

Project Profile
for
Proposed Temporary Bus Depot at Tseung Kwan O
Area 85

Reference : R831.00

Client : New World First Bus Services Limited

Date : August 2000

For and on behalf of EHS Consultants Limited:

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1. BASIC INFORMATION

1.1. Project Title

Proposed Temporary Bus Depot at Tseung Kwan O (TKO), Area 85

1.2. Purpose and Nature of the Project

The primary objective of this project is to construct and operate a temporary bus depot at TKO Area 85, which shall provide services such as coin collection, refuelling, maintenance, washing and parking area for buses.

1.3. Name of the Project Proponent

New World First Bus Services Limited

1.4. Location and Scale of the Project

The proposed temporary bus depot is located at Area 85, TKO, Sai Kung, bounded by Wan Po Road to the west. The Site occupies about 5583m². Location of the proposed temporary bus depot is shown in Figure A-1. The adjacent site to the north is currently used as temporary bus depot. A Sewerage Treatment Works is located to the further north of the site. TKO landfill Stage II/III can be found to the east of the site.

The proposed temporary bus depot will comprises of the following facilities:

1. 6 number of covered bus parking spaces on concrete floor slab
2. 30 number of open bus parking spaces on concrete floor slab
3. 1 number of bus washing bay
4. an above ground mechanical and electrical plant room
5. two above ground fuel tanks
6. 1 storey offices for traffic, revenue collection and engineering staff and Octopus system computer room

Majority of the site will be allocated for bus parking. Chain link fence will be erected along the site boundary for security purposes. The layout plan of the proposed temporary bus depot is shown in Appendix I.

1.5. Number and Types of Designated Projects to be Covered

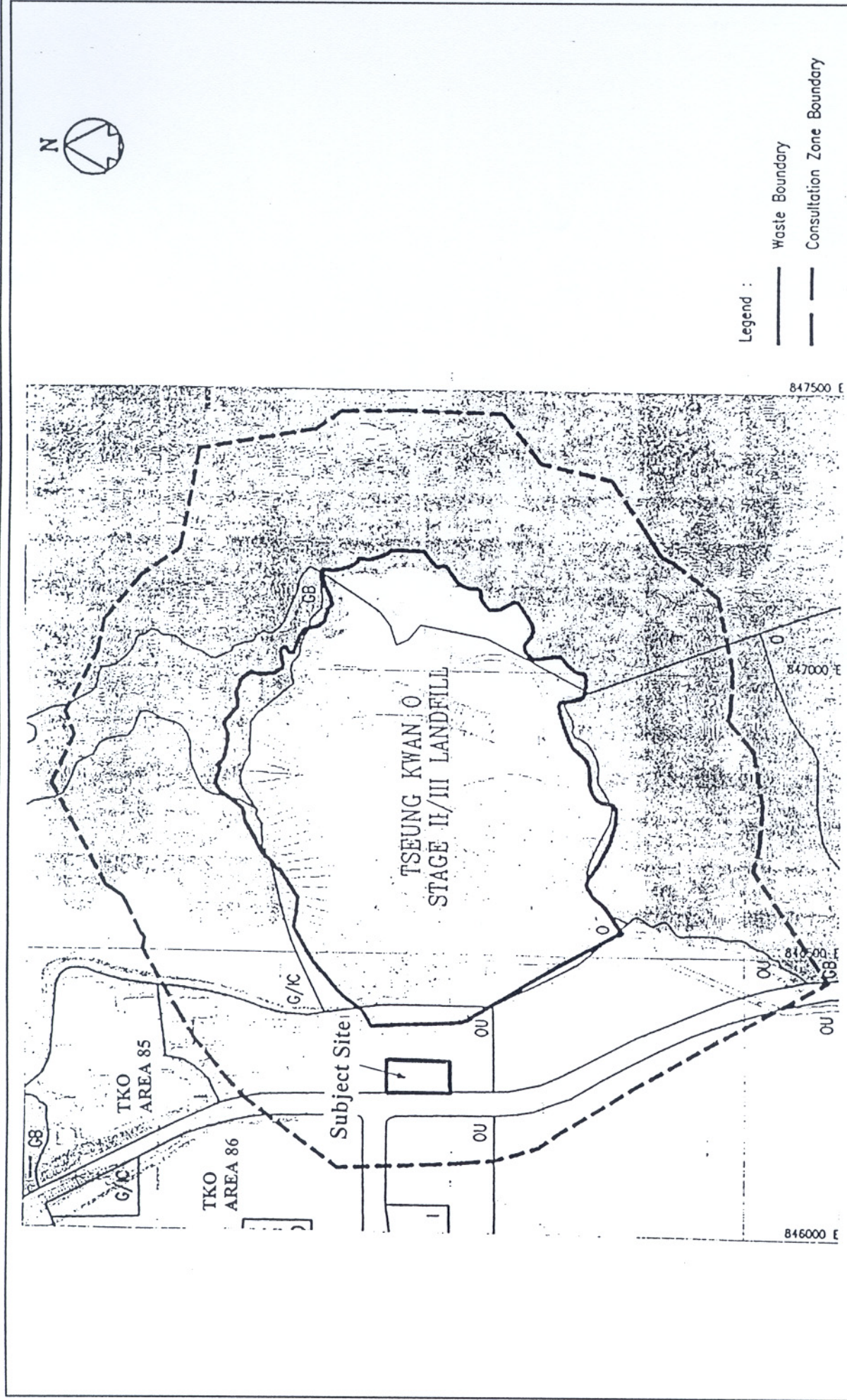
According to Part 1 Schedule 2 Section A.6(a) (Roads, railways and depot) of the Environmental Impact Assessment Ordinance (EIAO), as this proposed temporary bus depot is located at less than 200m from the nearest boundary of planned residential area at TKO Area 86, it is classified as a Designated Project. An Environmental Permit issued by the Director of Environmental Protection is required prior to the construction or operation of the subject temporary bus depot at TKO. However it is likely that the proposed temporary bus depot will be resumed by the Lands Department before the planned residential area is completed.


1.6. Name and Telephone Number of Contact Person

Key personnel of the project is listed in Table 1-1 for information.

Table 1-1 Contact for the Key Personal of the Project

Project Team	Company	Contact Person	Telephone Number	Fax Number
Project Proponent	New World First Bus Services Ltd.			
Project Architect	P&T Architects and Engineers Ltd.			
Environmental Consultant	EHS Consultants Limited			



Scale: NTS	Project: Proposed Temporary Bus Depot at Tseung Kwan O, Area 85
Figure: A-1	
Title: Location of the Proposed Temporary Bus Depot at Tseung Kwan O	
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2. OUTLINE OF PLANNING IMPLEMENTATION PROGRAMME

The project architect will design and plan the project and the construction of the project will be carried out by contractor.

The design of the proposed temporary bus depot has been finalised and building plans have been submitted to the Buildings Department for approval. Construction of the proposed depot is scheduled to commence by mid October 2000 and last for about 7 months, upon issue of environmental permit by Environmental Protection Department (EPD).

The site was leased by the Government of Hong Kong Special Administration Region (HKSAR) on a temporary bases. According to the TKO Outline Zoning Plan (OZP) No. S/TKO/6, the site is zoned as "O/U" and designated for sewerage treatment works. It is the Government's intention to take back the site for the sewerage treatment works expansion in due course. Hence, the proposed temporary bus depot is intended to be temporary in nature.

3. POSSIBLE IMPACT ON THE ENVIRONMENT

3.1. Construction Phase

The construction of the proposed temporary bus depot will be divided into two main stages: foundation works and superstructure. At the foundation stage, the site will be cleared and the concrete floor slab will be constructed. Following the foundation works, above ground structures such as the offices, covers of the bus parking spaces, electrical and mechanical rooms will be built.

3.1.1. Fugitive Dust Impact

Fugitive dust emission is likely to be the only main air quality pollutant upon the sensitive receivers during the construction phase of the proposed temporary bus depot. Since the site is on a flat terrain and limited underground installation will be involved, major excavation works is not anticipated. No significant dust impact on surrounding ASRs is expected.

3.1.2. Construction Noise Impact

Construction noise comes from the use of powered mechanical equipment (PME) for the construction of the aboveground structures which will be the dominant source of nuisance. It is not anticipated that the noise level to exceed the daytime construction noise guidelines of 75dB(A) at any of the sensitive receivers. No construction work will be carried out during night-time.

3.1.3. Water Quality Impact

Site construction activities will inevitably have the potential to generate wastewater. Construction runoff contains increased loads of sediments, other suspended solids and contaminants. Potential sources of pollution include runoff and erosion from the site surfaces, drainage channels, bentonite slurries and other grouting materials, unused batching washout and drainage from dust suppression sprays, fuel, oil and lubricants from construction vehicles and other equipment.

