EIA REPORT

HGH Limited

Proposed Karting Track in D.D. 134, Lung Kwu Sheung Tan, Tuen Mun: *Environmental Impact Assessment Report*

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HGH Limited

Proposed Karting Track in D.D. 134, Lung Kwu Sheung Tan, Tuen Mun: *Environmental Impact Assessment Report*

2nd December 2005

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For and on behalf of Environmental Resources Management	
Approved by:	Freeman Cheung
Signed:	
Position:	Executive Director
Date:	2nd December 2005

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1 INTRODUCTION

1.1 INTRODUCTION

This Environmental Impact Assessment (EIA) Report addresses the potential environmental impacts associated with the construction and operation of a project entitled "Proposed Karting Track in DD 134, Lung Kwu Sheung Tan, Tuen Mun" (hereinafter referred to as the Project).

The Project is classified as a Designated Project by virtue of Item O.4 of Part I of Schedule 2 (ie a motor racing circuit) under the *Environmental Impact Assessment Ordinance (Cap. 499) (EIAO).*

This report has been prepared by ERM-Hong Kong, Limited (ERM) in accordance with the *EIA Study Brief* (No. ESB-135/2005) and the *Technical Memorandum of the Environmental Impact Assessment Process* (*EIAO-TM*). The Study Area for the Project is presented in *Figure 1.1*.

1.2 BACKGROUND

Currently, there is no outdoor karting track in Hong Kong that meet international standard for kart racing. The project proponent, HGH Limited, is proposed to develop an outdoor karting track at Lung Kwu Tan, Tuen Mun. The design of the karting track will meet international standard for kart racing and safety standard, and will only serve members of the Hong Kong Kart Club for sporting purposes.

The karting track will be managed by the Project Proponent and oversee by the Hong Kong Kart Club (HKKC). HKKC is a member of the Sports Federation and Olympic Committee of Hong Kong, China, as well as one of the sporting organizations under the subvention of the Leisure and Cultural Services Department.

1.3 PURPOSE AND OBJECTIVES OF THIS EIA REPORT

The purpose of the EIA is to provide information on the nature and extent of environmental impacts arising from the construction and operation of the Project and related activities that take place concurrently, to contribute to decisions on:

- The overall acceptability of any adverse environmental consequences that are likely to arise as a result of the Project;
- The conditions and requirements for the detailed design, construction and operation of the Project to mitigate against adverse environmental consequences wherever practicable; and

- The acceptability of residual impacts after the proposed mitigation measures are implemented.

The detailed requirements of the EIA Study are set out in the *EIA Study Brief*. The objectives of the EIA Study are:

i. To describe the Project and associated works together with the requirements for carrying out the Project;

ii. To identify and describe elements of community and environment likely to be affected by the Project and / or likely to cause adverse impacts to the Project, including natural and man-made environment and the associated environmental constraints;

iii. To provide information on the consideration of alternatives to avoid and minimize potential environmental impacts to environmentally sensitive areas and other sensitive uses; to compare the environmental benefits and dis-benefits of each of different options; to provide reasons for selecting the preferred option(s) and to describe the part environmental factors played in the selection of preferred option(s);

iv. To identify and quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;

v. To identify and quantify any potential landscape and visual impacts and to propose measures to mitigate these impacts;

vi. To propose provision of mitigation measures so as to minimize pollution, environmental disturbance & nuisance during construction & operation of Project;

vii. To investigate the feasibility, practicability, effectiveness and implications of the proposed mitigation measures;

viii. To identify, predict and evaluate the residual environmental impacts (i.e. after practicable mitigation) and the cumulative effects expected to arise during the construction and operation phases of the Project in relation to the sensitive receivers and potential affected uses;

ix. To identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the Project which are necessary to mitigate these environmental impacts and cumulative effects and reduce them to acceptable levels;

x. To investigate the extent of the secondary environmental impacts that may arise from the proposed mitigation measures and to identify constraints associated with the mitigation measures recommended in the EIA study, as well as the provision of any necessary modification; and

xi. To design and specify environmental monitoring and audit requirements to ensure the effective implementation of the recommended

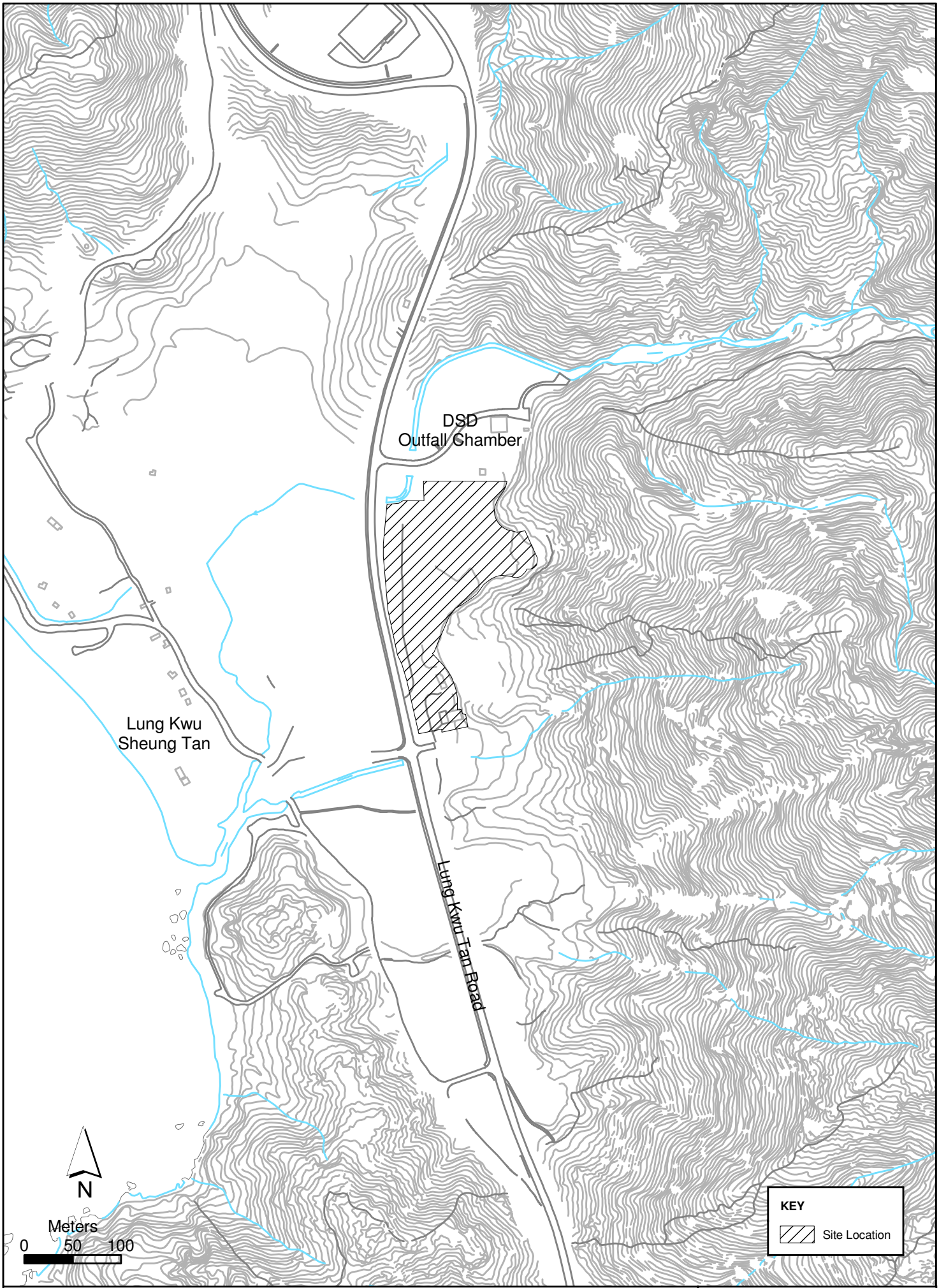

FIGURE 1.1

Site Location

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environmental protection and pollution control measures.

As specified by the *EIA Study Brief*, the EIA has addressed the following key environmental issues associated with the construction and operation of the Project.

- The potential air quality and noise impacts from construction and operation of the Project to nearby sensitive receivers, taking into account the cumulative impact from the existing and planned sources of pollution in the vicinity of the Project;
- The potential water quality impact from the construction and operation of the Project on the relevant water system(s);
- The waste arising as a result of the construction and operation activities of the Project;
- The potential land contamination from operation of the Project; and
- The potential landscape & visual impacts from construction and operation of the project.

It should also be noted that since the Project has no impact on agriculture and fisheries resources, agriculture and fisheries impact is not assessed in this EIA Report.

1.4 APPROACH TO THE EIA STUDY

The criteria and guidelines stipulated in the EIAO-TM, the EIA Study Brief, and other relevant legislation polices, and guidelines are adopted in carrying out this EIA Study.

To address the environmental concerns associated with the proposed karting track, the EIA Study has made reference to the operation of existing karting track located in Macau. In particular, on-site noise measurement was conducted to ensure that the potential noise emissions from the karting track operations are fully address in the EIA Study.

It should be noted that no models were used for the air and water quality assessment. For the noise assessment, actual on-site measurements were undertaken at a racing event whereby the participated karts were powered by the same engine to be used in this Project. The distance and barrier attenuation was calculated based on well proven standard acoustical principals. However, it should be noted that to allow a conservative assessment, the maximum noise emission of the kart was adopted. Also, the assessment has assumed 100% downwind propagation. In reality, the wind direction will vary from time to time and therefore, the actual noise levels perceived at the NSRs are expected to be lower than the predicted levels.

1.5 STRUCTURE OF THIS REPORT

The remainder of this EIA Report comprises the following sections.

