
Cassytha filiformis	無根藤	Climber			+		+		
Casuarina equisetifolia	木麻黃	Tree	++				+		
Catharanthus roseus	長春花	Shrub			+		+		
Celosia argentea	青葙	Herb		+		+			
Celtis sinensis	朴樹	Tree	+	+	+		+	+	
Centella asiatica	崩大碗	Herb					+		
Centotheca lappacea	假淡竹葉	Herb	+	+			+		
Cerbera manghas	海芒果	Tree	++						
Chloris barbata	孟仁草	Herb					+		
Cinnamomum camphora	樟	Tree	+						
Citrus maxima	柚	Tree					+	+	
Citrus microcarpa	四季桔	Shrub / Tree					+		
Clausena lansium	黃皮	Tree	+						
Clerodendrum cyrtophyllum	大青	Shrub	+						
Clerodendrum inerme	苦郎樹	Shrub				+			
Cordyline fruticosa	朱蕉	Shrub					+		
Cratoxylum cochinchinense	黃牛木	Shrub / Tree	+						
Cuphea hyssopifolia	細葉萼距花	Shrub					+		
Cuscuta campestris	田野菟絲子	Herb			+				
Cyperus involucratus	風車草	Herb		+		+			
Desmodium heterocarpon	假地豆	Shrub					+		
Desmos chinensis	假鷹爪	Shrub	+		+				
Dianella ensifolia	山菅蘭	Herb	+	+	+				
Dicranopteris pedata	芒萁	Herb	+	+	++				
Digitaria longiflora	長花馬唐	Herb					+		
Dimocarpus longan	龍眼	Tree	+		+				
Dioscorea bulbifera	黃獨	Climber					+		
Diospyros vaccinioides *	小果柿	Shrub			+				
Duranta erecta	假連翹	Shrub					++		
Eclipta prostrata	鱧腸	Herb					+		
Elephantopus tomentosus	白花地膽草	Herb			+				

			Habitat Type						
Botanical Name	**Chinese Name**	**Growth Form**	**WL**	**PL**	**SL**	**WC**	**DA**	**PL-PS**	**DA-PS**
Eleusine indica	牛筋草	Herb	+				+	+	+
Emilia sonchifolia	一點紅	Herb					+		
Eucalyptus sp.	桉屬	Tree		+					
Euphorbia hirta	飛揚草	Herb					+		
Euphorbia thymifolia	小飛揚	Herb					+		
Ficus benjamina	垂葉榕	Tree						+	
Ficus elastica	印度橡樹	Tree						++	
Ficus hirta	粗葉榕	Sheub / Tree	+	+	+				
Ficus hispida	對葉榕	Shrub / Tree		+					
Ficus microcarpa	細葉榕	Tree	+	+			+	+	
Ficus microcarpa 'Golden Leaves'	黃金榕	Shrub					++		
Ficus variolosa	變葉榕	Shrub / Tree		+	++				
Gardenia jasminoides	梔子	Shrub		+	++				
Glochidion eriocarpum	毛果算盤子	Shrub			+				
Glochidion zeylanicum	香港算盤子	Shrub			+				
Gnaphalium pensylvanicum	匙葉鼠麴草	Herb	+						
Hedyotis corymbosa	繖房花耳草	Herb	+				+		
Helicteres angustifolia	山芝麻	Shrub		+	+				
Hibiscus tiliaceus	黃槿	Tree	++				++		
Hymenocallis littoralis	水鬼蕉	Herb					+		
Ilex asprella	梅葉冬青	Shrub			+				
Imperata cylindrica var. *major*	大白茅	Herb					+		
Ipomoea cairica	五爪金龍	Climber	+	+	+	++	+		
Ipomoea nil	牽牛	Climber	+						
Ixora chinensis	龍船花	Shrub					+		
Kalanchoe pinnata	落地生根	Herb	+				+		
Kandelia obovata	秋茄樹	Shrub				++			
Kyllinga nemoralis	單穗水蜈蚣	Herb					+		
Lagerstroemia speciosa	大花紫薇	Tree					+		
Lantana camara	馬纓丹	Shrub	+	+	+		+		
Lepidosperma chinense	鱗子莎	Herb			+				
Leucaena leucocephala	銀合歡	Shrub	+	+	+		+	+	+
Ligustrum sinense	山指甲	Shrub	+		+				
Liquidambar formosana	楓香	Tree					+		
Liriope spicata	山麥冬	Herb	+		+				

			Habitat Type						
Botanical Name	**Chinese Name**	**Growth Form**	**WL**	**PL**	**SL**	**WC**	**DA**	**PL-PS**	**DA-PS**
Litchi chinensis	荔枝	Tree						+	
Litsea glutinosa	潺槁樹	Tree	+	+	+		+		
Litsea rotundifolia var. *oblongifolia*	豺皮樟	Shrub		+	+				
Livistona chinensis	蒲葵	Tree Palm					+		
Ludwigia hyssopifolia	草龍	Herb				+			
Ludwigia octovalvis	毛草龍	Herb				+			
Lygodium flexuosum	長葉海金沙	Herb			+				
Lygodium japonicum	海金沙	Herb	+	+	+				
Lygodium scandens	小葉海金沙	Herb	+	+	+				
Macaranga tanarius var. *tomentosa*	血桐	Tree	+	+	+	+	+	+	
Mallotus paniculatus	白楸	Shrub / Tree	+						
Mangifera indica	杧果	Tree						+	
Manihot esculenta	木薯	Shrub			+				
Melastoma sanguineum	毛蒽	Shrub	+	+	+				
Melia azedarach	苦楝	Tree	+	+	+		+	+	
Melinis repens	紅毛草	Herb	+	+					+
Melodinus suaveolens	山橙	Climber	+		++				
Microcos nervosa	布渣葉	Shrub / Tree	+	+	++		+		
Mikania micrantha	薇甘菊	Climber	+	+	+	+	+		
Millettia nitida	亮葉崖豆藤	Shrub	+						
Miscanthus floridulus	五節芒	Herb	+	+	+				
Miscanthus sinensis	芒	Herb		+					
Morus alba	桑	Tree					+		
Murraya paniculata	九里香	Shrub	+	+	+		+		
Musa x *paradisiaca*	大蕉	Herb	+						
Mussaenda pubescens	玉葉金花	Shrub		+	+				
Nerium oleander	夾竹桃	Shrub					+		
Neyraudia reynaudiana	類蘆	Herb	+	+	+		+		+
Ophiopogon jaburan	花葉沿階草	Herb					+		
Oxalis corniculata	酢漿草	Herb	+		+		+		
Oxalis debilis subsp. *corymbosa*	紅花酢漿草	Herb					+		
Pachira macrocarpa	馬拉巴栗	Tree					+		
Paederia scandens	雞矢藤	Climber	+	+	+		+		
Pandanus tectorius	露兜樹	Shrub / Tree			+				
Panicum maximum	大黍	Herb	+	+	+		+	+	+

			Habitat Type						
Botanical Name	**Chinese Name**	**Growth Form**	**WL**	**PL**	**SL**	**WC**	**DA**	**PL-PS**	**DA-PS**
Parthenocissus dalzielii	異葉爬山虎	Climber					+		
Paspalum notatum	百喜草	Herb	+				++		
Passiflora foetida	龍珠果	Climber	+				+	+	+
Pennisetum polystachion	牧地狼尾草	Herb				+	+		+
Peperomia pellucida	草胡椒	Herb			+				
Persicaria chinensis	火炭母	Herb	+	+	+				
Phoenix hanceana	刺葵	Tree Palm	+						
Phyllanthus cochinchinensis	越南葉下珠	Shrub		+	+				
Phyllanthus niruri	珠子草	Herb					+		
Phyllanthus urinaria	葉下珠	Herb	+				+		
Pilea microphylla	小葉冷水花	Herb	+						
Pogonatherum crinitum	金絲草	Herb			+				
Polyspora axillaris	大頭茶	Shrub / Tree			++				
Portulaca pilosa	毛馬齒莧	Herb	+						
Psidium guajava	番石榴	Tree						+	
Psychotria asiatica	山大刀	Shrub	+	+	+				
Psychotria serpens	穿根藤	Climber		+	+				
Pteris ensiformis	劍葉鳳尾蕨	Herb	+						
Pteris multifida	井欄邊草	Herb	+						
Pteris semipinnata	半邊旗	Herb	+	+					
Pueraria lobata var. montana	葛麻姆	Climber		+	+				
Rhaphiolepis indica	車輪梅	Shrub	+		+				
Rhapis excelsa	棕竹	Shrub Palm					+		
Rhodomyrtus tomentosa	崗梔	Shrub		+	+				
Rhoeo discolor	蚌花	Herb					+		
Rhus hypoleuca	白背漆	Shrub / Tree	+	+					
Rhus succedanea	野漆樹	Shrub / Tree		+	+				
Rubus reflexus	蛇泡勒	Climber		+	+				
Sageretia thea	雀梅藤	Shrub			+				
Sansevieria trifasciata	虎尾蘭	Herb					+		
Sapium discolor	山烏桕	Tree	+	+					
Sapium sebiferum	烏桕	Tree	++		+				
Schefflera arboricola 'Variegata'	斑葉鵝掌籐	Shrub			+				
Schefflera heptaphylla	鴨腳木	Tree	+	+	+		+		
Scindapsus aureus	黃金葛	Climber	+						