3.1.4. Landfill Gas Hazard

TKO Landfill Stage II/III is adjacent to TKO Area 85 to the east. The site for the proposed temporary bus depot is located at about 50m away from the boundary of the Landfill and falls within the 250m consultation zone of the Landfill. Due to the close proximity from the TKO Landfill Stage II/III, a landfill gas hazard assessment employing the source-pathway-target analysis method was conducted in accordance with the Landfill Gas Hazard Assessment Guidance Note

(GN) issued by the EPD. The detailed assessment report is contained in Appendix II for reference and the findings and conclusion of the assessment are summarised below.

The restoration works at the TKO Landfill Stage II/III has been completed and landfill gas monitoring records were obtained from EPD as contained in Appendix II for reference. Recent landfill gas monitoring record provided by EPD reveals that there is no sign of landfill gas migration from the landfill site towards the proposed temporary bus depot site. In this regard, the classification for the landfill gas source shall be "Low", with reference to the GN.

In view that the TKO Landfill Stage II/III is adjacent to the site of the proposed temporary bus depot, and no information on geology, hydrogeology or underground gas migration pathway was available, the worst case Pathway classification, "Moderately short/Direct", was assumed.

Since the site will be accessed by authorised, well trained personnel only and they will be briefed on the potential hazards relating to landfill gas and the specific safety procedures to be followed. In addition, only one storey high development will be built on the project site, no deep excavation or piling shall be required at the site. Therefore, the site is classified as "Medium Sensitivity".

With reference to the above classification, the landfill gas risk category of the site is classified as "Low". Construction and operation of the proposed temporary bus depot will be exposed to low risk of landfill gas hazard, some precautionary measures will be required to ensure that the planned development is safe.

In this regard, appropriate landfill gas control measures have been proposed for implementation at the site and additional precautionary measures to be followed by construction workers during construction stage of the bus depot and staff of the bus company during operational stage of the project were formulated. Furthermore, the operations of the depot does not require any confined location and the open air nature of the depot further reduce any chance of landfill hazard.

With sufficient and effective leachate control measures implemented at the TKO Stage II/III landfill, absent of deep excavation or piling at the site and the temporary nature of the project, no significant leachate impact from the landfill is anticipated.

3.2. Operational Phase

During operation phase of the project, buses will generally leave the proposed temporary bus depot early in the morning. After servicing hours, buses will return to the proposed temporary bus depot. Upon entering the proposed temporary bus depot, buses will line up for coil collection, refueling and bus washing, and get ready for service on the following day. The entire process can usually be completed within 5 minutes. The buses will then move to their designated parking space.

While entering the bus washing bay, the bus will be sprayed with recycled water. Formless shampoo will then be applied onto the bus, followed by cleaning with brushes mounted onto the washing systems.

Before leaving the bus washing bay, the bus will be rinsed.

The proposed temporary bus depot will be in operation on a 24 hour basis.

Within 2001, the maximum number of buses using the proposed temporary bus depot will be around 50, rising to around 90 by 2003. It should be noted that some buses come to the site for bus washing and coin collection only. They will leave the site and park at off site locations after being serviced.

3.2.1. Air Quality Impact

Vehicular emissions from buses leaving, entering and moving inside the proposed temporary bus depot shall be the major air quality from the project. However, with great setback distance from the planned sensitive receivers (about 100m from the planned residential development at TKO Area 86) and temporary nature of the project, the air quality impact shall not be significant and insurmountable.

3.2.2. Water Quality Impact

Wastewater generated from the operation of the proposed temporary bus depot, including bus washing, will be collected for re-use, the recycling rate of the bus washing system will be around 70%. An in-house treatment system with sedimentation facility, oil interceptors and grease traps will be provided to treat collected bus washing water. Although all water will be recycled for the bus washing, the treated water from the treatment system should still comply with the discharge limits as stipulated in the Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters under the Water Pollution Control Ordinance.

There will be no discharge from the bus washing system. The only water lost from the system will be the clean rinse water which remains on the vehicle as it leaves the bus washing area. This will gradually dry-off on the journey to the parking space and at the parking space.

Surface runoff will be collected by peripheral channels surrounding the site. Drainage will be treated by pretreatment facilities such as petrol interceptor and silt traps prior to disposal to public drainage system. Waste oil collected from the petrol interceptor will be regularly removed and properly stored up, handled and collected by registered chemical waste collector for disposal.

Sewage arising from the proposed temporary bus depot will be connected to public foul sewerage system. All discharges into the public sewer shall comply with the water quality standards for Junk Bay Water Control Zone as stipulated in the Water Pollution Control Ordinance.

3.2.3. Industrial Noise Impact

The major purpose of the proposed temporary bus depot is for bus refuelling, bus washing and parking. No major bus repair work will be carried out at the site. In addition, a large set back distance has been provided from the planned and existing noise sensitive receivers. Therefore, insurmountable industrial noise impact generated from the proposed temporary bus depot operations is not anticipated.

Should noisy operation be carried out at the site, sufficient noise mitigation measures, such as noise barrier, enclosure or silencer, shall be implemented. Noise criteria as stipulate under the Noise Control Ordinance will be meet.

3.2.4. Traffic Noise Impact

Traffic flow generated by the proposed temporary bus depot will be the major source of traffic noise. Buses leaving the depot in the morning and returning in the evening will generate off site traffic noise impact upon sensitive receivers. With the temporary nature of the proposed bus depot and long distance from existing and committed noise sensitive development in the area, traffic noise impact generated from the site shall be within acceptable level.

3.2.5. Landfill Gas Hazard

As presented in Section C.1.4., the qualitatively assessed landfill gas risk from the nearby TKO Landfill Stage II/III impacting upon at the site is Low.

3.2.6. Hazardous Installation

The two fuel tanks for storing diesel fuel will be installed in accordance with the requirements as stipulated by the Fire Services Department. The capacity of each tank is 22,500L. In compliance with the Dangerous Goods Ordinance, a license for the storage of the fuel at the site will be applied from the Fire Services Department prior to operation of the proposed temporary bus depot.

3.2.7. Land Contamination Impact

Since the proposed temporary bus depot will consist of two fuel storage tanks and a fuelling area for buses, it has a high potential of contaminating the ground due to mishandling of the petroleum fuel or leakage from the tanks.

3.2.8. Visual Impact

The proposed temporary bus depot will only comprises of single storey and low level development. Insignificant visual impact to the surrounding sensitive receiver is anticipated.

4. MAJOR ELEMENTS OF THE SURROUNDING ENVIRNMENT

Existing and planned land use in the vicinity of the proposed temporary bus depot are considered as sensitive receivers during construction and operational phase of the project. Affected elements of the surrounding environment due to this project can be classified into 3 types: the existing, planned sensitive receivers, and the existing and relevant past land use.

Currently, there are no residential development in the vicinity of the proposed temporary bus depot. The closest planned residential development is located about 100m away to the north west of the subject site - TKO Area 86, which is zoned as "Comprehensive Development Area" (CDA) according to the TKO Outline Zoning Plan No. S/TKO/6. Comprehensive developments including residential development, MTR depot and station, and other supporting community facilities are planned at the site. The scheduled population intake will start at early 2004.

The site to the west of the proposed bus depot, with less than 50m set-back distance is zoned as "Governmental, Institution or Community". Non-noise sensitive G/IC development will be built at this site and unlikely to be affected by the proposed temporary bus depot. A temporary bus depot currently located to the adjacent north of the subject site is neither noise nor air sensitive in nature.

Relative location of the above identified sensitive receivers and the proposed temporary bus depot and existing and proposed development in the vicinity are shown in Figure A-1.

5. ENVIRONMENTAL PROTECTION MEASURES

5.1. Construction Phase

5.1.1. Fugitive Dust Impact

The contractor of the project shall follow the requirement as stipulated in the Air Pollution Control (Construction Dust) Regulation and implement the necessary dust suppression measures to reduce the fugitive dust impact within the Air Quality Objectives at the sensitive receivers.

5.1.2. Water Quality Impact

Construction works shall be programmed to minimise soil excavation works in rainy seasons. A series of silt removal facilities shall be installed to settle siltation prior to discharge. Such facilities shall be properly designed in accordance with guidelines from the Civil Engineering Department to achieve the desired mitigating effect on the water quality. Typically, a detention time not less than 5 minutes for maximum design flow of inlet shall achieve adequate sediment removal. Channels or earth bunds or sand bag barriers shall be provided on site to properly direct surface runoff to such silt removal facilities. Sediment traps, channels and manholes shall be maintained and the deposited silt and grit shall be removed on regular basis.