Section 2	Provides information on the consideration of alternatives for the siting, design and operation of the Project.
Section 3	Provides a description of the Project highlighting the key infrastructure for the Project and the operation activities.
Section 4	Presents the findings of the air quality impact assessment.
Section 5	Presents the findings of the noise impact assessment.
Section 6	Presents the findings of the water quality impact assessment.
Section 7	Presents the findings of the waste assessment.
Section 8	Presents the findings of the land contamination assessment.
Section 9	Presents the findings of the landscape and visual impact assessment.
Section 10	Provides a summary of the conclusions and environmental outcomes drawn from the detailed assessment of the Project.

2 CONSIDERATIONS OF ALTERNATIVES

2.1 BACKGROUND TO THE PROJECT

Since the karting tracks in Lau Shiu Hang and Mai Po closed down in 1993, there are no outdoor karting tracks for training or local racing events in Hong Kong. Kart drivers would need to go to neighbouring cities such as Zhuhai, Shenzhen or Macau for training or kart racing. Without an international standard venue, the popularity and development of karting sport in Hong Kong is held back and hindered.

In this regard, the Project Proponent and HKKC propose to provide an outdoor karting track at Lung Kwu Tan which would satisfy the international standard for kart racing as well as safety standard. The proposed karting track is for sporting purposes and can only be used by members of the HKKC. The karting track will not be opened to the general public for recreational uses as a licence issue by the HKKC is required for driving the petrol karts, and no international racing events will be held at the proposed venue.

2.2 JUSTIFICATION FOR CHOOSING THE PRESENT SITE

A site selection exercise for a permanent karting track was conducted by the HKKC prior to the EIA study. Five potential sites, including Sheung Shui, Tin Shiu Wai, Robin's Nest, Sharp Island and Lung Kwu Tan, have been studied. The factors considered in the assessment included engineering feasibilities, potential environmental impacts to the adjacent sensitive receivers during construction and operational stages, and potential impacts to ecology.

Sheung Shui and Tin Shui Wai

Potential sites at Sheung Shui (near NENT Landfill) and Tin Shui Wan have been studied for the possibility of construction and operate a karting track. Preliminary study shows that both sites are in close proximity to scattered village houses or residential uses, which would potentially be affected by the construction and operation of the karting track in terms of air quality, noise and landscape impacts. These two potential sites are therefore not preferred.

Robin's Nest

A potential site at Robin's Nest has been studied. The site is located within the Closed Area for which any person access to these areas would need a Closed Area Permit issued by the Hong Kong Police Force. The poor accessibility of the site would affects the popularity of karting track and will also cause operational difficulties. The potential site in Robin's Nest is therefore not preferred.

Sharp Island

The study area at Sharp Island is far away from residential areas and thus potential air and noise impact on sensitive receivers is not expected to be a concern. However, the hilly terrain of Sharp Island would require extensive site formation works, such as excavation, site levelling, slope-cutting and tree felling works before track paving could start. Large amount of public fill materials would be produced and required offsite disposal and local terrestrial ecology may be disturbed. The potential site in Sharp Island is therefore not preferred.

Lung Kwu Tan

The proposed karting track at Lung Kwu Tan is remote (>1000m) from existing and planned residential area. Potential impacts on air quality and noise are anticipated to be small. The site currently is a flatted wasteland and no further excavation or slope-cutting would be required for the construction of an outdoor karting track, and hence the associated air quality and noise impacts and waste arising would be minimal. No tree felling would be required and hence impact on ecology resources is not anticipated. The footprints of the karting track would also be screened by the existing vegetation and the natural topography, so the Project would only be visible from limited viewpoints and no visual intrusion would be imposed by the Project.

Based on the above assessment, it was concluded that the site in Lung Kwu Tan would have minimal impacts on the environment and with good accessibility. Thus, the potential site at Lung Kwu Tan was considered to be the preferred location for the development of an outdoor karting track.

3 PROJECT DESCRIPTION

3.1 THE PROJECT

The project will comprise of the construction and operation of an outdoor karting track design to international standard for kart racing.

The karting track will be managed by the Project Proponent and oversee by the HKKC. HKKC is a member of the Sports Federation and Olympic Committee of Hong Kong, China, as well as one of the sporting organizations under the subvention of the Leisure and Cultural Services Department.

The proposed karting track is for sporting purposes and can only be used by members of the HKKC. The karting track will not be opened to the general public for recreational uses. A kart driving licence, issue by the HKKC, is required for driving the petrol karts and the proposed track will hold a maximum of 200 visitors with about 20 staffs. No on-site parking facility is provided at the proposed karting track. To control the number of visitors, a shuttle bus service would be provided for the visitors. A 45-person bus would run between Tuen Mun Town Centre and the karting track every hour.

The proposed karting track is for running with petrol karts. To operate any karting track, the design of the karting track must satisfy the international safety standard for kart racing. The karting track will operate from Monday to Sunday with operating hours from 09:30 to 19:00. A maximum of 40 karts would be allowed on the track for training or rental run and 34 karts for match. Each run would not last more than 30 minutes including kart running time and break time between each run. The karts to be running on the track are powered by Rotax Max FR125 2-stroke single cylinder engines with displacement of 125 c.c. The fuel tank capacity of the kart is small, i.e., about 3 litres, and re-fuelling will be required once or twice a day. The re-fuelling will be undertaken on site within the service area enclosed by chain link fence. A licence dangerous goods (DG) vehicle would transport the petrol tank to site for re-fuelling and the karts will be re-fuelled using hand pump. Only limited quantities of petrol, a standard 18 litre safety petrol tank, will be stored on site during the daytime. Any unused petrol will be collected by the DG vehicle after the operating time of the karting track. Only minor maintenance works will be conducted on-site, including the use of lubricants, chain oil, and brake cleaner. If any engine maintenance works are required, the kart vehicle will be transport to a garage.

The overall track length is about 900m, in a site of about 1.8 ha. The site is currently approximately 5 mPD and only very minor site levelling will be required. No slope cutting or major site formation is required as part of the construction and no superstructure will be constructed within the site. The karting track will be paved using asphaltic concrete and part of the site that will be used for regular maintenance work will also be paved using concrete. An existing village house within the site boundary will be used as an office for

the karting track and four units of mobile toilets will be provided at the site together with thirteen ISO containers to be used as maintenance and storage area for the petrol karts. The proposed site layout plan is shown in *Figure 3.1*.

A contractor will be commissioned by the Project Proponent to undertake the construction of the Project. In view that only minor construction activity is required, the construction stage is expected to be completed in two months. All the construction activities are expected to be undertaken during normal working hours (ie Monday to Saturday, from 07:00 to 19:00 hours). No restricted hour works are anticipated.

3.2 INTERACTION WITH OTHER PROJECTS

No other major project was identified to be carried out concurrently in the vicinity of the proposed Project.

3.3 SCOPING OF ENVIRONMENTAL ISSUES

The impacts associated with the Project are summarised in *Table 3.1* and are described in further detailed in the following sections.

Table 3.1 Potential Sources of Environmental Impacts

Type of Potential Impact	Construction	Operation	Remarks
Noise generation	✓	✓	See Section 5
Night time operations	X	X	
Impacts on ecological resources	X	X	
Landscape and visual impacts	✓	✓	See Section 9
Gaseous emissions	✓	✓	See Section 4
Dust	✓	X	See Section 4
Liquid effluents	✓	✓	See Section 6
Disposal of spoil material	✓	X	See Section 7
Generation of waste or by-products	✓	✓	See Section 7
Disruption of water movement or bottom sediment	X	X	
Risk of accidents which would result in pollution or hazard	X	X	
Endangerment of cultural heritage resources	X	X	
Traffic generation	✓	✓	See Section 4 & 5