			Habitat Type						
Botanical Name	**Chinese Name**	**Growth Form**	**WL**	**PL**	**SL**	**WC**	**DA**	**PL-PS**	**DA-PS**
Scleria ciliaris	緣毛珍珠茅	Herb		+	+				
Smilax hypoglauca	粉背菝葜	Climber			+				
Smilax glabra	土茯苓	Climber			+				
Solanum erianthum	假煙葉樹	Shrub	+				+		
Solanum americanum	少花龍葵	Herb	+						
Solanum nigrum	龍葵	Herb	+				+		
Spermacoce stricta	豐花草	Herb					+		
Sporobolus fertilis	鼠尾粟	Herb					+		
Stephania longa	千金藤	Climber	+		+		+	+	+
Sterculia lanceolata	假蘋婆	Tree	+	++	+		+		
Strophanthus divaricatus	羊角拗	Shrub			+				
Strychnos angustiflora	牛眼馬錢	Climber			+				
Syzygium jambos	蒲桃	Tree	+	+					
Tetracera asiatica	錫葉藤	Climber			+				
Tetradium glabrifolium	楝葉吳茱萸	Tree		+	+				
Thevetia peruviana	黃花夾竹桃	Shrub	+						
Trema tomentosa	山黃麻	Shrub / Tree	+	+	++		+		
Tridax procumbens	羽芒菊	Herb					+		
Tylophora ovata	娃兒藤	Climber	+						
Urena lobata	肖梵天花	Herb		+					
Vernonia cinerea	夜香牛	Herb	+	+	+		+		
Wedelia trilobata	三裂葉蟛蜞菊	Herb	+				+	+	+
Youngia japonica	黃鶴菜	Herb	+				+		
Zanthoxylum avicennae	簕欓花椒	Shrub / Tree	+	+					
Zanthoxylum nitidum	兩面針	Climber		+	+				
Zoysia sp.	結縷草屬	Herb					++		
TOTAL	**200**		**89**	**67**	**89**	**14**	**90**	**21**	**12**

Relative Abundance: + uncommon; ++ fairly common; +++ very common
* species of conservation interest

WL = Woodland
PL = Plantation
SL = Shrubland
DA-PS = Developed Area - Project Site
WC = Watercourse
DA = Developed Area
PL-PS = Plantation - Project Site

B2. List of Mammal Species Recorded during the Confirmatory Ecological Surveys

B2. List of Mammal Species Recorded during the Confirmatory Ecological Surveys

Scientific Name	Common Name	Habitat Type		Total
		WC	DA	
Canis lupus familiaris	Domestic Dog		2	2
	Insectivorous Bat	4	1	5
No. of species		**1**	**2**	**2**
No. of Individuals Recorded		**4**	**3**	**7**

Note:
WC = Watercourse
DA = Developed Area

B3. List of Avifauna Species Recorded during the Confirmatory Ecological Surveys

B3. List of Avifauna Species Recorded during the Confirmatory Ecological Surveys

Scientific Name	Common Name	Habitat Type								Total
		DA		MW	PL		SL	WC	WL	
		Project Site	Study Area		Project Site	Study Area				
Acridotheres cristatellus	Crested Myna		7							7
Actitis hypoleucos	Common Sandpiper							1		1
Aquila fasciata	Bonelli's Eagle						1			1
Ardea cinerea	Grey Heron			1						1
Copsychus saularis	Oriental Magpie Robin		1							1
Corvus macrorhynchos	Large-billed Crow		1			2	2			5
Corvus splendens	House Crow	2				1				3
Dicrurus macrocercus	Black Drongo		1							1
Egretta garzetta	Little Egret		1	1						2
Falco subbuteo	Eurasian Hobby						1			1
Garrulax perspicillatus	Masked Laughingthrush								2	2
Gracupica nigricollis	Black-collared Starling					4				4
Hirundo rustica	Barn Swallow						3		2	5
Milvus migrans	Black Kite		2				13			15
Motacilla alba	White Wagtail	2	2			2		2		8
Motacilla cinerea	Grey Wagtail								1	1
Orthotomus sutorius	Common Tailorbird	1					2		1	4
Parus cinereous	Cinereous Tit								1	1
Passer montanus	Eurasian Tree Sparrow	2	17		3	4				26
Phoenicurus auroreus	Daurian Redstart						1			1
Phylloscopus inornatus	Yellow-browed Warbler		1		2		5		4	12
Phylloscopus proregulus	Pallas's Leaf Warbler						3			3
Pica pica	Eurasian Magpie	1	2			1				4
Prinia inornata	Plain Prinia		2			1				3
Pycnonotus jocosus	Red-whiskered Bulbul	2			3	5	9		1	20
Pycnonotus sinensis	Chinese Bulbul	6			4	13	11		3	37
Spilopelia chinensis	Spotted Dove	2	13		1	1	7		3	27
Spodiopsar sericeus	Red-billed Starling	23								23
Zosterops japonicus	Japanese White-eye	2	5				7		15	29
No. of species		**10**	**13**	**2**	**5**	**10**	**13**	**2**	**10**	**29**
No. of Individuals Recorded		**43**	**55**	**2**	**13**	**34**	**65**	**3**	**33**	**248**

Note:
Highlighted as species of conservation interest
WL = Woodland WC = Watercourse SL = Shrubland
PL = Plantation DA = Developed Area MW = Marine Water

B4. List of Herpetofauna Species Recorded during the Confirmatory Ecological Surveys

B4. List of Herpetofauna Species Recorded during the Confirmatory Ecological Surveys

Scientific Name	Common Name	Habitat Type		Total
		DA	WL	
Fejervarya limnocharis	Paddy Frog		4	4
Gekko chinensis	Chinese Gecko	11		11
Hemidactylus bowringii	Bowring's Gecko	1		1
Kalophrynus interlineatus	Spotted Narrow-mouthed Frog		1	1
Microhyla ornata	Ornate Pigmy Frog		1	1
Polypedates megacephalus	Brown Tree Frog	1		1
No. of species		**3**	**3**	**6**
No. of Individuals Recorded		**13**	**6**	**19**

Note:
DA = Developed Area
WL = Woodland

B5. List of Butterfly Species Recorded during the Confirmatory Ecological Surveys

B5. List of Butterfly Species Recorded during the Confirmatory Ecological Surveys

Scientific Name	Common Name	Habitat Type					Total
		DA		WL	PL	SL	
		Project Site	Study Area		Study Area		
Abisara echerius echerius	Plum Judy				1		1
Catopsilia pomona pomona	Lemon Emigrant		1				1
Cupha erymanthis erymanthis	Rustic					1	1
Danaus genutia genutia	Common Tiger			1			1
Delias pasithoe pasithoe	Red-base Jezebel		2	1	2	12	17
Heliophorus epicles phoenicoparyphus	Purple Sapphire				2		2
Ideopsis similis similis	Ceylon Blue Glassy Tiger			2			2
Mycalesis mineus mineus	Dark-brand Bush Brown	1			1	1	3
Nacaduba kurava euplea	Transparent Six-line Blue				1		1
Papilio helenus helenus	Red Helen			1			1
Pieris canidia canidia	Indian Cabbage White			2		2	4
Zizeeria maha serica	Pale Grass Blue		2	3			5
No. of species		**1**	**3**	**6**	**5**	**4**	**12**
No. of Individuals Recorded		**1**	**10**	**10**	**7**	**16**	**39**

Note:
WL = Woodland
PL = Plantation
SL = Shrubland
DA = Developed Area

B6. List of Dragonfly Species Recorded during the Confirmatory Ecological Surveys

and

B7. List of Freshwater Aquatic Assemblages

B6. List of Dragonfly Species Recorded during the Confirmatory Ecological Surveys

Scientific Name	Common Name	Habitat Type			Total
		DA		WC	
		Project Area	Study Area		
Copera marginipes	Yellow Featherlegs			1	1
Crocothemis servilia servilia	Crimson Darter		1		1
Orthetrum pruinosum neglectum	Common Red Skimmer		1		1
Orthetrum sabina sabina	Green Skimmer			1	1
Pantala flavescens	Wandering Glider	3	4		7
No. of species		**1**	**3**	**2**	**5**
No. of Individuals Recorded		**3**	**6**	**2**	**11**

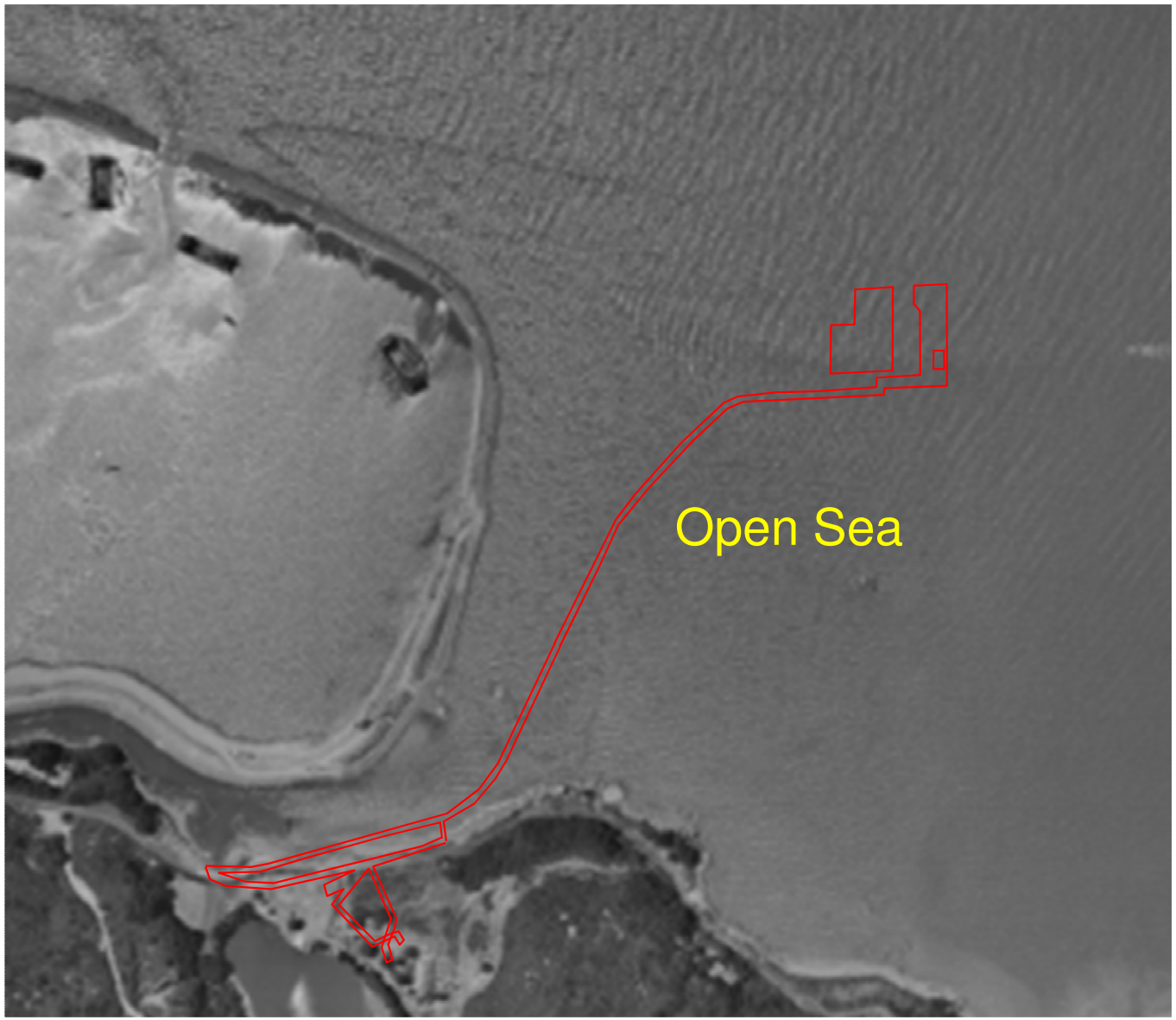
Note:
WC = Watercourse
DA = Developed Area