Sewage generated from the construction workers shall be contained by chemical toilets before connection to public foul sewer can be completed. These toilets shall be provided at a minimum rate of about 1 per 50 workers. The facility shall be serviced and cleaned by specialist contractor at

regular intervals. To prevent spillage of fuel oils or other polluting fluids at source, it is recommended that all the stocks shall be stored inside proper containers and sited on sealed areas.

Other relevant ProPECC Note requirements will be complied with through good housekeeping practices at the construction site.

5.1.3. Noise Impacts

With the implementation of appropriate and sufficient noise mitigation measures, such as use of quieter construction machinery, use of noise barrier, or avoid carrying out several noisy operations at the same time, it is envisaged that the potential construction noise impact can be substantially minimised.

5.1.4. General Management

As a general guidance, the contractor shall maintain high standard of housekeeping to prevent emission of fugitive dust emission. Loading, unloading, handling and storage of building materials and debris shall be carried out in a manner so as to minimise the release of visible dust emission.

A high standard of housekeeping shall be maintained. Any piles of debris accumulated on or around the work areas shall be cleaned up regularly. Cleaning, repair and maintenance of all plant facilities within the work areas shall be carried out in a manner without generating fugitive dust emissions. The material shall be handled properly to prevent fugitive dust emission before cleaning.

5.1.5. Landfill Gas Hazard

Some safe working practices to reduce gas related hazards such as asphyxiation, fires and explosions have been drawn up and to be implemented by the contractor during the project construction phase, these are:

1. avoid unnecessary erection of enclosed storage containers/ sheds on site;
2. gas measurement is recommended for excavations in excess of 0.3m before any worker enter the excavation and periodically throughout the working day. It should be force ventilated to avoid the potential accumulation of LFG;
3. level of flammable gas should be checked at places where ventilation is poor;
4. adequate instructions and training shall be given to construction workers on site;
5. safety equipment and fire extinguishers should be available in serviceable condition;
6. entry into any space where there is a risk of asphyxiation should be prohibited unless the precautions detailed in the Health and Safety Executive Guidance Note GS5 entitled "Entry into Confined Spaces" have been followed under the supervision of a competent safety supervisor. In addition, equipment like respirators, rescue sets, safety harness and breathing apparatus are necessary;
7. stop all works and improve ventilation if gas is detected to be in excess of 1% v/v of methane or 1.5% v/v of carbon dioxide in areas with poor ventilation;
8. Welding, flame-cutting or other works should be conducted well away from excavations.

5.2. Operational Phase

5.2.1. Air Quality and Noise Impact

In order to avoid insurmountable air quality impact or noise nuisance generated from the proposed temporary bus depot affecting air and noise sensitive receivers in the vicinity, such as the planned residential development at TKO Area 96 and the G/IC development to the west of the subject site, the site shall be vacated prior to population intake at TKO Area 86 and presence of any other air or noise sensitive uses in the vicinity.

Hence, no significant air quality or noise impact is anticipated during the operational phase of the project.

5.2.2. Water Quality

As mentioned, all used water from the bus washing system will be collected and treated for recycling use. The bus washing system is designed such that no effluent will be generated and to be discharged into the public sewer. Other discharges into public sewer from the site will comply with the water quality standards for Junk Bay Water Control Zone as stipulated in the Water Pollution Control Ordinance.

Shelter will be provided at the refuelling area to avoid ingress of rainwater and minimising the petroleum loading of the rain runoff. Surface runoff will be collected by peripheral channels surrounding the site. Drainage will be treated by pretreatment facilities such as petrol interceptor and silt traps prior to disposal to public drainage system. Waste oil collected from the petrol interceptor will be regularly removed and properly stored up, handled and collected by registered chemical waste collector for disposal.

Sewage arising from the proposed temporary bus depot will be connected to public foul sewerage system. All discharges into the public sewer shall comply with the water quality standards for Junk Bay Water Control Zone as stipulated in the Water Pollution Control Ordinance.

5.2.3. Landfill Gas Hazard

Passive control on landfill gas at the site has been incorporated in the proposed temporary bus depot design. The entire site will be covered with concrete floor slab, which is an effective measure to prevent the upward migration of landfill gas to the site. As a general design guideline, no underground structure will be constructed to minimise possible landfill gas migration pathway. All offices, air compressor room, switch room, transformer room and stores will be constructed above ground, with a minimum hourly air change of 5 by mechanical ventilation will be provided.

The two fuel tanks at the site, coupled with the landfill gas issue, poses explosion risk to the development. High concentration of landfill gas will easily trigger spark or fire. To prevent landfill gas from entering the tank and causing explosion, the two fuel tanks will be constructed above ground, on top of the concrete floor slab. The tanks will be constructed with gas non-permeable material to avoid landfill gas from entering the tanks.

Free air circulation will be ensures at covered area in the site, such as covered parking spaces and covered refueling area. The sides of the area will remain open to provide through ventilation and eliminate accumulation of landfill gas.

Although landfill gas control measures have been adopted at the site, precaution measures shall still be undertaken by the staff of the proposed temporary bus depot. Such measures shall included the following:

1. all staff and personnel working at the proposed temporary bus depot should be notified of the potential landfill gas hazard;
2. smoking should be prohibited at the proposed temporary bus depot;
3. appropriate precautions should be employed by maintenance workers at all time;
4. clauses of the Factories and Industrial Undertakings (Confined Spaces) Regulations of the Factories and Industrial Undertakings Ordinance should be complied with.

5.2.4. Waste Management

Sludge generated from the water treatment system of the bus washing machine will be collected and disposed by registered contractor with a valid sludge disposal licence under the Waste

Disposal Ordinance.

5.2.5. Land Contamination Impact

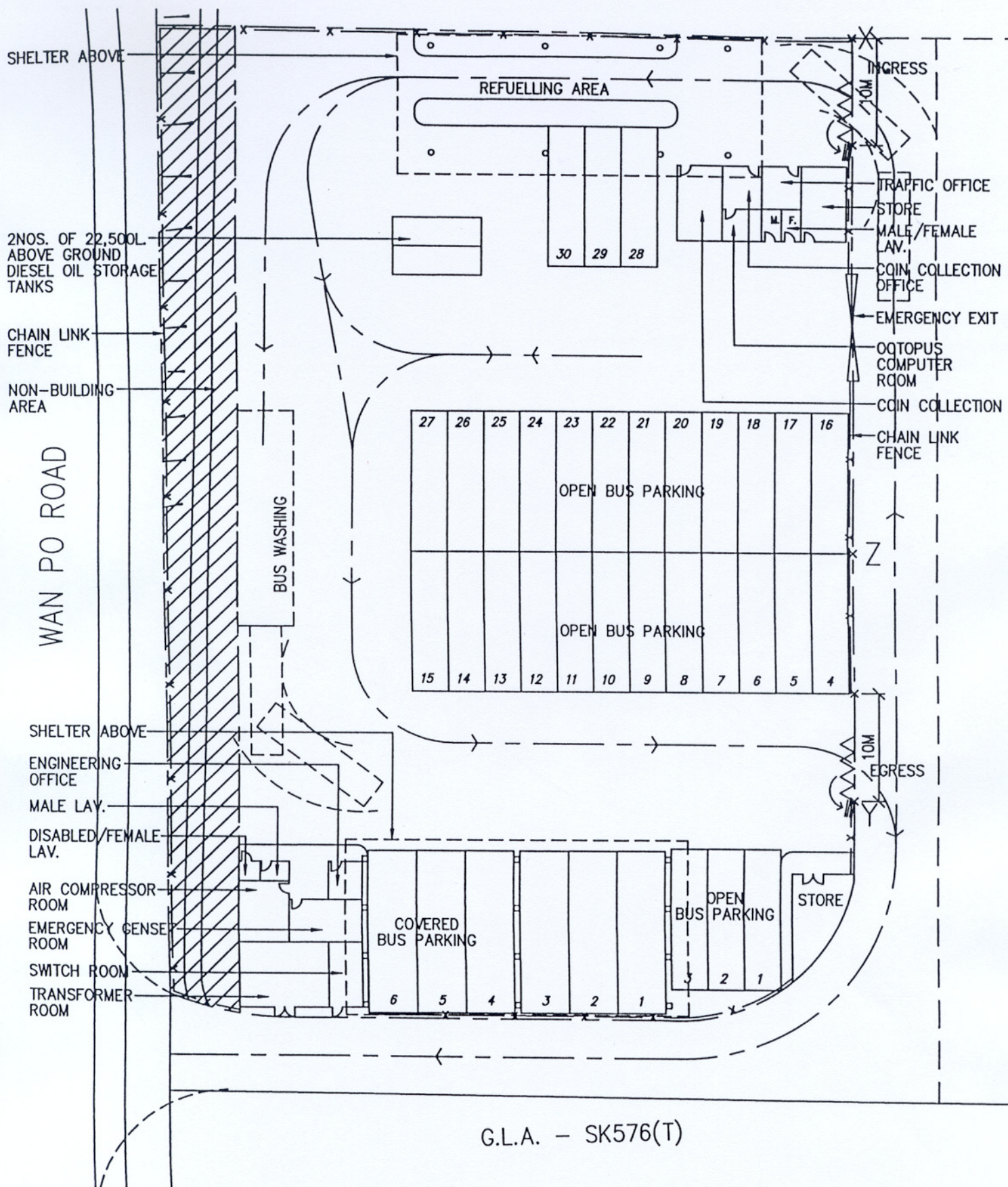
Apart from good housekeeping at the proposed temporary bus depot to minimise petroleum spillage and proper clean-up of spillages, a land contamination assessment will be conducted prior to returning the project site to the Land Department to identify if the construction and operation of the temporary bus depot had contaminated the site. The assessment will be conducted in accordance with EPD issued Practice Note for Professional Persons – Contaminated Land Assessment and Remediation (ProPECC PN 3/94) and Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards and Car Repair/Dismantling Workshops. All reports, including the Contamination Assessment Plan (CAP), Contamination Assessment Report (CAR) and Remediation Action Plan (RAP) where necessary, will be submitted to EPD for approval. If contamination is confirmed, the project proponent will follow the remediation proposal as contained in the approved RAP to clean up the site to the satisfaction of the Director of Environmental Protection.