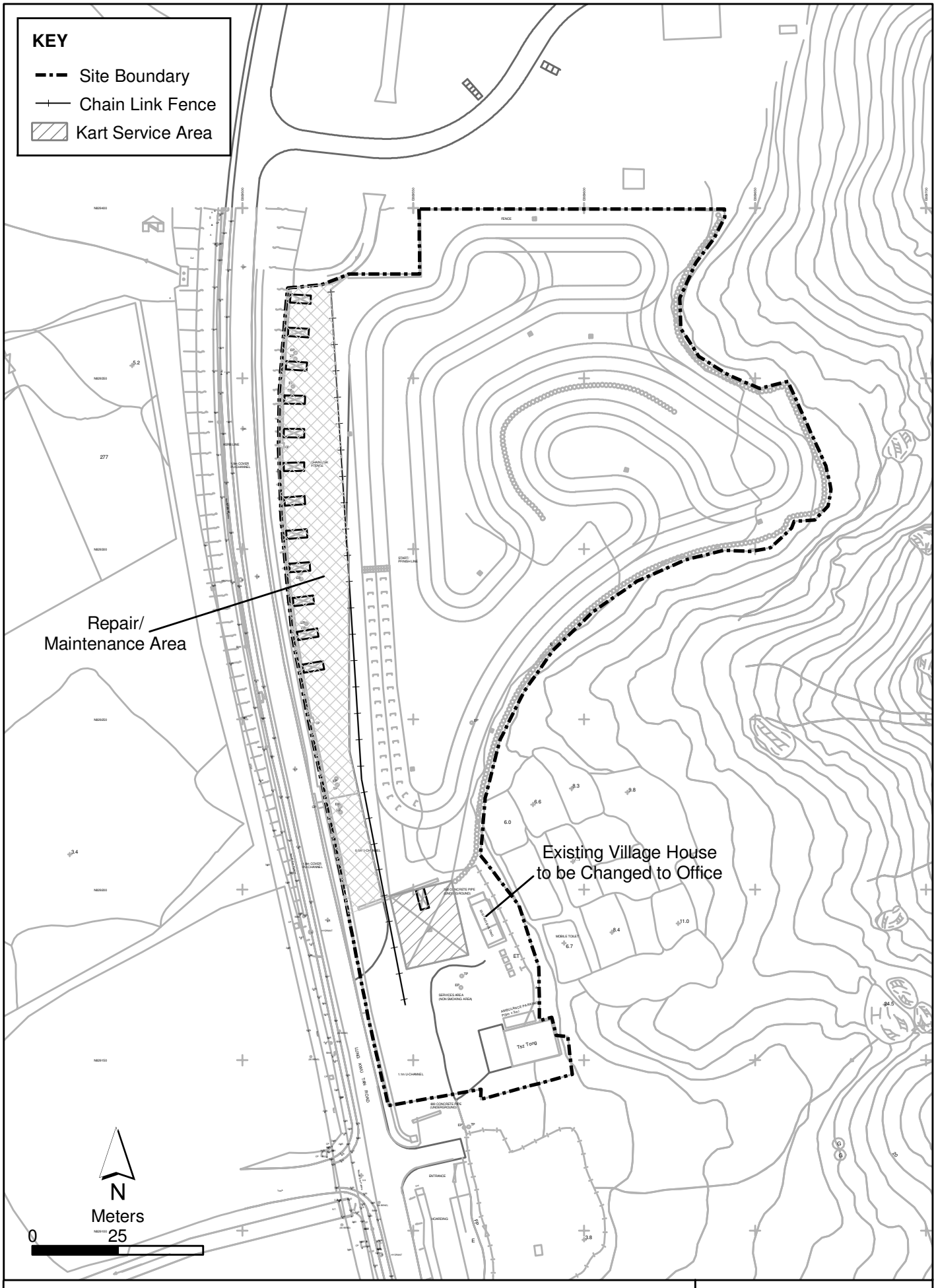

FIGURE 3.1

Site Layout Plan

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Type of Potential Impact	Construction	Operation	Remarks
Storage, handling, transport, or disposal of hazardous materials or wastes	✓	✓	See Section 7 & 8

✓ = Possible X = Not expected

3.4 ENVIRONMENTAL CONDITIONS IN ABSENCE OF THE PROJECT

The site selection exercise has resulted in a location that has avoided impacts to high ecological value habitats and is located away from residential developments. No felling of trees is required during the construction stage. The footprint of the karting track will also be screened by the existing vegetation and the natural topography, so the Project would only be visible from limited viewpoints.

The environmental condition of the proposed site is currently a flatted wasteland with patches of weed plants found at the western and northern end. A village house is located at the south and a DSD outfall chamber at the north. It is expected that if the Project will not proceed, the wasteland will be covered by weed plants. However, it should be noted that the land is likely to be rented out by the land owner for other uses such as open storage and / or recycling factory if the Project will not proceed.

The alternative assessment (*Section 2*) concluded that the site in Lung Kwu Tan is the preferred site both environmentally as well in terms of operational aspects. Subsequent sections of this report demonstrate that the Project can be constructed and operated in an environmentally acceptable manner.

4 AIR QUALITY

4.1 INTRODUCTION

This section presents the air quality impact assessment for the construction and operational phases of the Project. Potential sources of air quality impact and Air Sensitive Receivers have been identified and an assessment has been performed. Mitigation measures are recommended if necessary.

4.2 LEGISLATIVE REQUIREMENT AND EVALUATION CRITERIA

The principal legislation for the management of air quality in Hong Kong is the *Air Pollution Control Ordinance* (APCO) (Cap. 311). Under the APCO, the *Hong Kong Air Quality Objectives* (AQOs), see *Table 4.1*, stipulate the statutory limits for air pollutants and the maximum allowable numbers of exceedances over specific periods.

Table 4.1 Hong Kong Air Quality Objectives ($\mu g\ m^{-3}$) [a]

Air Pollutant	Averaging Time			
	1 Hour [b]	24 Hour [c]	3 Months [d]	1 Year [d]
Total Suspended Particulates (TSP)	-	260	-	80
Respirable Suspended Particulates (RSP) [e]	-	180	-	55
Sulphur Dioxide (SO_2)	800	350	-	80
Nitrogen Dioxide (NO_2)	300	150	-	80
Carbon Monoxide (CO)	30,000	-	-	-
Photochemical Oxidants (as ozone (O_3)) [f]	240	-	-	-
Lead (Pb)	-	-	1.5	-

Notes:

(a) Measured at 298K (25°C) and 101.325 kPa (one atmosphere)

(b) Not to be exceeded more than three times per year

(c) Not to be exceeded more than once per year

(d) Arithmetic means

(e) Suspended airborne particulates with a nominal aerodynamic diameter of 10 micrometres or smaller

(f) Photochemical oxidants are determined by measurement of ozone only

4.3 BASELINE CONDITIONS AND AIR SENSITIVE RECEIVERS

4.3.1 Baseline Conditions

The proposed karting track is located at Lung Kwu Sheung Tan which is a rural area surrounded by open storage, plastics recycling factories and dangerous goods stores located to the west of the site. There are an existing village house and a Tsz Tong located within the site area but the village house would be used as an office of the karting track without any modification of the structure. The Tsz Tong will be kept without any modification for villagers' private functions.

A cement plant is located about 350 m to the northwest of the site.

An enclosed DSD outfall chamber is located to the north of the site.

The existing air quality in the vicinity is dominated by the local vehicle emissions from Lung Kwu Tan Road, emissions from Castle Peak and Black Point Power Stations as well as the regional pollutant flux.

4.3.2 Air Sensitive Receivers

Air Sensitive Receivers (ASRs) have been identified in accordance with the criteria stated in the *Section 2 of Annex 12 of EIAO-TM*. The identified ASRs are summarized in *Table 4.2* and are shown in *Figure 4.1*. All the identified ASRs are either open storage, recycling factories or canteens for the workers in the vicinity. No existing residential use is identified within 1 km from the Site. In addition, as confirmed with the District Lands Office (DLO), there are no planned residential uses identified within the Study Area.

Table 4.2 Identified Air Sensitive Receivers

ASR	Location	Distance from the nearest Site Boundary (m)
A1	Plastic Recycling Factory	30
A2	Plastic Recycling Factory	67
A3	Plastic Recycling Factory	100
A4	Asphalt Plant	190
A5	Canteens	215
A6	LKT Transportation Co.	105
A7	GAMMON Construction Material Storage	155

In addition, the village house (to be used as an office) and the Tsz Tong located within the site area are also considered as ASRs (see *Figure 3.1*).

4.4 ASSESSMENT OF AIR QUALITY IMPACTS

4.4.1 Construction Phase

Site levelling, compacting, track paving works and fence installation are the major construction works. Dust emission is likely from materials handling, on-site truck movement, temporary stockpiling of dusty materials. Given the small scale of the construction works, the dust impact at ASRs is not expected.

A bulldozer, an excavator and a truck would be involved for the site levelling works. An asphalt paver and a road roller would be involved for the track paving works. In view of small scale of the site area and limited number of equipment operating on site, air quality impact during construction phase is not expected.

Although no construction air quality impact is expected, it is recommended to implement good site practices and housekeeping stated in *Section 4.5.1*.

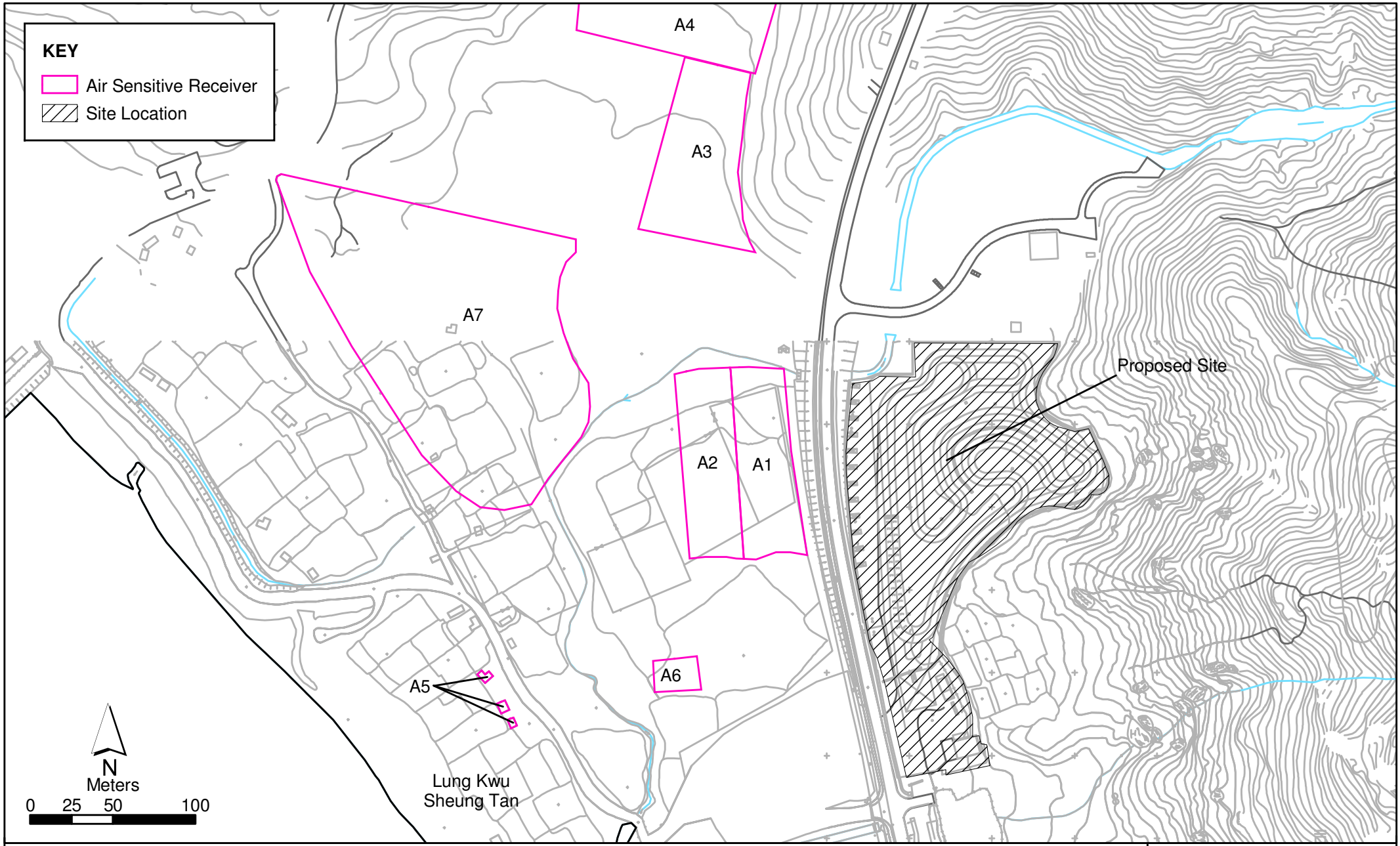

Figure 4.1

Location of Air Sensitive Receivers

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4.4.2 Operational Phase

During operation, vehicular emissions from the karts and the additional traffic generation on Lung Kwu Tan Road by the Project may affect the local air quality in the vicinity. In addition, odour emissions from karts and petrol storage tank may also be a concern.