B7. List of Freshwater Aquatic Assemblages

Order	Family	Scientific Name	Common Name	Chinese Name	Location/Transect	Abundance
Decapoda	Atyidae	*Caridina cantonensis*	N/A	廣東米蝦	Study Area	1
Heteroptera	Gerridae	*Metrocoris lituratus*	Water Skater	偽齒澗黽蝽	Study Area	16

Appendix C Historical Aerial Photographs

Appendix C Historical Aerial Photographs



Year: 1988
Ref: A13005

Appendix C Historical Aerial Photographs

Year: 1995
Ref: CN10614

Appendix C Historical Aerial Photographs

Year: 2003
Ref: CW47935

Appendix C Historical Aerial Photographs

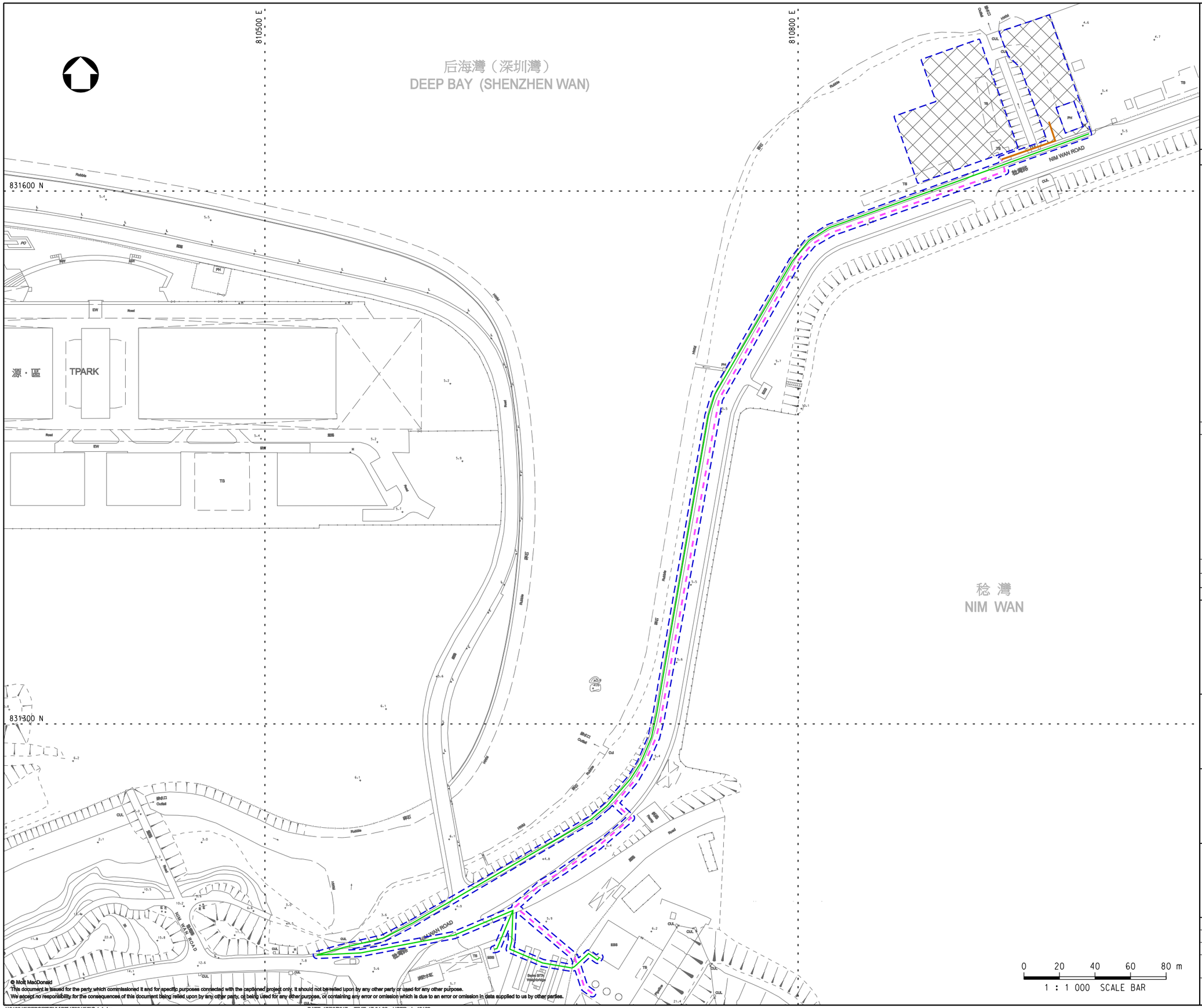
Year: 2009

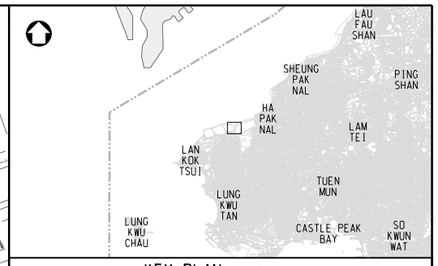
Ref: CS25500

Appendix C Historical Aerial Photographs

Year: 2015
Ref: CW116325

Figures





KEY PLAN (1:150000)

LEGEND:

- SITE BOUNDARY
- PROPOSED CLP CABLE
- PROPOSED GAS PIPE AND CONDENSATE PIPE (ABOVE GROUND)
- PROPOSED GAS PIPE AND CONDENSATE PIPE (UNDER GROUND)
- PROPOSED LANDFILL GAS UTILIZATION PLANT AREA

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P2	JAN 17	MING	GENERAL REVISION	EY	EC
P1	JAN 17	MING	FIRST ISSUE	EY	EC

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Project

LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

Title

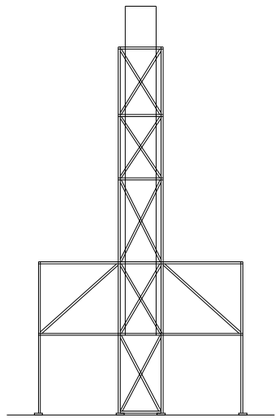
PROJECT LOCATION

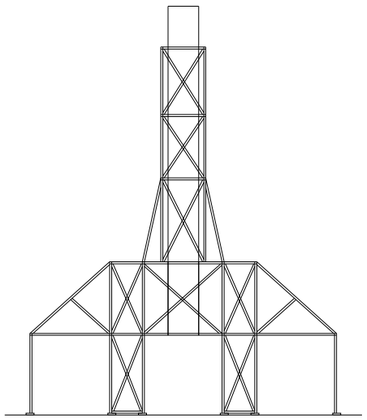
Designed	EY		Eng check	TC	
Drawn	MING		Coordination	TC	
Dwg check	EY		Approved	EC	
Scale at A1	1:1000	Status	PRE	Rev	P2

Drawing Number

FIGURE 1.1

J:\313243\REPORT\ENV\PP\170213\FIG 1-1.dgn DATE: 17/02/2017 TIME: 17:04:02 USER: ylm42169





0 2 4 6 8 10 m
1 : 150 SCALE BAR

Notes

Key to symbols

- ROAD
- FUTURE EXTENSION
- 11kV CABLE
- GAS PIPE
- PACKAGE SUBSTATION

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P2	FEB 17	MING	GENERAL REVISION	EY	EC
P1	JAN 17	MING	FIRST ISSUE	EY	EC