6. USE OF PREVIOUSLY APPROVED EIA REPORTS

No previously approved EIA reports relevant to this project was used.

Appendix I

Layout Plan
of the
Proposed Temporary Bus Depot
in Tseung Kwan O Area 85



Appendix II

Landfill Gas Hazard Assessment for the Proposed Temporary Bus Depot at Tseung Kwan O Area 85

Proposed Temporary Bus Depot

at

Area 85, Tseung Kwan O

Landfill Gas Hazard Assessment

Client : New World First Bus Services Limited

Date : August 2000

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APPENDICES

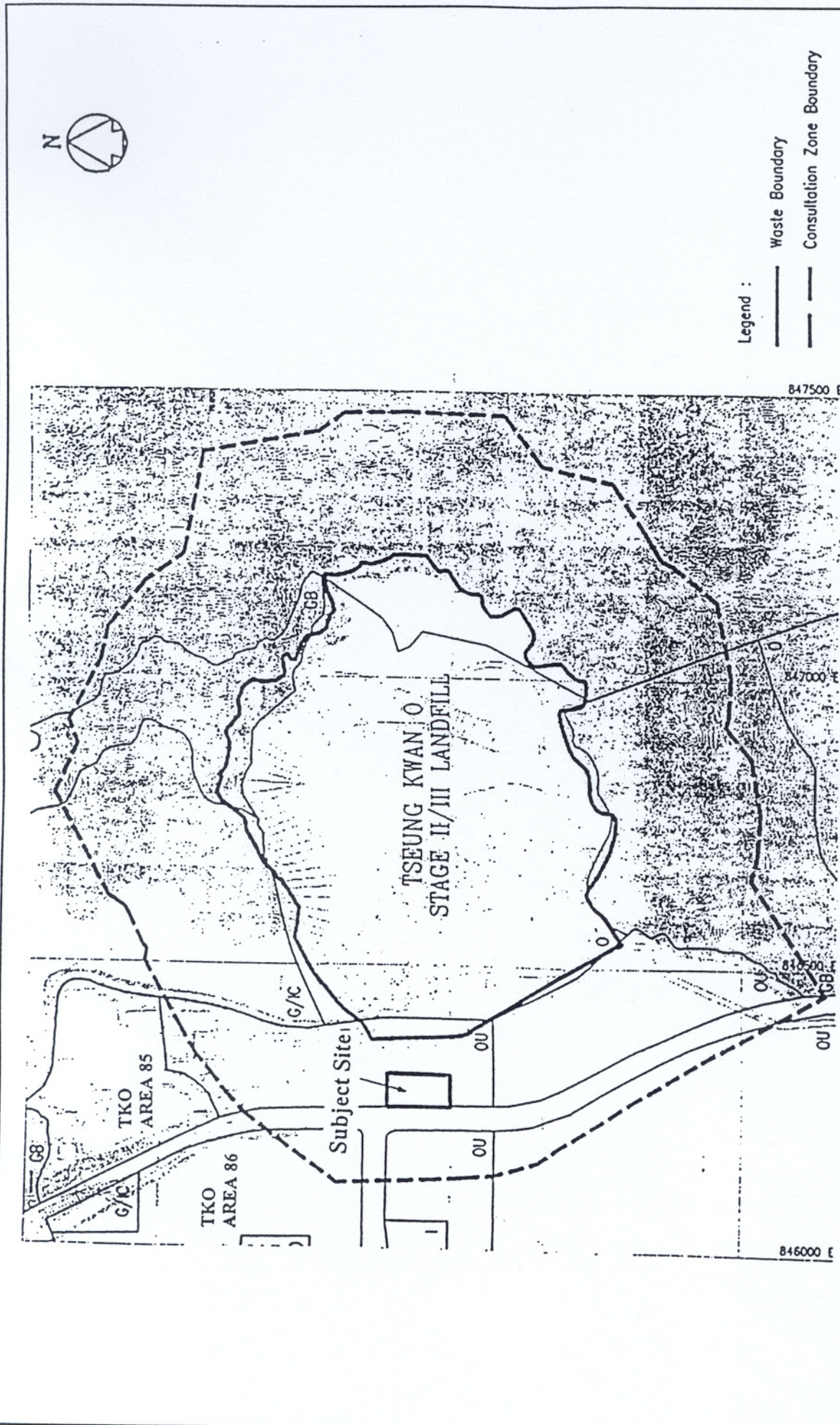
ANNEX I	LFG Monitoring Data Obtained at Various Drillholes by EPD near TKO Stage II/III landfill	
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1. BACKGROUND

A temporary bus depot is proposed at Area 85, Tseung Kwan O as shown in Figure 1-1. According to Part 1 Schedule 2 Section A.6(a) (Roads, railways and depot) of the Environmental Impact Assessment Ordinance (EIAO), as this proposed temporary bus depot located less than 200m from the nearest boundary of an existing or planned residential area, it is classified as a Designated Project. An Environmental Permit issued by the Director of Environmental Protection is required prior to the construction or operation of the subject temporary bus depot at TKO.

Since the subject site lies within the 250m consultation zone of the Tseung Kwan O Stage II/III Landfill (Figure 1-1 refers), this Landfill Gas Hazard Assessment report has been written to address the potential landfill gas hazard at the proposed temporary bus depot, which shall form part of the Project Profile submission for the project to facilitate application for approval to apply directly for Environmental Permit.

This Landfill Gas Hazard Assessment is prepared based on a source-pathway-target analysis to assess the overall risk to the future occupants in the development from landfill gas (LFG) migration generated by the landfill. The professional practice note Landfill Gas Hazard Assessment for Developments adjacent to Landfills (ProPECC PN 3/96) and Landfill Gas Hazard Assessment - Guidance Note, both published by EPD, have been used as references throughout the assessment.



Scale: NTS Figure: 1-1	Project: Proposed Temporary Bus Depot at Tseung Kwan O, Area 85
Title: Location of the Proposed Temporary Bus Depot at Area 85, Tseung Kwan O and Tseung Kwan O Stage II/III Landfill and the Associated Consultation	
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2. SCOPE OF THIS LANDFILL GAS HAZARD ASSESSMENT

The scope of this LFG hazard assessment includes the following:

- to review previous reports and updated LFG production and emission information related to the TKO Stage II/III Landfill;
- to identify the sources and nature of hazardous LFG emissions which may have potential to affect the proposed development;
- to identify the viable pathways through the ground, underground cavities, utilities or groundwater and the conditions of these pathways through which the hazardous emissions must pass if they are to reach the proposed development;
- to identify the elements (targets) of the proposed development which are sensitive to the hazardous emissions;
- to assess qualitatively the risk which the hazardous LFG emissions may pose to the target for each of the source-pathway-target combinations; and
- to propose the suitable type of protection measures to mitigate the identified hazards, if any, to an acceptable level.

3. THE DEVELOPMENT AND THE ENVIRONS

The locality of the site and how it is related to the TKO II/III Landfill is shown in Figure 1-1. Master layout plan of the development is shown in Figure 4-1.

The proposed temporary bus depot is bounded by Wan Po Road to the east. The Site occupies about 5583m². The adjacent site to the north is currently used as temporary bus depot. A Sewerage Treatment Works is located to the further north of the site. TKO landfill Stage II/III can be found to the east of the site.