Vehicular Emissions from Karts

The karting track would operate from Monday to Sunday with operating hours from 09:30 to 19:00. A maximum of 40 karts would be allowed on the track for training or rental run and 34 karts for match. Each session of kart running will last for a maximum of 30 minutes including running time and break time. For a worst case assessment, it is assumed a maximum of 40 karts and each run would last for 30 minutes with a short time break between each run.

The karts to be running on the track are powered by Rotax Max FR125 2-stroke single cylinder engines with displacement of 125 c.c. The information of the engine could be found at *www.maxchallenge-rotax.com*. The engine power is assumed to be 21 kW and normal unleaded gasoline would be used.

Hydrocarbons and nitrogen oxides ($HC+NO_x$) are the major air pollutants. Since the engine is produced in Austria, European Emission Standard will be used as a conservative approach. However, there is no specific emission standard for karts / recreational vehicles under European Standards, therefore, with reference to the *Directive 2002/88/EC of the European Parliament and of the Council* (1), the emission factors of $HC+NO_x$ of similar non-road mobile machinery engine (19 kW with a displacement of ≥ 100 cm^3 but < 225 cm^3) of 16.1 g / kW-hr will be used in the assessment.

Due to the combustion process of 2-stroke engine, NOx emission is minor compared with HC. With reference to *Section 2.10 of "Technical Report No. 49 COPERT III Computer Programme to Calculate Emissions from Road Transport – Methodology and Emission Factors (V2.1), November 2000, European Environment Agency"* (2), the emission factors of HC and NO_x of similar engine (2-stroke motorcycles with displacement > 50 cm^3) are 4 g / km and 0.1 g / km, respectively. Therefore, the fraction of NO_x is only 2.4% of total $HC+NO_x$ emission. (i.e., 0.1 / (0.1 + 4) x 100% = 2.4%). Therefore, the emission factor of NO_x become 16.1 g / kW-hr x 2.4% = 0.39 g / kW-hr. Thus, the total emission rate per track area of NO_x is calculated and presented in *Table 4.3*.

(1) Reference to http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_035/l_03520030211en00280081.pdf

(2) Reference to http://reports.eea.eu.int/Technical_report_No_49/en/tech49.pdf

Table 4.3 Emission Rates of NO_x and RSP from Karts

	Emission Rate Estimation
General Information	
Engine power	21 kW
Time for running	30 minutes running with a short time break between each run
Maximum no. of karts on track	40 (Training and Rental Run)
Area of running track	900m (length) x 8m (width) = 7,200 m^2
NO_x	
NO_x emission factor [(a)]	0.39 g / kW-hr
NO_x emission rate for each kart	0.29 x 21 = 8.19 g / hr = 8.19 / 3600 = 0.0023 g / s
Total NO_x emission rate	Training and Rental Run : 0.0023 x 40 = 0.091 g / s
Total NO_x emission rate per track area	Training and Rental Run : 0.091 / 7,200 = 1.26×10^{-5} g / m^2 / s

Note:
(a) Reference to *Directive 2002/88/EC of the European Parliament and of the Council (http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_035/l_03520030211en00280081.pdf)*

In view of the minimal aerial emissions generated from karts, the air quality impact would not be anticipated.

Vehicular Emissions from Additional Traffic Generation by the Project

The proposed karting track could hold a maximum of 200 visitors. Shuttle bus service would be provided for the visit. A 45-person bus would run between Tuen Mun Town Centre and the karting track every hour. The traffic generation is therefore, estimated to be around 10 bus round trips per day. In view of the small number of additional traffic induced on the existing road traffic, adverse air quality impact to the surrounding environment is not expected.

Odour Emissions from Karts and Petrol Storage Tank

Potential petrol odour would come from incomplete combustion or fuel leakage by the kart engine or during petrol re-fuelling. To avoid incomplete combustion or fuel leakage, the kart engines should undergo regular maintenance to maintain a good operation condition.

For the case of petrol re-fuelling, re-fuelling is required once or twice a day. Only limited quantities of petrol, a standard 18 litre safety petrol tank, will be stored on site during the daytime. Any unused petrol will be collected by the DG vehicle after the operating time of the karting track. Only minor maintenance works will be conducted on-site, including the use of lubricants, chain oil, and brake cleaner. If any engine maintenance works are required, the kart vehicle will be transport to a garage. As the fuel tank capacity of the kart is small, i.e., about 3 litres, the re-fuelling time would be short, i.e., about 15 second. Thus, with such short re-fuelling time and infrequent re-fuelling of the karts and the separation distance between ASRs and the petrol re-fuelling area, the odour impact arising from petrol re-fuelling is not expected.

Industrial Emissions Arising from Nearby Uses

As mentioned in Section 4.3.1, the surrounding area is occupied by open storage, plastic recycling factories and dangerous goods stores which are no industrial emissions produced. Therefore, no adverse air quality due to the industrial emissions from nearby industrial uses on the proposed karting track is anticipated.

4.5 MITIGATION MEASURES

4.5.1 Construction Phase

The following good site practices are recommended to minimize the dust nuisance during the construction of the proposed karting track:

- Stockpiling of dusty materials should be entirely covered or watered to avoid fugitive dust;
- Site area should be kept wet during excavation;
- Dusty materials carried by truck leaving the construction site should be covered by tarpaulin sheet to ensure no leakage of dusty materials from trucks;
- Regularly maintenance should be provided for the diesel-powered mechanical equipment especially black smoke is emitted; and
- The engine of the equipment should be switched off when it is not in operation.

4.5.2 Operational Phase

Although no exceedance of air quality impact is anticipated during the operation of karting track, the following measures are recommended:

- Maintenance of karts should be performed regularly to avoid incomplete combustion or fuel leakage;
- Proper handling of petrol storage tank and during refuelling to avoid leakage of petrol; and
- Only limited quantities of petrol, a standard 18 litre safety petrol tank, will be stored on site during the daytime. Any unused petrol will be collected by the DG vehicle after the operating time of the karting track. Only minor maintenance works will be conducted on-site, including the use of lubricants, chain oil, and brake cleaner. If any engine maintenance works are required, the kart vehicle will be transport to a garage.

4.6 ENVIRONMENTAL MONITORING AND AUDIT

4.6.1 Construction Phase

No dust monitoring is required as no exceedance of dust impact is anticipated.

4.6.2 Operational Phase

No operational air quality monitoring is required as no exceedance is anticipated.

4.7 CONCLUSIONS

Potential dust nuisance is a concern during construction of the karting track. Site levelling, compacting, track paving works, planting and fence installation are the major construction works. Given the small scale of the construction works, the dust impact at ASRs is minimal and no adverse impact is anticipated. Due to the small scale of site area, the number of construction plant operating on site is limited, therefore, the gaseous emissions from the construction equipment is minimal and no adverse impact is anticipated.

In view of the limited emissions from karts on tracks and separation distances between ASRs and tracks, air quality impact is not expected. Since the number of shuttle bus running between the karting track and Tuen Mun Centre are estimated to be around 10 bus trips per day, the air quality impacts due to additional traffic arising from karting track would not be anticipated. Besides, with the proper handling of petrol stores and re-fuelling and regular maintenance of karts, no odour nuisance is expected.

5 NOISE

5.1 INTRODUCTION

This Section presents the potential noise impacts associated with the site levelling, track paving and the noise impacts associated with maintenance and operation of the Project.

5.2 RELEVANT LEGISLATION AND GUIDELINES

5.2.1 Construction Noise

The principal legislation relating to the control of construction noise is the *Noise Control Ordinance (Cap. 400)* (*NCO*). Various Technical Memoranda (TMs), which stipulate control approaches and criteria, have been issued under the *NCO*. The following TMs are applicable to the control of noise from construction activities:

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

Apart from the above, the *Environmental Impact Assessment Ordinance* (*EIAO*) *(Cap. 499)* also provides means to assess construction noise impacts. The *Technical Memorandum on Environmental Impact Assessment Process* (*EIAO-TM*), issued under the *EIAO*, provides guidelines and noise criteria for evaluating construction noise impacts.

General Construction Works

Under the *EIAO*, noise impact arising from general construction works during normal working hours (i.e. 0700 to 1900 hours on any day not being a Sunday or public holiday) at the openable windows of buildings is to be assessed in accordance with the noise criteria as given in the *EIAO-TM*. The *EIAO-TM* noise standards are presented in *Table 5.1*.