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Project

LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

Title

LAYOUT OF PROPOSED LANDFILL GAS UTILISATION PLANT AREA

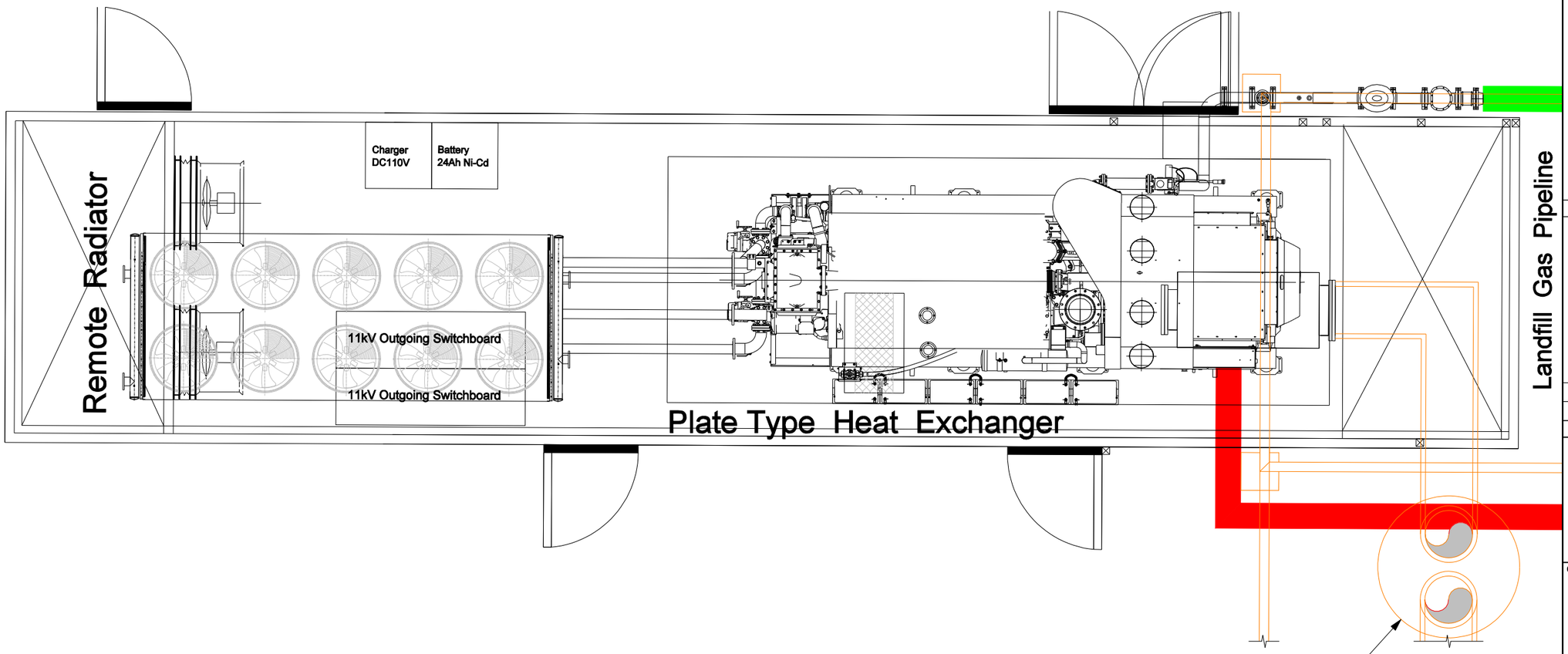
Designed	EY		Eng check	TC	
Drawn	MING		Coordination	TC	
Dwg check	EY		Approved	EC	

Scale at A1	Status	Rev
1:150	PRE	P2

Drawing Number

FIGURE 1.2

J:\313243\REPORT\ENV\PP\170213\FIG 1-2.dgn DATE: 13/02/2017 TIME: 12:55:35 USER: yilm42169



0 0.5 1 1.5 2 m

1 : 25 SCALE BAR

J:\313243\REPORT\ENV\PP\170213\FIG 1-3.dgn DATE: 13/02/2017 TIME: 12:58:44 USER: ylm42189

Notes

Key to symbols

11kV CABLE

GAS PIPE

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
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Project

LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

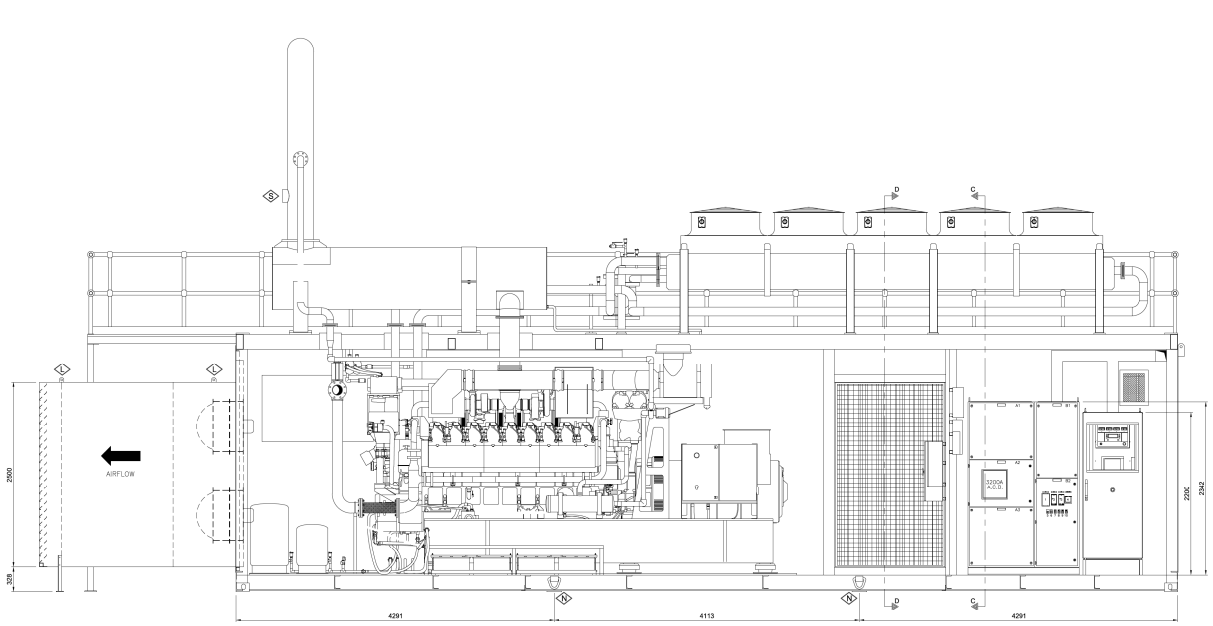
Title

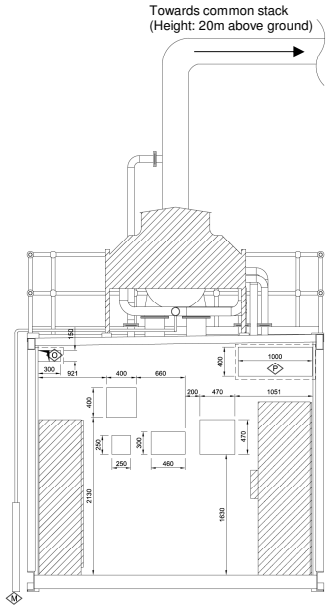
TYPICAL LAYOUT OF A LANDFILL GAS POWER GENERATION UNIT

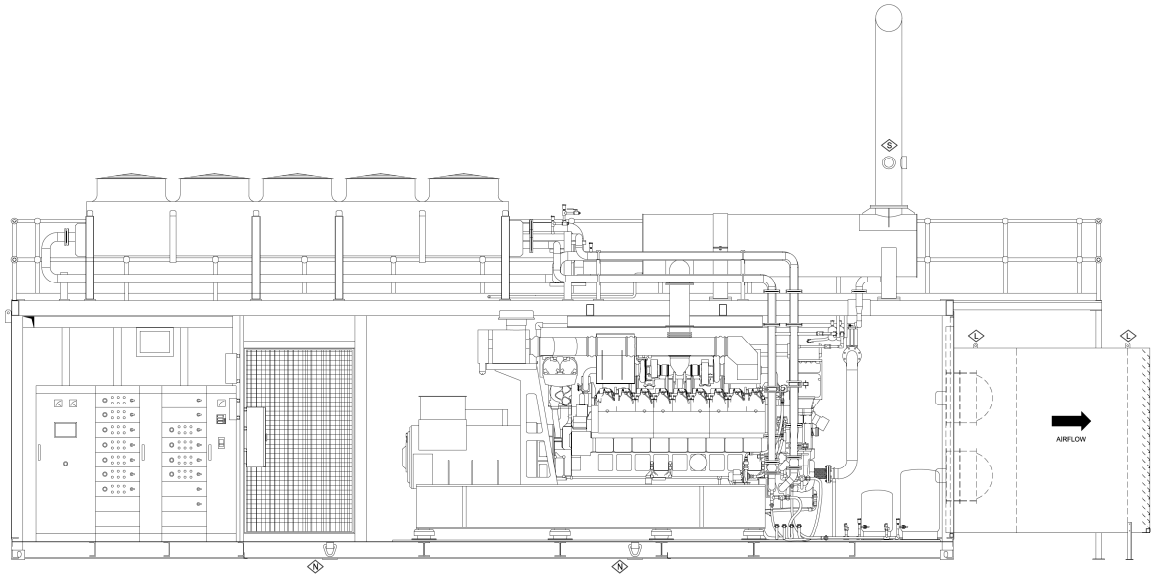
Designed	EY		Eng check	TC	
Drawn	MING		Coordination	TC	
Dwg check	EY		Approved	EC	
Scale at A1 1:25		Status PRE		Rev P2	

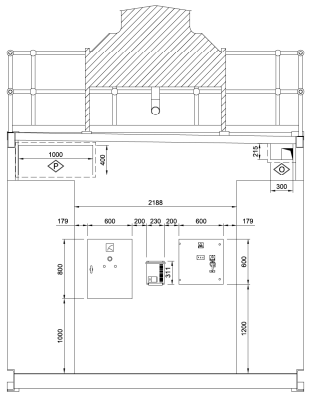
Drawing Number

FIGURE 1.3









J:\313743\CAD_ADMINIMMH-313743-P-A1_TI R-N3.dgn DATE: 13/02/2017 TIME: 12:48:43 USER: ylma2189

Notes

Key to symbols

Reference drawings

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Project

LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

Title

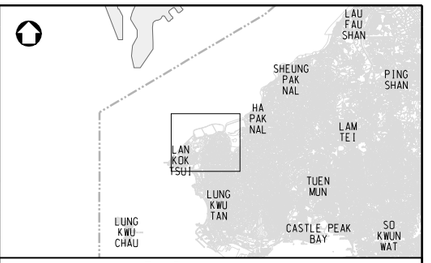
TYPICAL CROSS-SECTION OF A CONTAINERIZED LANDFILL GAS POWER GENERATION UNIT

Designed			Eng check		
Drawn			Coordination		
Dwg check			Approved		
Scale at A1 N.T.S.		Status		Rev	