The proposed temporary bus depot will comprises of the following facilities:

1. 6 number of covered bus parking spaces on concrete floor slab
2. 30 number of open bus parking spaces on concrete floor slab
3. 1 number of bus washing bay
4. an above ground mechanical and electrical plant room
5. two above ground fuel tanks
6. offices for traffic, revenue collection and engineering staff and Octopus system computer room

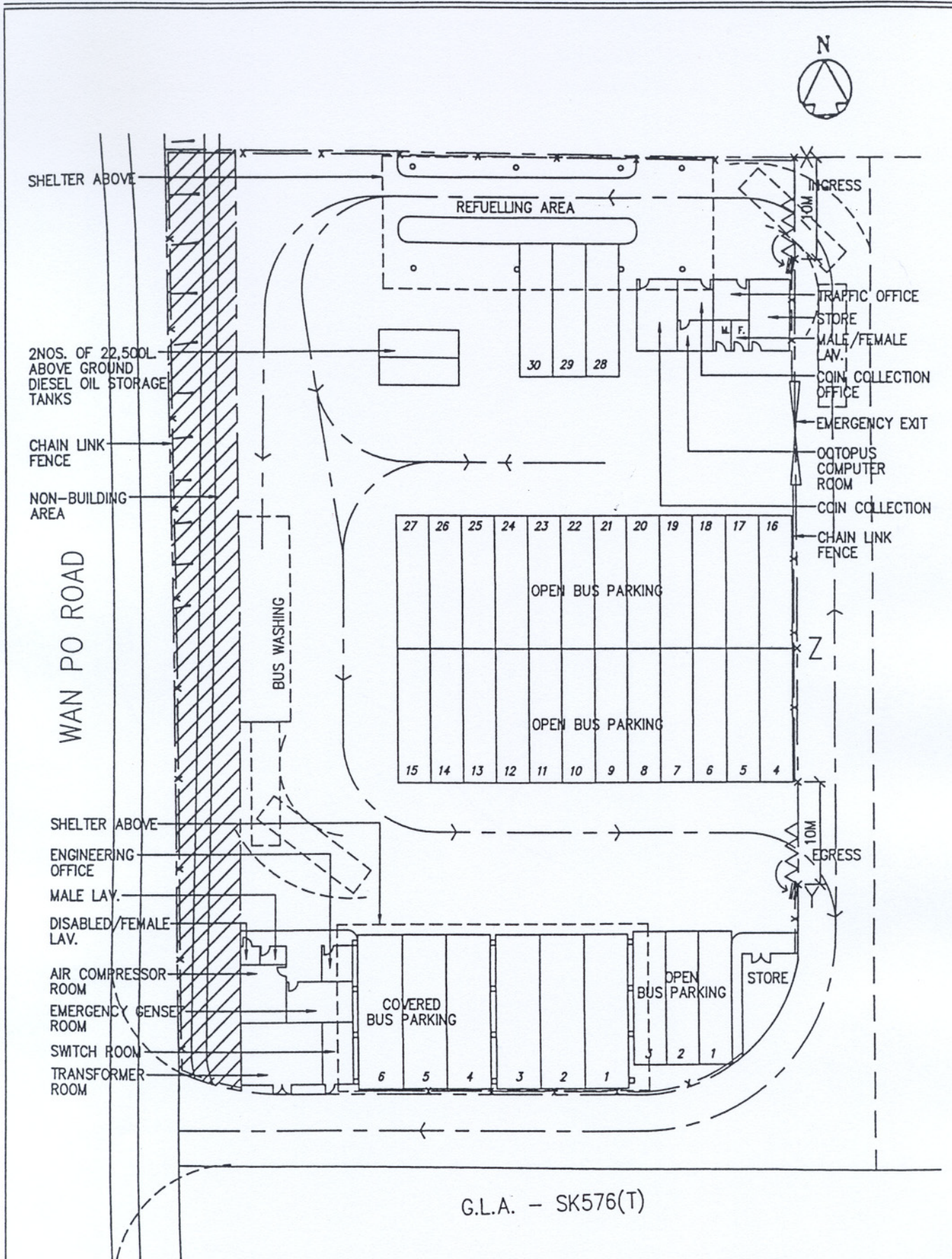
Majority of the site will be allocated for bus parking. Chain link fence will be erected along the site boundary for security purposes.

4. LEACHATE MIGRATION FROM THE LANDFILL

Wastes were being deposited above sea-level at TKO Stage II/III landfill and control measures were incorporated for leachate management, including partial lining and facilities for the collection and monitoring of leachate. Following the restoration with an impermeable cap covering the surface of the landfills, leachate generation rate and hence the leachate levels in the landfills is expected to fall significantly. The restoration works contract also requires the contractor to maintain the leachate levels in the landfills at or below certain compliance levels in specified boreholes, which are based on the leachate levels recorded in the landfills prior to restoration. An

existing leachate collection system by means of gravity flow is installed at the landfill. Leachate is collected by subsoil drain discharging into two large leachate sumps outside the waste mass. The leachate is then pumped into two buffer tanks for storage prior to treatment. Leachate collected from the TKO Stage II/ III landfill will be pre-treated and then discharged to the TKO Sewage Treatment Works in Area 85.

In addition to the leachate control measures at source, only single storey development will be built on the site, hence no deep excavation or piling will be required for the proposed temporary bus depot. In light of the temporary nature of the proposed bus depot, the leachate impact from the landfill shall be insignificant.



Title: Master Layout Plan of the Proposed Temporary Bus Depot

Project: Proposed Temporary Bus Depot at Tseung Kwan O, Area 85

Figure: 4-1

Scale: NTS



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5. THE SOURCE - TSEUNG KWAN O STAGE II/III LANDFILL

5.1. History of the TKO Stage II/III Landfill

The TKO Stage II/III landfill lies to the south-east of Area 86. The closest point between the boundary of the landfill and that of Area 86 is more than 200m. The landfill site has a total area of 42 hectares. It started to receive wastes since 1989 by infilling of the Tai Chik Sha Valley. More site preparation works were undertaken on TKO Stages II/III than that of the TKO Stage I landfill. Wastes were being deposited above sea-level and control measures were incorporated for leachate management, including partial lining and facilities for the collection and monitoring of leachate. The landfill received some 12.6 million cubic metres of waste prior to its closure in 1994.

5.2. Landfill Gas Generation

Microbial degradation of wastes within the landfills will continue with the generation of landfill gas for a long period of, say 30 years. Biodegradable matter in wastes can undergo two forms of decomposition i.e. aerobic and anaerobic degradation. Aerobic decomposition predominates during waste deposition and continues until there is insufficient free oxygen to sustain the process. The major decomposition products include water and carbon dioxide. Anaerobic decomposition of waste takes place in several stages, with the ultimate generation of methane (CH₄), carbon dioxide (CO) and water (H₂O).

Based on the Initial Environmental Assessment prepared for the Restoration of TKO Landfills (Scott Wilson Kirkpatrick, 1993)¹, the LFG generation rates peaked at 1988 at the Stage II/III landfill, with a generation rate of $120 \times 10^6 \text{ m}^3/\text{yr}$. Following the peak generation rates, a rapid decline in LFG generation is expected which is usually followed by an extended period of lower generation rates over time. The composition of landfill gas was found to consist of 50-60% methane, 30-40% carbon dioxide and minor constituents of nitrogen, oxygen and trace gases at TKO Stage II/III landfills.

With the capping of the TKO Stage II/III landfill, release of LFG from the surface of the landfill site would be prevented. The continuous generation of LFG from waste decomposition may as a result increase the pressure within the waste mass and hence the likelihood of off-site gas migration. The build-up of gas pressure within the waste is relieved by the provision of LFG extraction and flaring system.

Landfill gas could be transported in leachate or may be generated from the anaerobic degradation of organic compounds in the leachate. Such release will be controlled by the incorporation of the leachate collection system into the restoration work design.

5.3. Restoration of the TKO Stage II/III Landfill

A comprehensive restoration programme has been initiated by Environmental Protection Department to restore the 13 old landfills in the territory. TKO landfills are included in the list which the advance works began in late 1994.

EPD has commissioned Swire SITA Waste Services Ltd. in August 1997 to undertake a "Design, Build, and Operation" (DBO) contract for the restoration works of the TKO Stage II/III landfill. Construction of the restoration works has completed by the end of 1998.

Active landfill gas management system will be installed and operated at the TKO Stage II/III landfill which aims at :

¹ Restoration of Tseung Kwan O Landfills - Initial Environmental Assessment, Scott Wilson Kirkpatrick in association with Aspinall & Company, 1993.