Table 5.1 EIAO-TM Daytime Construction Noise Standard ($L_{eq, 30\ min}$ dB(A))

Use	Noise Standard
Domestic Premises	75
Educational Institutions (normal periods)	70
Educational Institutions (during examination periods)	65

When assessing a CNP application for the use of Powered Mechanical Equipment (PME) during restricted hours, the Noise Control Authority will compare the ANLs, as promulgated in *GW-TM*, and the CNLs (after accounting for factors such as barrier effects and reflections) associated with

the proposed PME operations. The ANLs are related to the noise sensitivity of the area in question and different Area Sensitivity Ratings have been established to reflect the background characteristics of different areas. The relevant ANLs are shown in *Table 5.2*.

The Noise Control Authority will consider a well-justified Construction Noise Permit (CNP) application, once filed, for construction works within restricted hours as guided by the relevant Technical Memorandum issued under the *NCO*. The Noise Control Authority will take into account adjoining land uses and any previous complaints against construction activities at the site before making a decision in granting a CNP. Nothing in this EIA Report shall bind the Noise Control Authority in making his decision. The Noise Control Authority may include any conditions in a CNP that it considers appropriate. Failure to comply with any such conditions may lead to cancellation of the CNP and prosecution action under the *NCO*.

Table 5.2 Acceptable Noise Levels (ANL, $L_{eq,\ 5\ min}$ dB(A))

Time period	**Area Sensitivity Rating**		
	A	B	C
All days during the evening (1900-2300 hours) and general holidays (including Sundays) during the day and evening (0700-2300 hours)	60	65	70
All days during the night-time (2300-0700 hours)	45	50	55

In addition to the general controls on the use of PME during restricted hours, the EPD has implemented a more stringent scheme via the *DA-TM*. The *DA-TM* regulates the use of five types of Specified Powered Mechanical Equipment (SPME) and three types of Prescribed Construction Work (PCW), which are non-PME activities, in primarily densely populated neighbourhoods called Designated Areas (DAs). The SPME and PCW are:

SPME:

- hand-held breaker;
- bulldozer;
- concrete lorry mixer;
- dump truck; and
- hand-held vibratory poker.

PCW:

- erection or dismantling of formwork or scaffolding;
- loading, unloading or handling of rubble, wooden boards, steel bars, wood or scaffolding material; and
- hammering.

A CNP will be required for works during the time between 1900 and 0700 hours and any time on a general holiday, including Sunday, and the noise

criteria for evaluating noise impact laid down in relevant *TM* issued under the *NCO* must be met.

As the Study Area is located outside a designated area, the noise criteria stipulated under the DA-TM are not applicable in this Study.

5.2.2 Operational Noise

The *EIAO-TM* and *Technical Memorandum on Noise From Places Other than Domestic Premises, Public Places or Construction Sites* (*IND-TM*) specifies the applicable Acceptable Noise Levels (ANLs) for operational noise of the karting track. The ANLs are dependent on the Area Sensitivity Rating (ASR) and the time of the day and are presented in *Table 5.3*.

Table 5.3 ANLs to be used as Operation Noise Criteria

Time Period	**$L_{Aeq\ 30min}$ (dB(A))**		
	ASR "A"	**ASR "B"**	**ASR "C"**
Daytime 0700-1900	60	65	70
Evening 1900-2300	60	65	70
Night-time 2300-0700	50	55	60

Fixed Plant Noise

Fixed plant noise is controlled under *Section 13* of the *NCO* and the predictions will be undertaken in accordance with the *IND-TM*. The criteria noise limits are set out in the *EIAO-TM* as follows:

- the total fixed source noise level at the facade of the nearest NSR is at least 5 dB(A) lower than the appropriate ANL (as shown in *Table 5.3*) as specified in the *Technical Memorandum on Noise from Places other than Domestic Premises, Public Places or Construction Sites* (*IND-TM*); or,

- where the prevailing noise level in the area is 5 dB(A) or more below the appropriate ANL, the total fixed source noise level must not exceed this noise level.

The criteria noise limits stipulated in the *IND-TM* are dependent on the Area Sensitivity Rating (ASR) of the NSRs as shown in *Table 5.3*.

In any event, the Area Sensitive Rating assumed in this Report is for indicative assessment only given that there are currently no influencing factors assumed in the vicinity of the NSRs. It should be noted that fixed noise sources are controlled under Section 13 of the *NCO*. At the time of investigation, the Noise Control Authority shall determine noise impact from concerned fixed noise sources on the basis of prevailing legislation and practices being in force, and taking account of contemporary conditions / situations of adjoining land uses. Nothing in this Report shall bind the Noise Control Authority in the context of law enforcement against all the fixed noise sources being assessed in this report.

5.3 BASELINE ENVIRONMENTAL CONDITIONS AND NOISE SENSITIVE RECEIVERS

5.3.1 Baseline Environmental Conditions

The proposed karting track is located at Lung Kwu Sheung Tan which is rural in nature and is characterised predominantly industrial uses. The existing land uses to the west of the site are open storage of powered mechanical equipment, plastics recycling factories, concrete batching plant and dangerous goods stores. The site is currently approximately 5 mPD, which is lower than the level of Lung Kwu Tan Road. A Tsz Tong (Lau's ancestral hall) and a village house are located within the site area.

Background noise is dominated by the traffic noise from Lung Kwu Tan Road and the loading and unloading activities undertaken in the plastics recycling factory and the traffic movement within the area located to the west of the site.

5.3.2 Noise Sensitive Receivers

As discussed in *Section 5.3.1*, the proposed site included an existing village house and a Tsz Tong. The Tsz Tong will be kept without any modification and will only be used by the Lau's family members of Lung Kwu Tan village for private functions and unauthorized public entry is strictly prohibited, and therefore Tsz Tong is not considered as a public place of worship. In view that the Tsz Tong will not be used by any public at any time, for the purpose of this EIA, the Tsz Tong has not been identified as a NSR.

Agreement has been made between the land owner and the Project Proponent that the proposed site (including the village house to be used as an office) will be leased to the Project Proponent for the development of an outdoor karting track. The village house within the site boundary will be used as an office for the karting track only. Residential use is not permitted at the village house while the land is used as an outdoor karting track. The Project Proponent also confirmed that the village house will only be used as an office of the karting track. In view that the village house will not be used as residential purpose during the karting track leasing period, for the purpose of this EIA, the village house has not been identified as a NSR. However, should this village house is to be used for residential purpose during the operation of the karting track, mitigation measures are proposed in order to attenuate the noise impact (see *Annex B*).

A land search has been conducted to identify any existing NSRs within 300 m from the Study Area boundary. Three ruined and vacant building structures were observed to be located to the west of site during the search. During a site visit, it has been identified that these structures have been converted as a canteen and located within the industrial area and therefore these village houses have not been identified as a NSR. However, should these building structures are used for residential purpose, in view of the large separation distance, noise impacts associated with the karting track is not expected.

In addition, as confirmed with the District Lands Office (DLO), there are no planned residential uses identified within the Study Area.

It has been identified during site visit that the industrial area located to the west of the Site are used for open storage, plastics recycling factories and canteens for the workers in the vicinity.

The nearest residential uses have been identified as the village house at Pak Long located at about 1153m from the southern site boundary. The locations of the identified NSRs are shown in *Figure 5.1*. No planned NSRs are identified in the study boundary.

A noise survey was conducted in 22nd July 2005 to investigate the existing acoustic condition at the identified NSRs. The background in Pak Long was dominated by the road traffic noise from Lung Kwu Tan Road, and the measured daytime noise level $L_{eq, 15min}$ at the NSR was 54.9 dB(A).

As the site is located in a rural area and no influencing factors affect the NSRs, an ASR "A" has been assumed for the NSRs located at Pak Long. As the measured prevailing noise level was lower than the (ANL-5) criterion, and therefore the criterion, i.e. 54.9 dB(A) $L_{Aeq, 30min}$ for daytime period will be considered as the stipulated noise limit for the assessment of operational noise impact.

Table 5.4 Identified Noise Sensitive Receivers

NSR	Location	Type of Uses
N1	No. 32 Pak Long	Residential (3-Storey)

5.4 POTENTIAL SOURCES OF IMPACT

5.4.1 Construction Phase

The major construction activities associated with the Project that may cause noise impacts to the NSRs are:

- Excavation and compaction works for forming levelled ground; and
- Track Paving.

The construction period of the Project will take approximate 2 months. In addition, the construction works for site leveling and track paving will be carried out in phases without overlapping according to planned project programme, i.e. track paving will be carried out after completion of Site Formation.

The use of PME during the construction phase will be the main source of noise impact. The use of PMEs such as bulldozer, excavator, dump truck, asphalt paver and road roller will be involved in the construction activities.

Annex A presents a detailed list of PMEs, which are provided by the Project Proponent, assumed for each construction activity considered in the noise impact assessment. Project Proponent has confirmed that the plant inventory is practicable for the construction of karting track.

The normal working hours of the contractor will be between 07:00 and 19:00 hours from Monday to Saturday (except public holidays) and construction activities during restricted hours are not expected. Should evening and night works between 19:00 and 07:00 hours or on public holidays (including Sunday) be required, the contractor should submit a CNP application and will be assessed by the Noise Control Authority. Conditions stipulated in CNPs should be strictly followed.

5.4.2 Operational Phase

The design of the karting track will meet international standard for kart racing and safety standard, and will only serve members of the Hong Kong Kart Club for sporting purposes. In addition, the proposed karting track will be used for training or local racing events. It should be iterated that there will be no international events to be carried out at the proposed track.

The karts to be running on the track are powered by Rotax Max FR125 2-stroke single cylinder engines with displacement of 125c.c. As given in the technical specification of the kart, the exhaust system is provided with intake silencer for reduction of noise from exhaust system. The major noise sources during the operational phase are therefore identified as kart movement and public address (PA).