Drawing Number

FIGURE 1.4

809000 E
810000 E
811000 E
831500 N
830500 N
829500 N



KEY PLAN (1:150000)

LEGEND:

- PLANNED WEST NEW TERRITORIES (WENT) LANDFILL EXTENSIONS
- PROPOSED LANDFILL GAS POWER GENERATION PROJECT AT THE WENT LANDFILL
- SLUDGE TREATMENT FACILITIES
- SITE IDENTIFIED FOR DEVELOPMENT OF THE INTEGRATED WASTE MANAGEMENT FACILITIES
- ADDITIONAL GAS-FIRED GENERATION UNITS AT BLACK POINT POWER STATION
- PROVISION OF COLUMBARIUM AND GARDEN OF REMEMBRANCE AT TSANG TSUI, TUEN MUN
- DECOMMISSIONING OF WEST PORTION OF THE MIDDLE ASH LAGOON AT TSANG TSUI

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P2	FEB 17	MING	GENERAL REVISION	EY	EC
P1	JAN 17	HK	FIRST ISSUE	EY	EC

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Project

LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

Title

LOCATIONS OF INTERFACING PROJECTS

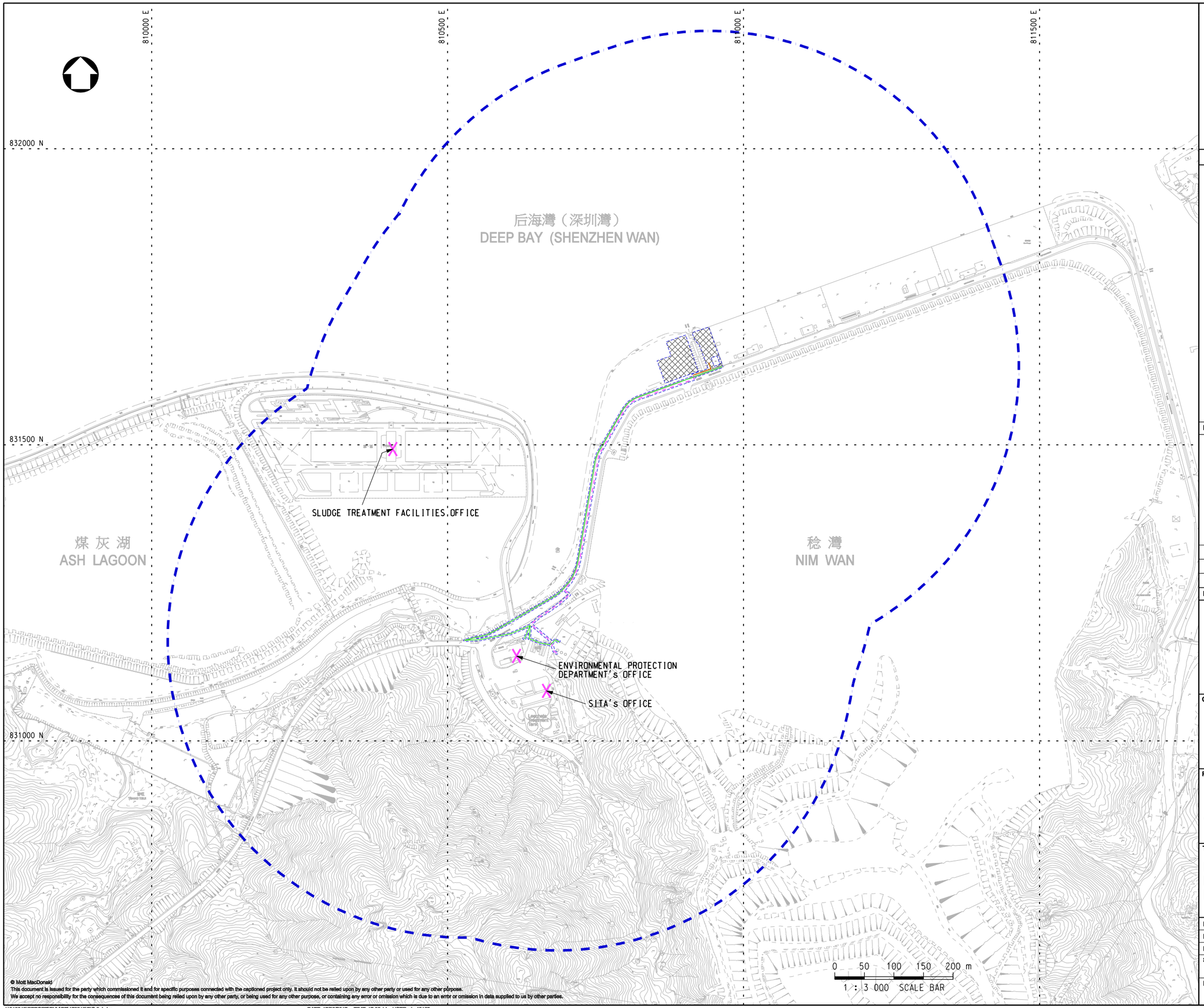
Designed	EY		Eng check	TC	
Drawn	HK		Coordination	TC	
Dwg check	EY		Approved	EC	
Scale at A1	1:5000	Status	PRE	Rev	P2

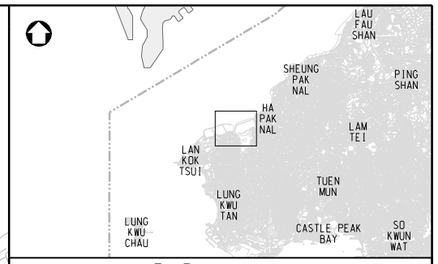
Drawing Number

FIGURE 2.1

0 100 200 300 400 500m
1 : 5 000 SCALE BAR

J:\313243\REPORT\ENV\PP\170213\FIG 2-1.dgn DATE: 17/02/2017 TIME: 17:05:09 USER: yiim42169





KEY PLAN (1:150000)

LEGEND:

- 500m ASSESSMENT AREA
- SITE BOUNDARY
- PROPOSED CLP CABLE
- PROPOSED GAS PIPE AND CONDENSATE PIPE (ABOVE GROUND)
- PROPOSED GAS PIPE AND CONDENSATE PIPE (UNDER GROUND)
- PROPOSED LANDFILL GAS UTILIZATION PLANT AREA
- AIR SENSITIVE RECEIVERS

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P3	FEB 17	MING	GENERAL REVISION	HC	EC
P2	JAN 17	MING	GENERAL REVISION	HC	EC
P1	JAN 17	MING	FIRST ISSUE	HC	EC