- ◇ relieving build-up pressure of landfill gas in buried waste;
- ◇ preventing lateral migration of landfill gas off-site;

Various control measures for landfill gas migration has been implemented with regard to the restoration of the TKO Stage II/III Landfill. These measures include the following :

Primary Control - On-site landfill gas extraction

- ◇ Vertical gas extraction wells, typically spaced at 70m to 90m, and the associated pipework and pumping station will be constructed. The extracted LFG will be conveyed to a extraction main leading to an extraction plant compound where it will be flared.

Secondary control - Perimeter migration control

- ◇ Perimeter ring main capable of isolation;
- ◇ Vertical wells at about 50m spacing on landward boundary;
- ◇ Active horizontal gas extraction trench on seaward boundary, within waste;

Tertiary Control - LFG and Groundwater Monitoring

An environmental monitoring and audit programme is currently being implemented by the restoration contractor which include the installation and monitoring of LFG and groundwater at monitoring wells installed across the landfills and in off-site wells. It is understood that this EM&A programme will continue throughout the duration of the restoration and aftercare works (for a period of up to 30 years) in order to demonstrate that the contractors' designs and control measures installed can meet the Contract Requirements.

Active LFG management systems has be installed and operated at the Stage II/III landfill. Subsequent to the successful implementation of the restoration works by the contractor, it is anticipated that methane and carbon dioxide concentrations as measured at the boundary of the landfills shall fall below 1% v/v and 1.5% v/v respectively, in accordance with the Landfill Gas Hazard Assessment Guidance Note.

5.4. Landfill Gas Monitoring Data and LFG Migration Potential

EPD have installed numerous drillholes in the vicinity of the Stage II/III landfill before the commencement of the restoration works. LFG monitoring was conducted prior to the commencement of the restoration programme, during the restoration and after the completion of the restoration works. These data gives information on the historical risk level from LFG migration on the landuses in the vicinity of the landfills. Annex I presents latest gas monitoring data obtained for the period January 1999 to January 2000, which was taken after completion of the restoration.

The monitoring records indicated that upon completion of the restoration works, insignificant methane has been detected at selected drillholes. Considering that the methane generation from the landfill will subside significantly after the restoration, and from the evidence of generally undetectable methane level at the drillholes, it can be concluded that landfill gas migration in the direction towards the bus depot site is not anticipated, or at least not anticipated to be significant. Landfill gas hazard impact upon the proposed temporary bus depot is therefore highly reduced.

6. HAZARD FROM LANDFILL GAS MIGRATION

Typical LFG, with a majority of methane and carbon dioxide, may have the potential to cause asphyxiation, fire or explosion. The following properties of the LFG components are particularly of concern :

- ◇ Methane or hydrogen may explode or cause fire under ignition when they mixed with air within certain concentrations limits, commonly referred to as the "Lower Explosive Limit" (LEL) and "Upper Explosive Limit" (UEL). The explosive ranges of methane and hydrogen are 5 to 15 and 4 to 74% by volume, respectively. In addition, both methane and hydrogen are simple asphyxiants, i.e. at high concentrations they can reduce the oxygen content in the air to such an extent that life cannot be supported.
- ◇ Another major component of LFG, CO₂ is also asphyxiating,. The 15-minute short-term and 8-hour time-weighted average Occupational Exposure Limits (OEL) of CO₂, as published by the Labour Department are 30,000 and 5,000 ppm, respectively.
- ◇ The density of LFG depend on the proportion of components that are present. A mixture of 60% methane and 40% carbon dioxide will be slightly lighter than air, while a mixture of 10% hydrogen and 90% carbon dioxide (typically evolved in the early stages of anaerobic degradation) will be denser than air. The density of the gas mixture relative to air has implication in terms of the potential hazard to the sensitive targets at where these gases exit.

LFG can present a number of potential hazards as it migrates into and accumulates in confined spaces during excavation and foundation works, basement construction and maintenance of drains or other underground services. Other susceptible locations include site huts, basements and similar poorly ventilated enclosures that exist during construction and those eventually in completed development.

7. QUALITATIVE LANDFILL GAS RISK ASSESSMENT

7.1. Classification of Source

Landfill gas emission from TKO Stage II/III landfill is classified as "Minor" noting the following criteria:

- Restoration work has been completed successfully at the TKO Stage II/III landfill.
- Active gas extraction, perimeter migration control measures (including perimeter ring, vertical wells, passive gas vent trench) has been implemented at the landfill. Hence, both active and passive gas control measures have been adopted.
- Landfill gas monitoring programme is currently being undertaken by the restoration contractor and will continue for at least 30 years after the restoration.
- Recent landfill gas monitoring data taken at the western boundary of the TKO Stage II/III landfill reveals insignificant landfill gas migration beyond the landfill boundary in the western direction, towards the subject site.

7.2. LFG Migration Pathways

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

There are several types of pathways identified for the present case:

Utilities

There is no existing utilities at the site that will be re-used.

Planned utilities, as listed below will run longitudinally across at sub-surface level and enter the building from underground and are hence likely to contribute as landfill gas migration pathway.

- ◇ Water pipes
- ◇ Sewage pipes
- ◇ Drainage pipes
- ◇ Telephone cables

There is however no direct connection of these utilities from the site to TKO Stage II/III landfill site. They are primarily associated with the utility entries from Wan Po Road, hence can only form a secondary pathway for gas migration into the development via loose packed infill materials or possible open void conduits.

Intervening Soil

Since the entire site is reclaimed from the sea, the fill materials will form a primary pathway for LFG migration. Due to the close proximity of the site from the sea, the layer of unsaturated soil from ground level down to the water table will form a primary pathway for off-site migration of LFG.

8. SENSITIVE TARGETS OF THE DEVELOPMENT

The proposed development will rest on concrete floor slab, which will be in direct contact with the soil. Accumulation of LFG in the voids built on top of the concrete floor slab may happen due to diffusion of LFG through minor cracks and the annular openings on the slab allowed for service ducts and manholes. This would be undesirable although the gas can be easily get dissipated once it has reached the above ground level.

Sensitive targets are therefore places where natural ventilation are less effective with walls and floors in contact with the soil, especially the enclosed rooms for transformer, electric switches and M/E installations where there are potential ignition sources.

During the construction stage of the project, the site will be opened and no enclosed or confined area will be constructed. Hence, no sensitive target can be identified during the construction stage.

Upon completion of the construction, covered parking and fuelling area will only be covered at the top and all sides of the area will remain open to allow maximum natural ventilation and shall not be a major problem. No enclosed or confined area will be included in the proposed temporary bus depot. Mechanical rooms and transformer room at the site will not be fully enclosed and sufficient fresh air will be provided through the doors or by mechanical ventilation for dilution of landfill gas, if there is any.

Sensitive targets of the proposed development are divided into the following categories according to their sensitivity:

Sensitive targets with potential risk of fire and explosion due to presence of ignition source:

- T1. Mechanical room on ground
- T2. Transformer room on ground
- T3. Two fuel storage tanks on ground

Sensitive targets with potential risk of asphyxiation:

- T1. Offices for traffic, revenue collection and engineering staff and Octopus system computer room

The bus depot will only be accessed by authorised staff of the bus company or staff of the utility companies, no public access is anticipated. In this regard, the site is classified as "Medium Sensitivity".

9. SOURCE-PATHWAY-TARGET ANALYSIS

9.1. Methodology

The risk which the hazardous source emissions may pose to the target for each of the source-pathway-target combinations will be qualitatively assessed in accordance to the "Landfill Gas Hazard Assessment - Guidance Note" (the Guidance Note) issued by the Environmental Protection Department.

From the assessment results, the suitable type of gas protection measures to mitigate the identified hazards has been proposed.

The qualitative source - pathway - target approach is outlined below:

Table 9-1 Source- pathway- target Analysis

Source	Pathway	Target	Assessment of Risk
<p>S1. TKO Stages II/III Landfill</p> <p>The landfill commenced to receive waste in 1989 by infilling of the Tai Chik Sha Valley. The peak landfill gas generation rates were identified to be 205 to 250 x 10⁶ m³/yr. Recently obtained gas monitoring data in general show low level of landfill gas migration after the completion of the restoration programme.</p> <p>(Minor source)</p>	<p>P1. Utilities</p> <p>All utilities will enter the development from the western site boundary, away from the TKO landfill site.</p> <p>(Moderately short/ direct pathway)</p> <p>P2. Intervening Soil</p> <p>The subject site is about 50m from the west side of the landfill.</p> <p>Successful restoration of the landfill has been completed, which include landfill gas control measures such as active landfill gas extraction and impermeable boundary barrier.</p> <p>(Moderately short/ direct pathway)</p>	<p>T1. Mechanical room on ground</p> <p>T2. Transformer room on ground</p> <p>T3. Two fuel storage tanks on ground</p> <p>T4. Offices for traffic, revenue collection and engineering staff and Octopus system computer room</p> <p>Identified sensitive targets are built in contact with ground and accessed only by authorised, well trained personnel.</p> <p>(Medium sensitivity)</p>	<p>Low</p>

9.2. Results

The risk classification, as recommended in the Guidance Note, for a **Minor source, Moderately Short/Direct pathway**, and **Medium sensitivity target** will result in a **Low risk category**, which falls into Risk Category D. For Risk Category D, "Some precautionary measures will be required to ensure that the planned development is safe" as stated in the Guidance Note.