The karting track will operated from Monday to Sunday with operating hours from 09:30 to 19:00 hours. The maximum number of karts to be allowed to run on the track is 40 at any time. In addition, for a conservative assessment, each run with up to 40 karts on the track is assumed to last for a full 30 minutes during any half hour. Project Proponent has also confirmed to maintain a maximum number of 200 visitors on site at any time. To control the number of visitors and traffic generation, a 45-person bus would run every hour between Tuen Mun Town Centre and the karting track for transportation of the guest and participants, and there will be around 10 bus trips per day. In addition, no on-site parking facility / area will be provided at the proposed karting track for minimizing traffic generation and there are no parking facility / area located in the vicinity of the proposed site, it is anticipated that small number of visitors may drive to the site. In view of the small number of traffic induced on the existing road traffic, it is anticipated that induced traffic noise would not pose adverse impact to the NSRs in Lung Kwu Sheung Tan.

Only minor maintenance works will be carried out within the site so as to ensure the karts operate properly. In addition, only external repair will be undertaken at site (ie replacement of bodywork). Any engine maintenance work will not be carried on site. If such works are required, the vehicle will be transport to a garage for such repair.

The PA system at the karting track will be similar to the PA system at Kartodromo de Coloane, however the project size of karting track is smaller than Kartodromo de Coloane, and therefore the power and number of speakers at the karting track will be smaller that at Kartodromo de Coloane.

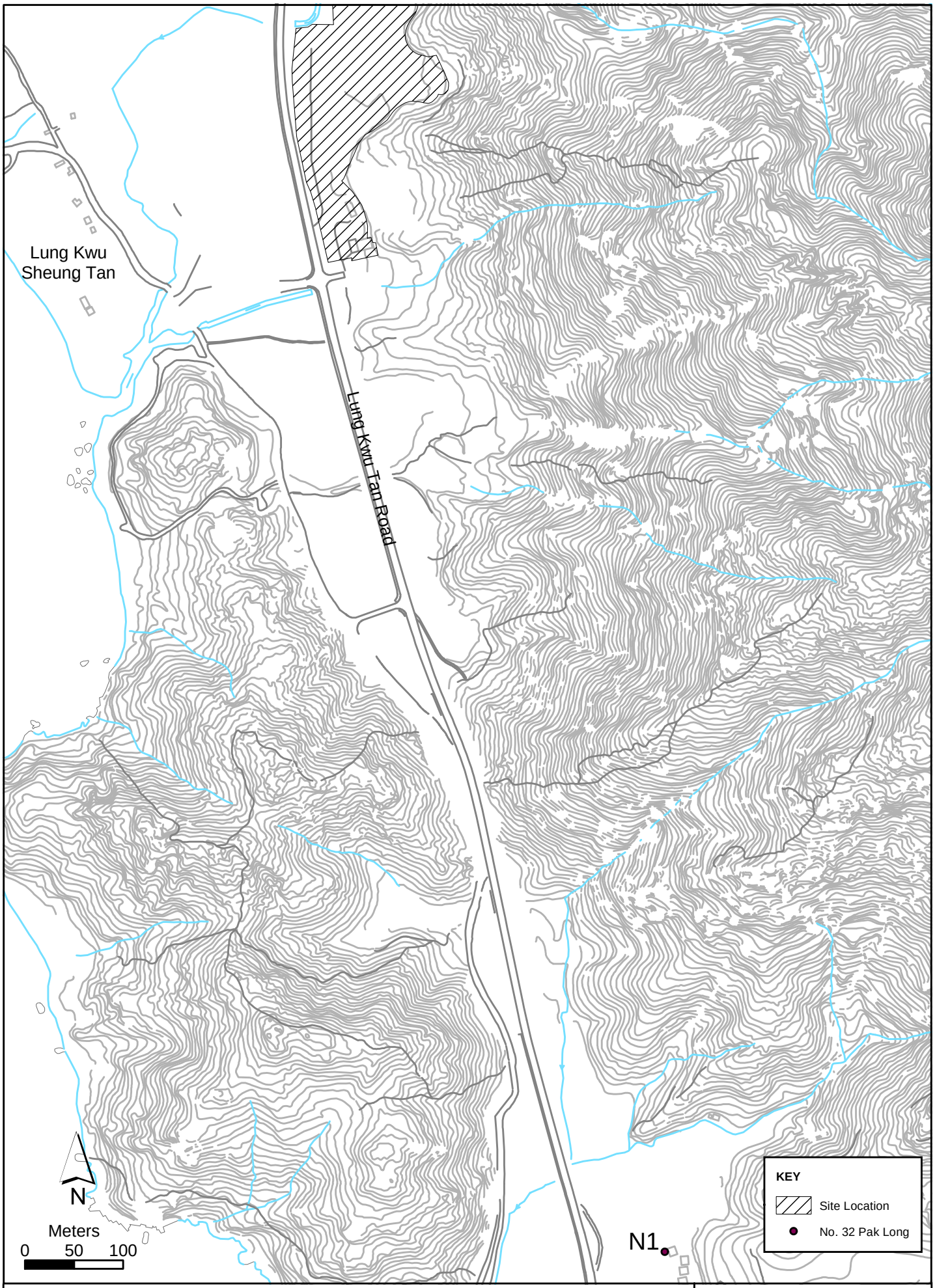

FIGURE 5.1

Identified Noise Sensitive Receivers (NSRs)

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Date: 22/11/2005

Environmental Resources Management

ERM

It is assumed that a total of 5 sets of PA system (each with 2 speakers) will be provided within karting track.

Noise Emission from Karts and PA System

Noise measurement has been conducted for a kart racing on 27 November 2005 in the Kartodromo de Coloane at Macau, to obtain noise emission data of similar karting track operation. The kart race was participated by 13 karts which are powered by the same engine (ie Rotax Max FR125 2-stroke single cylinder engines with displacement of 125 c.c) to be used in the Project. The noise measurement is therefore considered to be representative of the proposed karting track operation.

Broadband measurement of L_{Aeq}, L_{10}, L_{90}, L_{max} and L_{min} has been recorded at 500ms interval to capture the noise emissions from karts moving in high speed in front of sound level meter. At least 5 minutes measurement was conducted at different locations along the track in order to collect noise data from different kart movements inclusion of tyre noise, skidding noise and braking noise. To allow a conservative assessment, the highest $L_{eq,5\ min}$ among different kart movements has been taken to predict the sound pressure level at the identified NSRs. A summary of the noise measurement results is presented in *Table 5.5*. *Annex B* presents the $L_{eq,\ 500ms}$ time history measured at the different measurement locations.

As PA system at the karting track will be similar to the PA system at Kartodromo de Coloane, noise measurement was also conducted for the PA system during announcement period only and the measured $L_{eq,\ 8\ sec}$ at 3m from the PA system (with two speakers) is 86.2 dB(A). The sound power level of the PA system is 104 dB(A). The PA system was used occasionally and it is assumed that the PA system will be used 5 minutes in every 30 minutes.

Table 5.5 Summary of Noise Measurement for Kart Track Operation

Source	**Distance from source, m**	**Leq, $_{5\ min}$[(1)(2)], dB(A)**	**Calculated Leq, $_{5\ min}$ at 1 meter , dB(A)**	**Remarks**
Kart Movement (13 karts running at high speed)	3	85.2	94.7	Measurement taken in front of a straight section of the track
	2.5	82.6	90.6	Measurement taken in front of a 90° turning section
	5	84.2	98.2	Measurement taken in front of a 120° turning section
	4	85.1	97.1	Measurement taken in front of a 180° turning section

Source	Distance from source, m	Leq, 5 min(1)(2), dB(A)	Calculated Leq, 5 min at 1 meter , dB(A)	Remarks

Remarks:
1) Noise measurement was conducted with reference to the calibration and measurement procedures as stated in the *Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites* (IND-TM). Immediately prior to and following each noise measurement the accuracy of the monitoring equipment was checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements were accepted as the calibration level from before and after the noise measurement agree to within 1.0 dB. Noise measurements were made without the presence of fog and rain, and with steady wind speed and gusts not exceeding 5m/s and 10m/s, respectively.
2) The background noise levels are in the range of 46 - 54dB(A), and therefore the influence of background noise will not be included in the measurement results.

Based on the measured noise data from a kart racing, the measured noise levels show regular pattern over the measured time period, and therefore the measured $L_{eq,5\ min}$ represents a 30-minute continuous kart movement. In addition, for a conservative assessment, the maximum $L_{eq,5\ min}$ of 98.2 dB(A) for the 13-kart movement will be adopted in the prediction of operational noise impact.

5.5 ASSESSMENT METHODOLOGY

5.5.1 Construction Phase

The methodology for the noise impact assessment is in accordance with the procedures outlined in the *GW-TM*, which is issued under the *NCO* and the *EIAO-TM*. In general, the methodology is as follows:

- locate representative NSRs that may be affected by the works;
- determine the plant teams for corresponding activities, based on agreed plant inventories;
- assign sound power levels (SWLs) to the PME proposed based on the *GW-TM* or other sources;
- calculate the correction factors based on the distance between the NSRs and the notional noise source position of the work sites;
- apply corrections in the calculations such as potential screening effects and acoustic reflection, if any; and
- predict the construction noise levels at NSRs in the absence of any mitigation measures.

The total SWL associated with each activity was based on an assumed plant inventory, agreed with the Project Proponent. The notional source position of the work site was established in accordance with the procedures stated in the *GW-TM*. Noise impacts at NSRs were subsequently evaluated by comparing the predicted noise levels with the *EIAO-TM* daytime construction noise limits ($L_{eq,\ 30min}$ dB(A)), as outlined in *Section 5.2.1*.

5.5.2 Operational Phase

The methodology for the noise impact assessment is in accordance with the procedures outlined in the *IND-TM,* which is issued under the *NCO* and the *EIAO-TM*. The assessment will take into account the distance attenuation, barrier attenuation and corrections of operation mode in accordance with the IND-TM.