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Project

LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

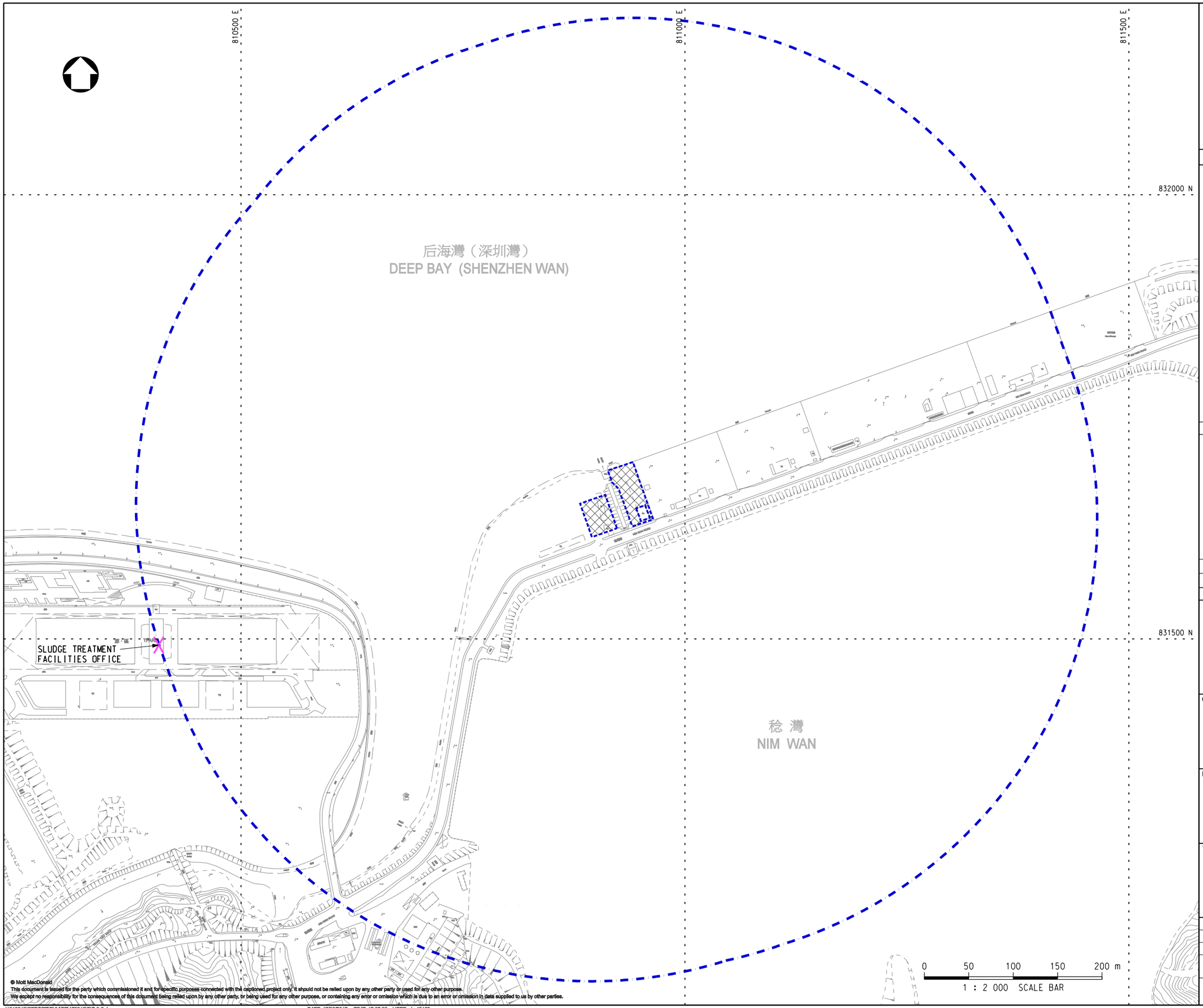
Title

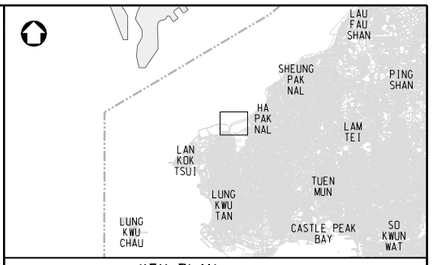
LOCATIONS OF AIR SENSITIVE RECEIVERS DURING CONSTRUCTION PHASE

Designed	EY		Eng check	TC	
Drawn	MING		Coordination	TC	
Dwg check	EY		Approved	EC	
Scale at A1	1:3000	Status	PRE	Rev	P3

Drawing Number

FIGURE 3.1





KEY PLAN (1:150000)

LEGEND:

- 500m ASSESSMENT AREA
- SITE BOUNDARY
- PROPOSED LANDFILL GAS UTILIZATION PLANT AREA
- AIR SENSITIVE RECEIVERS

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P2	FEB 17	MING	GENERAL REVISION	HC	EC
P1	JAN 17	MING	FIRST ISSUE	HC	EC

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Project

LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

Title

LOCATIONS OF AIR SENSITIVE RECEIVERS DURING OPERATION PHASE

Designed	EY		Eng check	TC	
Drawn	MING		Coordination	TC	
Dwg check	EY		Approved	EC	

Scale at A1	Status	Rev
1:2000	PRE	P2

Drawing Number

FIGURE 3.2

J:\313243\REPORT\ENV\PP\170213\FIG 3-2.dgn DATE: 17/02/2017 TIME: 17:07:32 USER: ylm42169

807000 E
810000 E
813000 E
838000 N
830000 N

TSANG KOK STREAM

SLUDGE TREATMENT FACILITIES
SEAWATER INTAKE

BLACK POINT POWER STATION
SEAWATER INTAKE

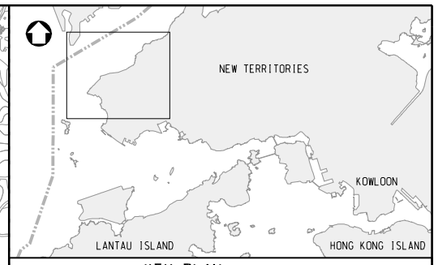
LUNG KWU SHEUNG TAN BEACH

LUNG KWU TAN BEACH

PAK NAI SITE OF SPECIAL
SCIENTIFIC INTEREST

龍鼓水道

0 250 500 750 1000 m
1 : 15 000 SCALE BAR



KEY PLAN (1:300000)

LEGEND:

- HKSAR BOUNDARY
- SITE BOUNDARY
- OYSTER PRODUCTION AREA
- SECONDARY CONTACT RECREATION AREA
- INNER DEEP BAY SUBZONE
- OUTER DEEP BAY SUBZONE

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P2	FEB 17	MING	GENERAL REVISION	DC	EC
P1	JAN 17	MING	FIRST ISSUE	EY	EC

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Project

LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

Title

LOCATION OF WATER SENSITIVE RECEIVERS

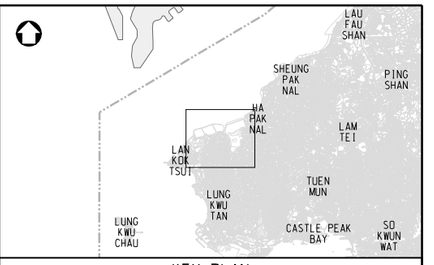
Designed	DC		Eng check	TC	
Drawn	MING		Coordination	TC	
Dwg check	DC		Approved	EC	
Scale at A1	1:15000	Status	PRE	Rev	P2

Drawing Number

FIGURE 3.3

J:\313243\REPORT\ENV\PP\170213\FIG 3-3.dgn DATE: 17/02/2017 TIME: 17:08:23 USER: ylm42169

809000 E
810000 E
811000 E
812000 E
831500 N
830500 N



KEY PLAN

LEGEND:

- WASTE BOUNDARY OF WENT LANDFILL EXTENSION
- BOUNDARY OF EXISTING WENT LANDFILL
- APPROXIMATE WASTE BOUNDARY OF EXISTING WENT LANDFILL
- 250m CONSULTATION ZONE OF WENT LANDFILL AND ITS EXTENSION
- SITE BOUNDARY
- PROPOSED LANDFILL GAS UTILIZATION PLANT AREA

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P2	FEB 17	MING	GENERAL REVISION	EY	EC
P1	JAN 17	MING	FIRST ISSUE	DC	EC

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Project

LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

Title

BOUNDARY AND 250m CONSULTATION ZONE OF WENT LANDFILL AND ITS EXTENSION

Designed	EY		Eng check	TC	
Drawn	HK		Coordination	TC	
Dwg check	EY		Approved	EC	
Scale at A1	1:5000	Status	PRE	Rev	P2

Drawing Number

FIGURE 3.4

0 100 200 300 400 500m
1 : 5 000 SCALE BAR

J:\313243\REPORT\ENV\PP\170213\FIG 3-4.dgn DATE: 17/02/2017 TIME: 17:09:22 USER: ylm42169

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

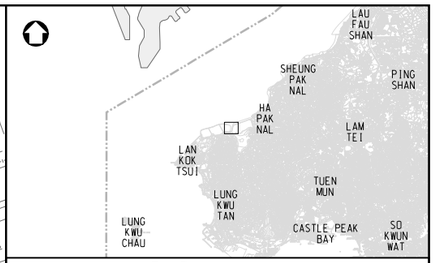
Photo 9

Photo 10

Photo 11

Photo 12

J:\313243\REPORT\ENV\PP\170213\FIG 3-5.dgn DATE: 13/02/2017 TIME: 13:07:20 USER: ylm42169



KEY PLAN (1:150000)

LEGEND:

- SITE BOUNDARY
- PROPOSED CLP CABLE
- PROPOSED GAS PIPE AND CONDENSATE PIPE (ABOVE GROUND)
- PROPOSED GAS PIPE AND CONDENSATE PIPE (UNDER GROUND)
- PROPOSED LANDFILL GAS UTILIZATION PLANT AREA

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P3	FEB 17	MING	GENERAL REVISION	PL	EC
P2	JAN 17	HK	GENERAL REVISION	TC	EC
P1	JAN 17	HK	FIRST ISSUE	EY	EC

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Project

LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

Title

CURRENT LAND USE OF PROJECT SITE

Designed	PL		Eng check	TC	
Drawn	MING		Coordination	TC	
Dwg check	PL		Approved	EC	
Scale at A1	1:1000	Status	PRE	Rev	P3

Drawing Number

FIGURE 3.5

SPECIES OF CONSERVATION INTEREST:

PLANTS
- PITCHER PLANT (INDIVIDUALS)
- PITCHER PLANT (MAJOR COLONY)
- BAMBOO ORCHID
- IXONANTHES
- INCENSE TREE
- SMALL PERSIMMON

MAMMALS
- SMALL ASIAN MONGOOSE
- SHORT-NOSED FRUIT BAT
- JAPANESE PIPISTRELLE
- SMALL INDIAN CIVET (SCAT)

DRAGONFLY
- COASTAL GLIDER

BUTTERFLY
- RED LACEWING
- GLASSY BLUEBOTTLE
- DANAID EGGFLY
- LITTLE BRANDED SWIFT

REPTILE
- COPPERHEAD RACER

BIRDS
- EURASIAN WIGEON
- CHINESE POND HERON
- GREAT EGRET
- PACIFIC REEF EGRET
- LITTLE EGRET
- CATTLE EGRET
- GREY HERON
- BLACK-CROWNED NIGHT HERON
- LITTLE GREBE
- LITTLE GREBE (JUVENILE)
- LITTLE GREBE (NEST)
- WOOD SANDPIPER
- WHITE-BELLIED SEA EAGLE
- BLACK KITE
- COMMON BUZZARD
- COLLARED SCOPS OWL
- LITTLE RINGED PLOVER
- KENTISH PLOVER
- BLACK-WINGED STILT
- GREATER COUCAL
- EMERALD DOVE
- WHITE-SHOULDERED STARLING
- WHITE-THROATED KINGFISHER
- PIED KINGFISHER
- BLACK-CAPPED KINGFISHER
- COMMON JAY
- ZITTING CISTICOLA
- RED-BILLED STARLING
- BONELLI'S EAGLE
- EURASIAN HOBBY

后海灣（深圳灣）
DEEP BAY (SHENZHEN WAN)

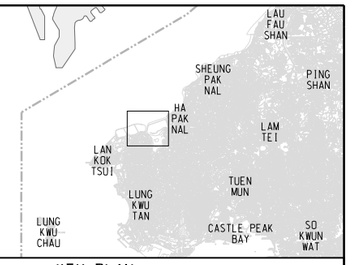
煤灰湖
ASH LAGOON

稔灣
NIM WAN

TSANG KOK STREAM

832000 N
831500 N
831000 N
810000 E
810500 E
811000 E
811500 E

0 50 100 150 200 m
1 : 3 000 SCALE BAR



KEY PLAN (1:150000)