10. RECOMMENDATIONS AND MITIGATION MEASURES

Although the qualitative risk assessment has identified that the risk associated with the landfill is low, measures to safeguard the construction workers and users of the proposed bus depot is still recommended.

10.1. At Identified Sensitive Targets

The following were found to be beneficial for mitigating landfill gas within selective sensitive targets and will be implemented at the site:

- The two fuel storage tanks to be installed at the site will be constructed above ground and will be made of impermeable, leak prove material, which will prevent landfill gas from getting into the tank and accumulate inside
- A minimum hourly air change rate of 5 will be provided to all indoor area, including the mechanical room (T1), transformer room (T2) and offices for traffic, revenue collection and engineering staff and Octopus system computer room (T4) by mechanical ventilation
- All sensitive targets will be constructed on concrete floor slab with minimum thickness of 0.5m

10.2. Precautionary Measures During Construction Phase

Some safe working practices to reduce gas related hazards such as asphyxiation, fires and explosions have been drawn up and to be implemented by the contractor during the project construction phase, these are :

1. avoid unnecessary erection of enclosed storage containers/ sheds on site;
2. gas measurement is recommended for excavations in excess of 0.3m before any worker enter the excavation and periodically throughout the working day. It should be force ventilated to avoid the potential accumulation of LFG;
3. level of flammable gas should be checked at places where ventilation is poor;
4. adequate instructions and training shall be given to construction workers on site;
5. safety equipment and fire extinguishers should be available in serviceable condition;
6. entry into any space where there is a risk of asphyxiation should be prohibited unless the precautions detailed in the Health and Safety Executive Guidance Note GS5 entitled "Entry into Confined Spaces" have been followed under the supervision of a competent safety supervisor. In addition, equipment like respirators, rescue sets, safety harness and breathing apparatus are necessary;
7. stop all works and improve ventilation if gas is detected to be in excess of 1% v/v of methane or 1.5% v/v of carbon dioxide in areas with poor ventilation;
8. Welding, flame-cutting or other works should be conducted well away from excavations.

10.3. Precautionary Measures During Operational Phase

Although landfill gas control measures have been adopted at the site, precaution measures shall still be undertaken by the staff of the proposed temporary bus depot. Such measures shall included

the following:

1. all staff and personnel working at the proposed temporary bus depot should be notified of the potential landfill gas hazard;
2. smoking should be prohibited at the proposed temporary bus depot;
3. appropriate precautions should be employed by maintenance workers at all time;
4. clauses of the Factories and Industrial Undertakings (Confined Spaces) Regulations of the Factories and Industrial Undertakings Ordinance should be complied with.

11. CONCLUSION

The proximity of the subject sites to the Tseung Kwan O landfill Stage II/III has necessitated this qualitative risk assessment to investigate into the likelihood of LFG migration which may lead to possible hazards of fire, explosion and asphyxiation. The subject site lies within the consultation zone (CZ) of the landfill.

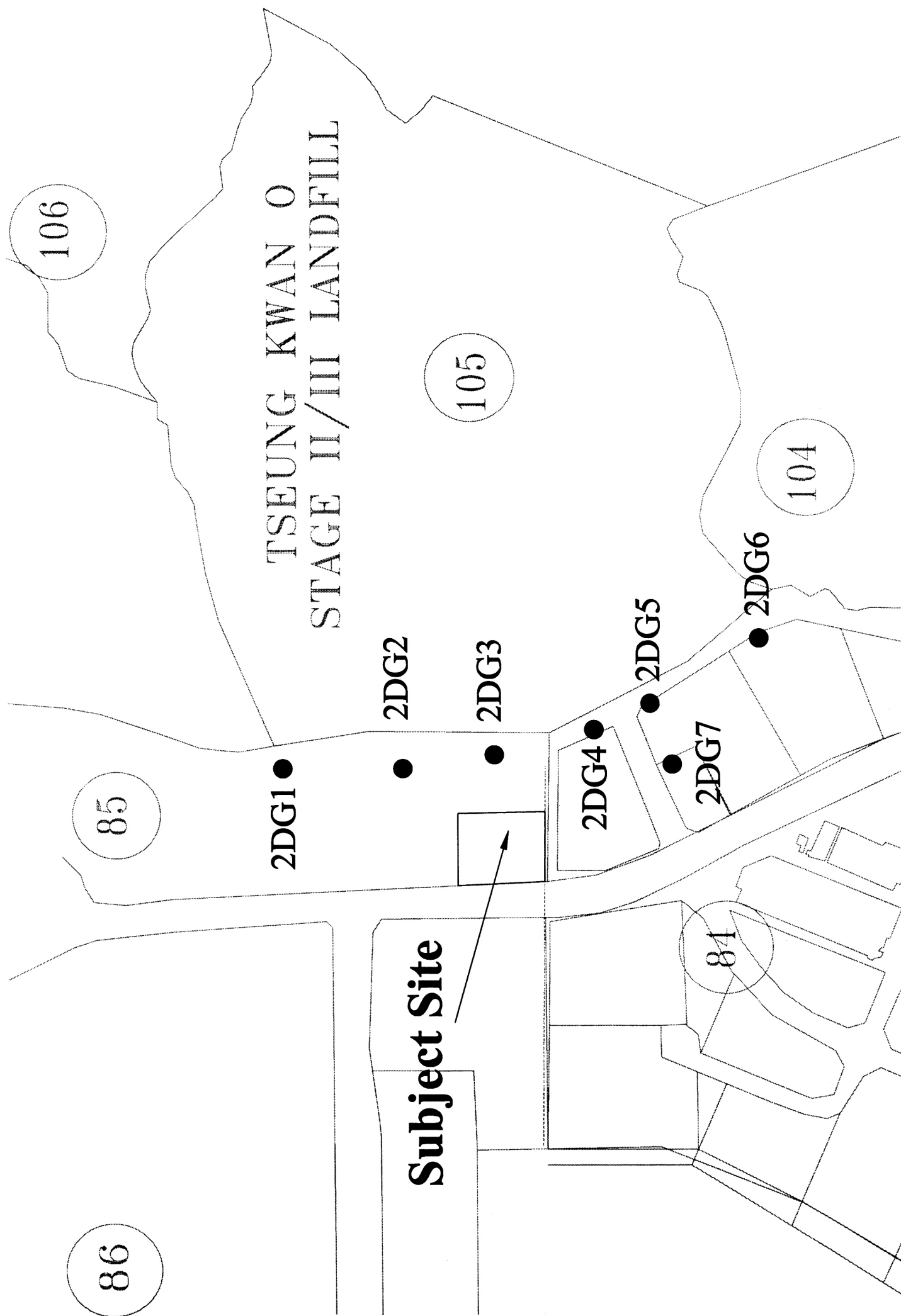
With sufficient and effective leachate control measures implemented at the TKO Stage II/III landfill, absent of deep excavation or piling at the site and the temporary nature of the project, no significant leachate impact from the landfill is anticipated.

A source - pathway - target analysis in accordance with the Landfill Gas Hazard Assessment Guidance Note issued by EPD was conducted. This assessment concluded that the landfill gas hazard at the proposed temporary bus depot is low. Some precautionary measures shall be required to ensure that the planned development is safe. In this regard, appropriate landfill gas control measures have been proposed for implementation at the site and additional precautionary measures to be followed by construction workers during construction stage of the bus depot and staff of the bus company during operational stage of the project were formulated. Furthermore, the operations of the depot does not require any confined location and the open air nature of the depot further reduce any chance of landfill hazard.

In conclusion, with the predicted low landfill gas hazard at the site and implementation of the proposed mitigation measures, future user of the bus depot is not anticipated to be exposed to unacceptable level of landfill gas hazard.