To assess the worst-case noise impact from the karting track, the maximum noise emission of the kart has been taken in the assessment.

5.5.3 Evaluation of Impacts

Construction Phase

Based on the notional source position as identified in accordance with the procedures stated in the *GW-TM*, the source-to-NSR distances are presented in *Table 5.6*.

Table 5.6 Noise Sensitive Receivers

NSR	Location	Approx. Horizontal Distance to Source (m)
N1	No. 32 Pak Long	1153

Based on existing topography, the NSRs do not have direct line of sight to the construction site. Therefore, with reference to the *GM-TM*, a negative correction of 10 dB(A) has been included in the construction noise assessment.

Without the use of mitigation measures, predicted construction noise levels at all NSRs during all construction stages will comply with the stipulated criterion. Details of the calculations are presented in *Annex A*. A summary of the construction noise levels is presented in *Table 5.7*. As confirmed by the Project Proponent, there will not be overlapping periods between each construction activities. Hence cumulative noise impact during the construction period will not be a concern. Given that the predicted construction noise levels are well within the stipulated noise criterion, mitigation measures are not required to alleviate the noise impacts.

Table 5.7 Construction Noise Levels - Unmitigated ($L_{eq, 30\ min}$ dB(A))

	Construction Noise Levels at Different Stages, $L_{eq, 30\ min}$ dB(A)	
NSRs	**Site Formation**	**Track Paving**
N1	37	35

Operational Phase

Based on the maximum sound pressure level of $L_{eq, 5min}$ 98.2 dB(A) at 1m for 13-kart movement, the facade noise levels at the identified NSRs are predicted and summarised in *Table 5.8*. Results indicate that the nearest NSR (N1), which are shielded by the existing topography, will be subject to noise level of 35 dB(A). Details of the calculations are presented in *Annex B*.

Table 5.8 Predicted Facade Noise Levels at NSRs

NSRs	Description	Predicted Facade Noise Level, dB(A)
N1	No. 32 Pak Long	35

Results indicated that the predicted facade noise levels will comply with the day-time (ANL-5) noise criterion of 55 dB(A) at all NSRs.

5.6 MITIGATION MEASURES

5.6.1 Construction Phase

Though the predicted construction noise levels comply with the stipulated noise criterion, good site practice and noise management is recommended for minimising the construction noise impact on nearby NSRs, including:

- Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction works;
- Machines and plant that may be use intermittently, such as vibratory poker, should be shut down between work periods or should be throttled down to a minimum;
- Plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from nearby NSRs; and
- Mobile plant should be sited as far away from NSRs as possible.

5.6.2 Operational Phase

The noise assessment indicated that based on the maximum sound pressure level of 98 dB(A) at 1 m for 13-kart movement, the predicted facade noise levels for a maximum of 40-kart event will comply with the day-time noise criterion at the nearest NSRs. No mitigation measures are required.

5.7 ENVIRONMENTAL MONITORING AND AUDIT

5.7.1 Construction Phase

Given the compliance with the stipulated noise criterion, noise monitoring is not required during the construction stage.

5.7.2 Operational Phase

Given the compliance with the stipulated noise criterion, noise monitoring is not required during the operation stage.

5.8 CONCLUSION

Due to the large separation distances, unmitigated construction activities associated with the Project will not cause adverse noise impact at the NSRs. The predicted construction noise levels are in the range of 35 – 37 dB(A), which complied with the stipulated noise criterion.

Based on the worst case scenario by adopting a maximum sound pressure level of 98 dB(A) at 1 m for 13-kart movement, the predicted facade noise levels for a maximum of 40-kart event is well below the daytime noise criterion of 55 dB(A) at all NSRs located at more than 1km from the site boundary.

Given the NSRs located at more than 1km and the compliance with the stipulated noise criteria, noise monitoring during the construction and operational phase is not required.

6 WATER QUALITY

6.1 INTRODUCTION

This section presents the water quality impact assessment for the construction and operational phases of the Project. As the construction works of the Project will be land-based, direct impacts on water quality will not arise. Nevertheless, the construction of the tracks would generate surface run-off and wastewater which may cause adverse water quality impacts if not properly controlled or mitigated. Appropriate mitigation measures and environmental monitoring and audit, if necessary, are recommended.

6.2 LEGISLATION REQUIREMENT AND EVALUATION CRITERIA

The *Water Pollution Control Ordinance (WPCO), Environmental Impact Assessment Ordinance (Cap. 499. S.16)* and *Annexes 6 and 14* of *Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM)* are applicable to the evaluation of water quality impacts associated with the Project, whereas *Annexes 6* and *14* of the *EIAO-TM* provide general guidelines and criteria to be used in assessing water quality issues.

Apart from the above statuary requirements, the Practice Note for Professional Persons, *Construction Site Drainage* (ProPECC PN 1/94) and *Drainage Plan subject to comment by the Environmental Protection Department* (ProPECC PN 5/93), issued by EPD, also provides useful guidelines on the management of construction site drainage and prevention of water pollution associated with construction activities.

6.3 BASELINE CONDITIONS AND AIR SENSITIVE RECEIVERS

6.3.1 Baseline Conditions

The proposed karting track is located at Lung Kwu Sheung Tan which is a rural area with open storage and several plastics recycling factories located to the west of the site. There are no watercourses passing through the site. Instead, there is one open drainage channel located to the west of the site.

6.3.2 Water Sensitive Receivers

In order to evaluate the water quality impacts resulting from the construction and operation of Project, the proximity of Water Sensitive Receivers (WSRs) must be considered. WSRs have been identified in accordance with HKPSG as well as the *EIAO-TM*, which provide criteria for identifying environmental factors influencing development planning.

There were no water sensitive receivers identified within 300 m of the Project site boundary.

6.4 POTENTIAL SOURCES OF IMPACTS

6.4.1 Construction Phase

As aforementioned, minor site levelling, compacting, track paving works, planting and fence installation are the major construction works and these would take approximately two months. Therefore, potential sources of water quality impacts associated with the construction of the karting tracks comprise:

6.4.2 Construction runoff and drainage;

6.4.3 Runoff from general construction activities; and

6.4.4 Domestic sewage effluent produced by the on-site construction workers.

6.4.5 Operational Phase

Potential sources of water quality impact during operation of the Project include:

- Surface runoff and drainage; and
- Domestic sewage effluent produced by the operators and visitors.

6.5 ASSESSMENT OF WATER QUALITY IMPACTS

6.5.1 Construction Phase

Construction Runoff and Drainage

Runoff and drainage from construction sites may contain considerable loads of suspended solids and contaminants. Potential sources of water pollution from site runoff include:

- Runoff and erosion of exposed bare soil and earth, drainage channels and stockpiles;
- Release of cement materials with rain wash;
- Wash water from dust suppression sprays and vehicle wheel washing facilities; and
- Fuel, oil, and lubricant from maintenance of construction vehicles and mechanical equipment.

Local and coastal water pollution will be substantial if the construction site runoff is allowed to drain into the storm sewer or natural drainage without mitigation. Nevertheless, with the proper implementation of the good site practices and housekeeping, as to be discussed in *Section 6.6.1*, unacceptable water quality impacts due to construction runoff and drainage are not expected.

General Construction Site Activities

On-site construction site activates may cause water pollution due to the follows:

- Uncontrolled discharge of debris and rubbish such as packaging, construction waste and refuse etc; and
- Spillages of liquid stored on-site, such as oil, diesel and solvents etc.

The debris and rubbish would probably enter the open drainage channels and cause blockage. The spillage of liquid may also result in water quality impacts if they enter storm water drains or open drainage channels.

However, the effects on water quality from the construction activities are likely to be minimal, provided that site boundaries are well maintained and good construction practices are implemented to ensure that litter, fuel and solvents are managed, stored and handled properly.

Sewage Effluent

Portable chemical toilets will be provided for the site workers. A licensed contractor will be responsible for appropriate disposal and maintenance of these facilities. Therefore, no adverse water quality impacts are anticipated.

6.5.2 Operational Phase

Surface runoff and drainage

The main identified source of potential impact on water quality during the operation phase will be runoff from the road surfaces. There would be a vehicle and plant servicing area at where maintenance of karts and petrol re-fuelling activities would take place. With this context, the road runoff may contain minimal amounts of oil, grease and grit that may cause water quality impacts to the receiving water during rainfall events if uncontrolled.

However, the servicing area and lubrication bays would be located within paved areas. The drainage serving the servicing area and petrol re-fuelling point would be connected to storm drains via a petrol interceptor with peak storm bypass to collect the road runoff contaminants and to avoid the contaminants entering the watercourses. Therefore, it is considered unlikely to produce any quantifiable adverse water quality impacts.

Sewage Effluent

Similar to the construction phase, four portable chemical toilets will be provided for the visitors. A licensed contractor will be responsible for appropriate disposal and maintenance of these facilities. Therefore, no adverse water quality impacts are anticipated.

6.6 MITIGATION MEASURES

6.6.1 Construction Phase

The following mitigation measures should be implemented during the construction of the karting track:

Construction Runoff and Drainage

6.6.2 Construction site runoff and drainage should be prevented or minimized in accordance with the guidelines stipulated in the EPD Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94). The practices include the following items:

- Provision of perimeter channels to intercept storm-runoff from outside the site. These shall be constructed in advance of site formation works and earthworks.
- Exposed soil surface shall be covered by tarpaulin as soon as possible to reduce the potential of soil erosion.
- Open stockpiles of construction materials on site shall be covered with tarpaulin or similar fabric during rainstorms.

General Construction Activities

Debris and rubbish generated on-site shall be collected, handled and disposed of properly to avoid entering the nearby stormwater drains and open drainage channels. All fuel tanks and storage areas shall be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. Open storm water drains and culverts near the works area shall be covered to block the entrance of large debris and refuse.