LEGEND:
- 500m ASSESSMENT AREA
- SITE BOUNDARY
- PROPOSED CLP CABLE
- PROPOSED GAS PIPE AND CONDENSATE PIPE (ABOVE GROUND)
- PROPOSED GAS PIPE AND CONDENSATE PIPE (UNDER GROUND)
- LOCATION OF FRESHWATER STREAM SURVEY
- PROPOSED LANDFILL GAS UTILIZATION PLANT AREA
- WOODLAND
- PLANTATION
- SHRUBLAND
- WASTELAND
- WATERCOURSE
- COASTAL WATER
- DEVELOPED AREA

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P4	FEB 17	MING	GENERAL REVISION	KI	EC
P3	FEB 17	MING	GENERAL REVISION	KI	EC
P2	FEB 17	MING	GENERAL REVISION	PK	EC
P1	JAN 17	MING	FIRST ISSUE	PK	EC

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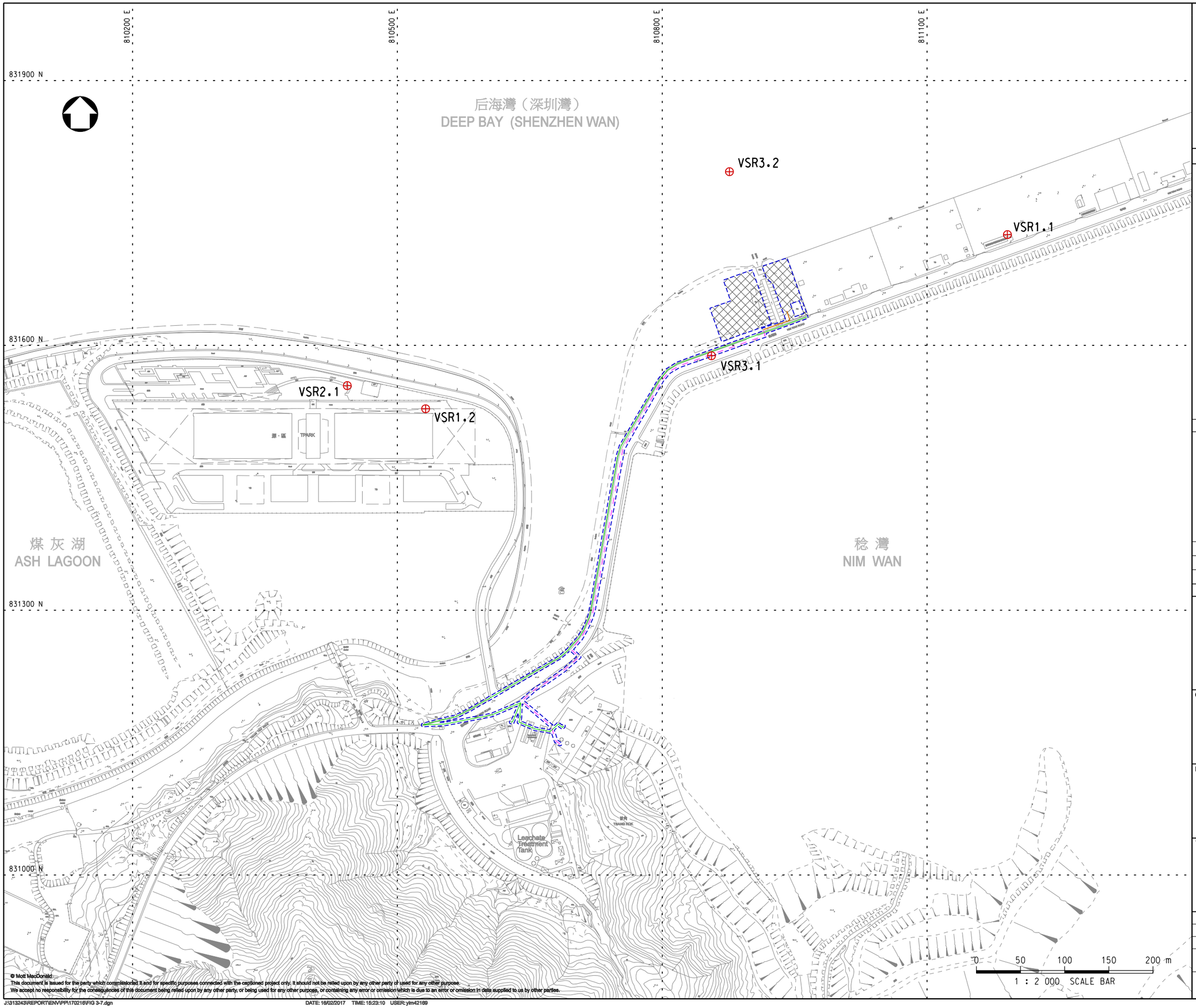
Project: LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

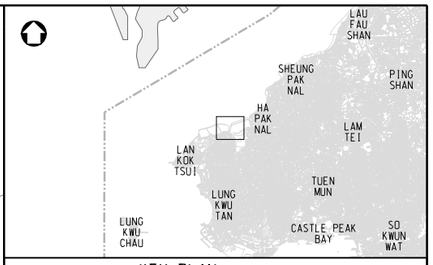
Title: HABITAT MAP

Designed	PK		Eng check	TC	
Drawn	MING		Coordination	TC	
Dwg check	PK		Approved	EC	
Scale at A1: 1:3000		Status: PRE		Rev: P4	

Drawing Number: FIGURE 3.6

J:\313243\REPORT\EN\PP\170223\FIG 3-8.dgn DATE: 23/02/2017 TIME: 10:33:04 USER: YIM42189





KEY PLAN (1:150000)

LEGEND:

- SITE BOUNDARY
- PROPOSED CLP CABLE
- PROPOSED GAS PIPE AND CONDENSATE PIPE (ABOVE GROUND)
- PROPOSED GAS PIPE AND CONDENSATE PIPE (UNDER GROUND)
- PROPOSED LANDFILL GAS UTILIZATION PLANT AREA
- VISUALLY SENSITIVE RECEIVER

VSR1.1	WORKERS IN WENT LANDFILL
VSR1.2	WORKERS IN T-PARK
VSR2.1	VISITORS IN T-PARK
VSR3.1	TRAVELLER ALONG NIM WAN ROAD
VSR3.2	MARINE TRAVELLERS IN DEEP BAY

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P3	FEB 17	MING	GENERAL REVISION	PK	EC
P2	FEB 17	MING	GENERAL REVISION	PK	EC
P1	FEB 17	MING	FIRST ISSUE	PK	EC

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LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

Title

VISUALLY SENSITIVE RECEIVERS

Designed	PK		Eng check	TC	
Drawn	MING		Coordination	TC	
Dwg check	PK		Approved	EC	

Scale at A1	Status	Rev
1:2000	PRE	P3

Drawing Number

FIGURE 3.7

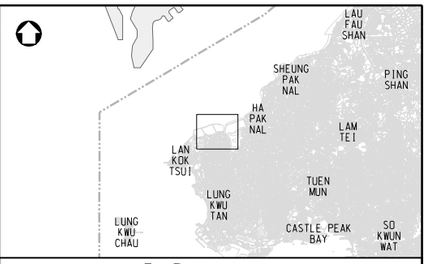
809500 E
810000 E
810500 E
811000 E
832000 N
831500 N
831000 N
830500 N

后海灣（深圳灣）
DEEP BAY (SHENZHEN WAN)

煤灰湖
ASH LAGOON

稔灣
NIM WAN

0 50 100 150 200 m
1 : 3 000 SCALE BAR



KEY PLAN (1:150000)

LEGEND:

- TSANG TSUI SITE OF ARCHAEOLOGICAL INTEREST
- PROPOSED LANDFILL GAS POWER GENERATION PROJECT AT THE WENT LANDFILL
- CLAN GRAVES

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P2	FEB 17	MING	GENERAL REVISION	EY	EC
P1	FEB 17	MING	FIRST ISSUE	EY	EC

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LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

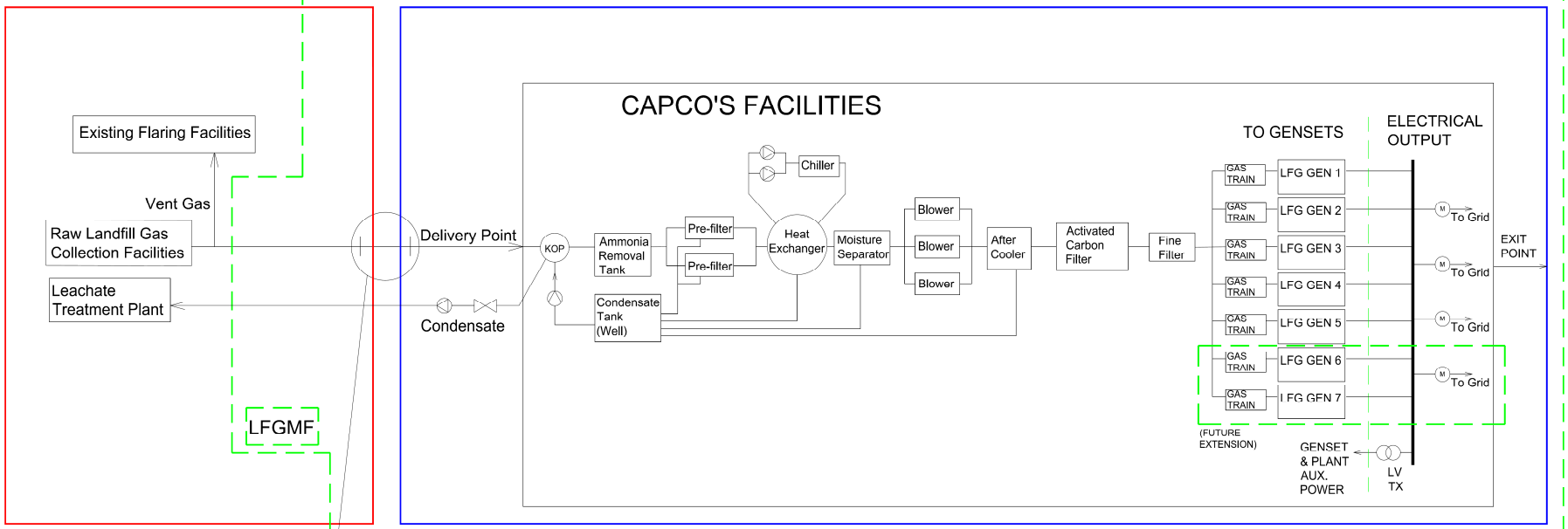
Title

LOCATION OF NEAREST CULTURAL HERITAGE RESOURCES

Designed	EY		Eng check	TC	
Drawn	MING		Coordination	TC	
Dwg check	EY		Approved	EC	
Scale at A1	1:3000	Status	PRE	Rev	P2