ANNEX I

LFG Monitoring Data Obtained at Various Drillholes by EPD near TKO Stage II/III landfill



Landfill Gas Monitoring Record at Tseung Kwan O Stage II/III Landfill

Location	Date of Sample	Time		CO ₂ (%)	Methane (%)	O ₂ (%)	Pressure (mbar)	Temp. (°C)	Remarks	Laboratory result					
		From	To							Methane, %	CO ₂ , %	H ₂ , %	N ₂ , %	O ₂ , %	
2DG1	11-Nov-98	12:10	12:15	3.1	0.0	17.1	3.0	25.0		<0.25	<0.31	1.5	<0.13	74	21
	26-Nov-98	11:50	11:55	4.2	0.0	15.4	2.0	27.4							
	14-Dec-98	14:05	14:10	1.9	0.0	18.5	0.0	21.8							
	12-Jan-99	11:10	11:15	3.8	0.0	15.4	1.0	27.4							
	20-Apr-99	10:40	10:45	0.6	0.0	19.5	2.0	25.4							
	24-May-99	14:52	14:57	1.0	0.5	19.5	1.0	33.9							
	10-Jun-99	10:35	10:40	0.1	0.5	20.5	0.0	31.5							
	12-Jul-99	12:08	12:13	0.1	0.5	20.2	0.0	34.5							
2DG2	23-Sep-99	15:23	15:28	2.9	0.5	17.3	0.0	35.0							
	25-Oct-99	14:10	14:15	0.0	0.5	19.3	0.0	31.4							
	21-Dec-99	09:54	09:59	1.4	0.5	18.9	-1.0	14.9							
	6-Jan-00	14:26	14:31	0.1	0.5	20.0	0.0	28.9							
	31-Aug-98	17:42	17:47	11.2	0.0	2.3	4.0	34.2		<0.25	<0.31	4.8	<0.12	86	7.3
	10-Sep-98	14:52	14:57	12.8	0.0	3.6	1.0	32.6							
	23-Sep-98	14:52	14:57	11.8	0.0	1.7	4.0	34.8	Blocked by Concrete						
	14-Oct-98	-	-	-	-	-	-								
	30-Oct-98	11:55	12:00	12.3	0.0	4.5	3.0	27.5							
	11-Nov-98	11:50	11:55	11.7	0.0	5.4	3.0	29.4		<0.25	<0.31	5.4	<0.13	72	12
	26-Nov-98	12:00	12:05	9.6	0.0	7.4	3.0	26.6							
	14-Dec-98	12:40	12:45	12.3	0.0	3.5	0.0	21.4							
	26-Feb-99	14:10	14:15	11.4	0.1	7.1	1.0	28.5							
	12-Aug-99	10:30	10:35	12.9	0.0	5.0	0.0	28.3		<0.25	<0.31	10	<0.13	84	7.4
	16-Nov-99	09:51	09:56	10.3	0.0	8.4	6.0	25.2		<0.000016	<2.0	29	<0.13	54	10
	1-Feb-00	14:24	14:29	8.8	0.0	8.2	0.0	14.6		0.00031	2.3	21	<0.13	60	9.8
2DG3	20-Apr-99	10:26	10:31	3.5	0.0	7.6	1.0	25.0							
	21-May-99	10:28	10:33	0.3	0.0	1.0	1.0	25.2							
	25-May-99									<0.25	<0.31	1.3	<0.13	85	2.8
	10-Jun-99	10:25	10:30	0.2	0.1	0.3	0.0	29.1							
	12-Jul-99	11:56	12:01	0.3	0.0	0.3	1.0	31.3							
	12-Aug-99	10:45	10:50	0.1	0.0	0.3	0.0	28.3							
	23-Sep-99	15:10	15:15	0.1	0.0	2.3	0.0	30.1							
	25-Oct-99	14:19	14:24	1.1	0.4	0.0	2.0	29.1							
	16-Nov-99	11:05	11:10	3.9	0.1	0.5	7.0	26.6		<0.000016	<2.0	37	<0.13	50	14
	7-Dec-99	14:23	14:28	1.4	0.0	17.9	0.0	23.7							
	6-Jan-00	14:52	14:57	4.5	0.4	0.0	1.0	27.4							
	1-Feb-00	14:32	14:37	0.2	0.0	19.8	0.0	16.9							
2DG4	30-Oct-98	12:05	12:10	5.9	0.0	12.7	3.0	33.1							
	11-Nov-98	12:22	12:27	5.2	0.0	13.1	4.0	33.9		<0.25	<0.31	<0.06	<0.13	71	22
	26-Nov-98	14:10	14:15	4.2	0.0	14.6	3.0	30.2							
	14-Dec-98	14:13	14:18	10.0	0.0	5.5	0.0	21.9							
	12-Jan-99	11:25	11:30	5.2	0.0	13.6	2.0	28.0							
	20-Apr-99	10:50	10:55	0.9	0.0	19.1	2.0	25.8							
	10-Jun-99	10:44	10:49	0.3	0.0	20.0	1.0	32.4	Valve did not fit to the joint						

Landfill Gas Monitoring Record at Tseung Kwan O Stage II/III Landfill

Location	Date of Sample	Time		CO ₂ (%)	Methane (%)	O ₂ (%)	Pressure (mbar)	Temp. (°C)	Remarks	Laboratory result					
		From	To							Methane, %	CO ₁ %	CO ₂ %	H ₂ %	N ₂ %	O ₂ %
2DG5	12-Jul-99	12:29	12:34	0.4	0.0	19.7	0.0	-							
	23-Sep-99	15:34	15:39	1.0	0.0	18.7	0.0	34.8							
	25-Oct-99	14:27	14:32	0.9	0.0	19.2	2.0	31.4							
	7-Dec-99	14:29	14:34	1.5	0.0	18.2	0.0	23.4							
	6-Jan-00	15:02	15:07	0.9	0.0	19.1	1.0	30.2							
	23-Sep-98	14:00	14:05	0.0	0.0	20.1	2.0	33.3							
	14-Oct-98	15:26	15:31	0.0	0.0	19.6	6.0	34.9							
	30-Oct-98	12:20	12:25	0.0	0.0	20.4	4.0	29.3							
	11-Nov-98	14:30	14:35	0.1	0.0	19.8	2.0	29.0							
	26-Nov-98	14:18	14:23	0.0	0.0	20.3	2.0	25.4							
2DG6	14-Dec-98	14:28	14:33	0.8	0.0	16.9	0.0	17.1							
	12-Jan-99	11:34	11:39	0.0	0.0	20.5	0.0	24.3							
	26-Feb-99	14:20	14:25	0.3	0.1	19.1	3.0	29.6							
	21-May-99	10:40	10:45	0.3	0.0	20.2	1.0	25.8							
	12-Aug-99	10:57	11:02	0.2	0.0	19.1	0.0	29.3							
	16-Nov-99	11:18	11:23	0.3	0.0	19.7	6.0	26.8							
	1-Feb-00	14:40	14:45	0.3	0.0	19.7	0.0	16.3							
	14-Oct-98	15:11	15:16	0.0	0.0	19.6	6.0	34.3							
	30-Oct-98	12:30	12:35	0.0	0.0	20.4	3.0	29.6							
	11-Nov-98	12:20	12:25	0.1	0.0	19.9	2.0	24.8							
2DG7	26-Nov-98	14:30	14:35	0.0	0.0	20.4	1.0	25.8							
	14-Dec-98	14:33	14:38	0.1	0.0	19.8	0.0	21.6							
	20-Apr-99	10:58	11:03	0.3	0.0	0.7	3.0	26.2							
	10-Jun-99	10:52	10:57	0.3	0.0	19.7	1.0	-							
	12-Jul-99	12:36	12:41	0.7	0.0	17.7	0.0	-							
	23-Sep-99	15:40	15:45	0.2	0.0	20.1	0.0	37.6							
	25-Oct-99	14:35	14:40	0.0	0.0	20.5	2.0	33.3							
	7-Dec-99	14:47	14:52	0.3	0.0	19.9	1.0	25.3							
	6-Jan-00	15:09	15:14	0.3	0.0	19.2	2.0	30.8							
	23-Sep-98	14:10	14:15	0.0	0.0	20.3	2.0	36.2							
2DG8	14-Oct-98	14:42	14:47	3.2	0.0	14.3	5.0	36.4							
	30-Oct-98	12:40	12:45	1.8	0.0	16.7	4.0	29.7							
	11-Nov-98	14:46	14:51	3.0	0.0	16.8	2.0	28.4							
	26-Nov-98	14:46	14:51	0.0	0.0	20.4	1.0	25.6							
	14-Dec-98	14:42	14:47	1.9	0.0	16.8	0.0	22.8							
	26-Feb-99	14:29	14:34	1.5	2.0	17.3	4.0	28.8							
	21-May-99	10:46	10:51	2.9	0.0	14.6	2.0	26.5							
	25-May-99														
	12-Aug-99	11:07	11:12	3.2	0.0	13.4	0.0	28.7							
	16-Nov-99	11:46	11:51	3.6	0.0	16.3	5.0	26.3							
2DG9	1-Feb-00	14:40	14:45	2.1	0.0	17.0	1.0	15.6							