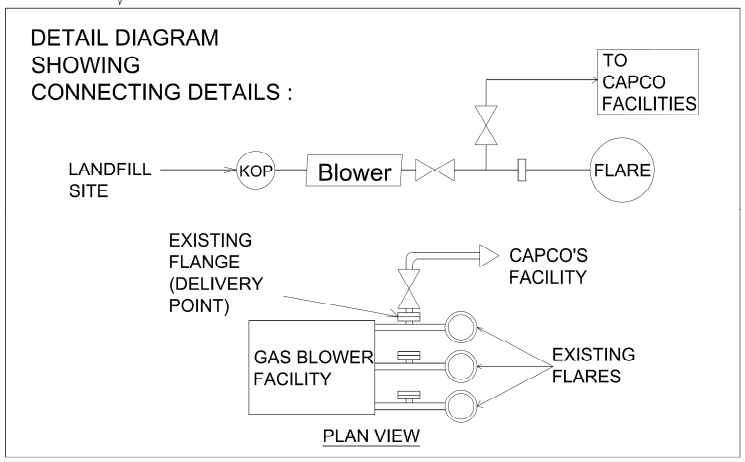
Drawing Number

FIGURE 3.8



EXISTING SITA'S FACILITIES

PROCESSING FACILITIES (CAPCO'S FACILITIES)



LEGEND:

- KOP — KNOCKOUT POT
- PUMP
- M — METER
- VALVE

Notes

Key to symbols

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd

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LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

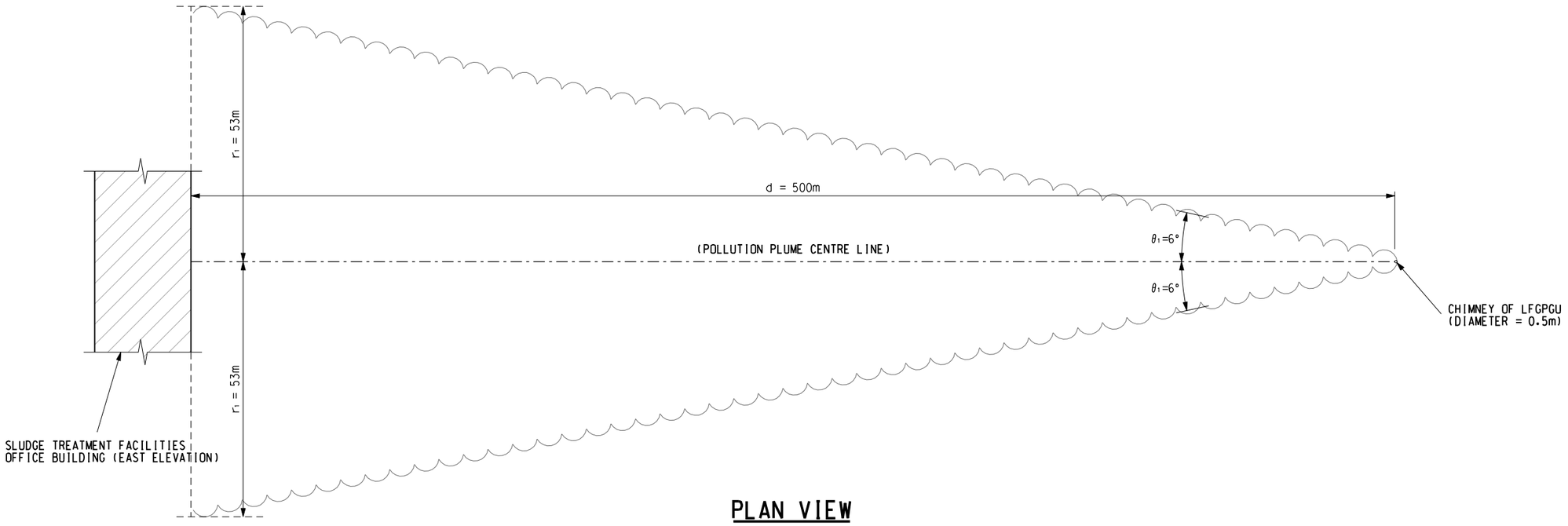
Title

FLOW DIAGRAM OF OVERALL OPERATION PROCESS

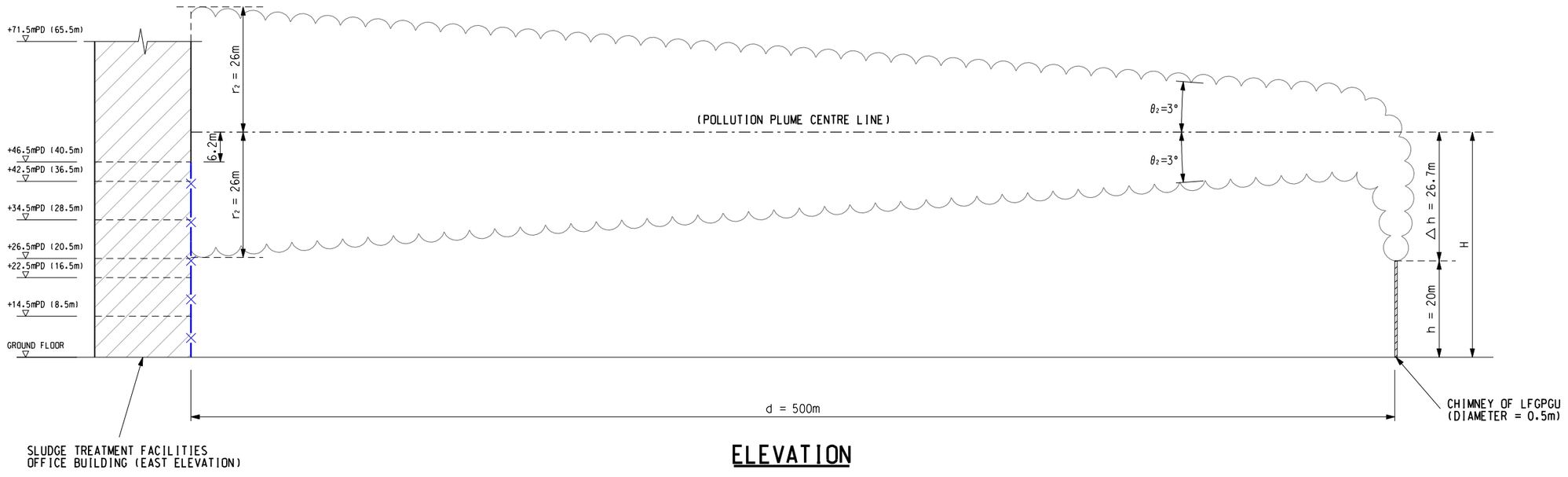
Designed			Eng check		
Drawn			Coordination		
Dwg check			Approved		
Scale at A1 N.T.S.		Status		Rev	

Drawing Number

FIGURE 4.1



PLAN VIEW



ELEVATION

ASSUMPTION:
WIND SPEED: 1m/s

0 10 20 30 40 50m
1 : 500 SCALE BAR

0 20 40 60 80 100m
1 : 1 000 SCALE BAR

J:\313243\REPORT\ENV\PP\170223\FIG 4-2.dgn DATE: 23/02/2017 TIME: 10:52:04 USER: YIM42169

Notes

Key to symbols

FRESH AIR INTAKE (FAI) OF SLUDGE TREATMENT FACILITIES OFFICE BUILDING (EAST ELEVATION)

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P2	FEB 17	MING	GENERAL REVISION	HC	EC
P1	JAN 17	MING	FIRST ISSUE	HC	EC

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LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

Title

CONCEPTUAL DIAGRAM OF POLLUTION PLUME ON THE SLUDGE TREATMENT FACILITIES OFFICE BULIDING

Designed	HC		Eng check	TC	
Drawn	MING		Coordination	TC	
Dwg check	HC		Approved	EC	

Scale at A1
VERTICAL: 1 : 500
HORIZONTAL: 1 : 1000

Status: PRE

Rev: P2

Drawing Number

FIGURE 4.2

Existing View of the LFGPGUs Project Site from T-Park

Photomontage Showing the Proposed Above-ground Structures at the LFGPGUs Project Site

Notes

Key to symbols

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	FEB 17	PK	FIRST ISSUE	TC	EC

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LANDFILL GAS POWER GENERATION PROJECT AT THE WEST NEW TERRITORIES (WENT) LANDFILL

Title

PHOTOMONTAGE OF PROPOSED ABOVE-GROUND STRUCTURES

Designed	PK		Eng check	TC	
Drawn	PK		Coordination	TC	
Dwg check	TC		Approved	EC	

Scale at A1: N.T.S. | Status: PRE | Rev: P1

Drawing Number: FIGURE 4.3