Sewage from Workforce

Temporary sanitary facilities, such as portable chemical toilets, shall be employed at the areas where the temporary connection is not feasible. A licensed contractor would be responsible for appropriate disposal and maintenance of these facilities.

6.6.3 Operational Phase

Although no unacceptable water quality impact is anticipated during the operational phase, the following measures are recommended:

Surface Runoff

- Maintenance of karts should be performed regularly to avoid leakage of fuel on tracks; and
- Proper handling of petrol storage tank to avoid leakage of petrol.

- Drainage serving the open petrol re-fuelling point should be connected to storm drains via a petrol interceptor with peak storm bypass.

- The servicing areas should be located within roofed areas and concrete paved area. The drainage in the concrete paved areas should be connected to foul sewers via a petrol interceptor. 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*.

Sewage Effluent

Four portable chemical toilets will be provided for the visitors. A licensed contractor would be responsible for appropriate disposal and maintenance of these facilities.

6.7 ENVIRONMENTAL MONITORING AND AUDIT

6.7.1 Construction Phase

No water quality monitoring is required as no unacceptable water quality impact is expected.

6.7.2 Operational Phase

No operational water quality monitoring is required as no adverse water quality impact is anticipated.

6.8 CONCLUSIONS

Given the small scale of the construction works, short duration of construction period and no identified WSRs within the study area, water quality impacts are negligible and minimal during construction phase of the Project provided that good site practices and housekeeping are implemented as suggested in *Section 6.6.1*. Hence, it is considered that no water quality monitoring would be necessary to carry out during construction phase.

For the operation of karting, the main concern is the water quality impact may be caused by the servicing and petrol re-fuelling activities. Nevertheless, the surface runoff can be well controlled by adoption of a proper drainage system with peripheral channel and petrol interceptor. Addition to the proper handling of petrol tank and re-fuelling and regular maintenance of karts, no adverse water quality impacts are anticipated. Therefore, it is suggested that no operational water quality monitoring would be required.

7 WASTE MANAGEMENT ASSESSMENT

7.1 INTRODUCTION

This section identifies the potential wastes arising from the construction and operation of the Project. The potential environmental impacts associated with the handling and disposal of waste arising from the Project are assessed in accordance with the criteria presented in *Annexes 7* and *15* of the *EIAO-TM*, which are summarised as follows:

- Evaluate opportunities for reduce, reuse and recycle of waste;
- Estimation of the types and quantities of the wastes to be generated; and
- Assessment of the secondary environmental impacts due to the management of waste with respect to potential hazards, air and odour emissions, noise, wastewater discharges and traffic.

7.2 LEGISLATION REQUIREMENT AND EVALUATION CRITERIA

The following discussion on legislative requirements and evaluation criteria applies to both the construction and operational phases of the Project. The following legislation covers, or has some bearing upon, the handling, treatment and disposal of wastes in Hong Kong, and will also be considered in the assessment.

- *Waste Disposal Ordinance (Cap 354);*
- *Waste Disposal (Chemical Waste) (General) Regulation (Cap 354C);*
- *Land (Miscellaneous Provisions) Ordinance (Cap 28)*; and
- *Public Health and Municipal Services Ordinance (Cap 132) - Public Cleansing and Prevention of Nuisances Regulation.*

7.2.1 *Waste Disposal Ordinance (Cap 354)*

The *Waste Disposal Ordinance* (WDO) prohibits the unauthorised disposal of wastes, with waste defined as any substance or article, which is abandoned. Under the *WDO*, wastes can only be disposed of at a licensed site. A breach of these regulations can lead to the imposition of a fine and / or a prison sentence. The *WDO* also provides for the issuing of licences for the collection and transport of wastes. Licences are not, however, currently issued for the collection and transport of construction waste or trade waste.

The *Waste Disposal (Charges for Disposal of Construction Waste) Regulation* defined construction waste as any substance, matters or things that is generated from construction work and abandoned, whether or not it has been processed or stockpiled before being abandoned, but does not include any sludge, screening or matter removed in or generated from any desludging, desilting or dredging works.

The Construction Waste Disposal Charging Scheme will come into operation on 1 December 2005. Processing of account applications by the EPD will start on the same day. Starting from 1 December 2005, main contractor who undertakes construction work under a contract with value of $1 million or above is required to open a billing account solely for the contract. Application shall be made within 21 days after the contract is awarded. Failing this will be an offence under the law.

For construction work under a contract with value less than $1 million, such as minor construction or renovation work, any person such as the owner of the premises where the construction work takes place or his/her contractor can open a billing account; the account can also be used for contracts each with value less than $1 million. The premises owner concerned may also engage a contractor with a valid billing account to make arrangement for disposal of construction waste.

Charging for disposal of construction waste will start on 20 January 2006 and from this day, any person before using waste disposal facilities for disposal of construction waste needs to open an account.

Construction work contracts awarded or tenders of which closed before 1 December 2005 are eligible for exemption from charges. Application for exemption account must be made on or before 22 December 2005. Depending on the percentage of inert materials in the construction waste, construction waste can be disposed at public fill, sorting facilities, landfills and outlying islands transfer facilities where different disposal cost would be applied. The scheme encourages reduce, reuse and sorting of construction waste such that the waste producer can minimise their disposal fee. *Table 7.1* summarises the government construction waste disposal facilities, types of waste accepted and disposal cost.

Table 7.1 Government Waste Disposal Facilities for Construction Waste

Government Waste Disposal Facilities	Type of Construction Waste Accepted	Charge Per Tonne
Public fill reception facilities	Consisting entirely of inert construction waste	$27
Sorting facilities	Containing more than 50% by weight of inert construction waste	$100
Landfills	Containing not more than 50% by weight of inert construction waste	$125
Outlying Islands Transfer Facilities	Containing any percentage of inert construction waste	$125

7.2.2 Waste Disposal (Chemical Waste) (General) Regulation

Chemical waste as defined under the *Waste Disposal (Chemical Waste) (General) Regulation* includes any substance being scrap material, or unwanted substances specified under *Schedule 1* of the *Regulation*, if such a substance or chemical occurs in such a form, quantity or concentration so as to cause

pollution or constitute a danger to health or risk of pollution to the environment.

A person should not produce, or cause to be produced, chemical wastes unless he is registered with the EPD. Any person who contravenes this requirement commits an offence and is liable to a fine and imprisonment. Producers of chemical wastes must treat their wastes, utilising on-site plant licensed by the EPD or have a licensed collector take the wastes to a licensed facility. For each consignment of wastes, the waste producer, collector and disposer of the wastes must sign all relevant parts of a computerised trip ticket. The system is designed to allow the transfer of wastes to be traced from cradle-to-grave.

The *Regulation* prescribes the storage facilities to be provided on site including labelling and warning signs. To minimise the risks of pollution and danger to human health or life, the waste producer is required to prepare and make available written procedures to be observed in the case of emergencies due to spillage, leakage or accidents arising from the storage of chemical wastes. He/she must also provide employees with training in such procedures.

7.2.3 Land (Miscellaneous Provisions) Ordinance (Cap 28)

The inert portion of C&D materials (1) (also called public fill) may be taken to public filling areas. Public filling areas usually form part of land reclamation schemes and are operated by the Civil Engineering and Development Department (CEDD) and others. The *Land (Miscellaneous Provisions) Ordinance* requires that individuals or companies who deliver public fill to the public filling areas obtain Dumping Licences. The licences are issued by the CEDD under delegated authority from the Director of Lands.

Individual licences and windscreen stickers are issued for each vehicle involved. Under the licence conditions, public filling areas will accept only inert building debris, soil, rock and broken concrete. There is no size limit on rock and broken concrete, and a small amount of timber mixed with inert material is permissible. The material should, however, be free from marine mud, household refuse, plastic, metal, industrial and chemical wastes, animal and vegetable matter and any other materials considered unsuitable by the public filling supervisor.

7.2.4 Public Cleansing and Prevention of Nuisances Regulation

This *Regulation* provides a further control on the illegal dumping of wastes on unauthorised (unlicensed) sites. The illegal dumping of wastes can lead to a fine and imprisonment.

(1) "C&D materials" refers to materials arising from any land excavation or formation, civil/building construction, road works, building renovation or demolition activities. It includes various types of reusable materials, building debris, rubble, earth, concrete, timber and mixed site clearance materials. When sorted properly, materials suitable for land reclamation and site formation (known as public fill) should be reused at public filling area. The rock and concrete can be crushed and processed to produce aggregates for various civil and building engineering applications. The remaining C&D waste (comprising timber, paper, plastics, general refuse) are to be disposed of at landfills.

7.2.5 Other Relevant Guidelines

Other 'guideline' documents, which detail how the Contractor should comply with the regulations are as follows:

- *Waste Disposal Plan for Hong Kong* (December 1989), Planning, Environment and Lands Branch Government Secretariat, Hong Kong Government;
- *Environmental Guidelines for Planning In Hong Kong* (1990), Hong Kong Planning Standards and Guidelines, Hong Kong Government;
- *New Disposal Arrangements for Construction Waste* (1992), EPD & CED, Hong Kong Government;
- *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes* (1992), EPD, Hong Kong Government;
- *Works Branch Technical Circular (WBTC) No. 32/92, The Use of Tropical Hard Wood on Construction Site*; Works Branch, Hong Kong Government;
- *WBTC No. 2/93, Public Dumps.* Works Branch, Hong Kong Government;
- *WBTC No. 2/93B, Public Filling Facilities*, Works Branch, Hong Kong Government;
- *Waste Reduction Framework Plan, 1998 to 2007*, Planning, Environment and Lands Bureau, Government Secretariat, 5 November 1998;
- *WBTC Nos. 25/99, 25/99A* and *25/99C, Incorporation of Information on Construction and Demolition Material Management in Public Works Sub-committee Papers*; Works Bureau, Hong Kong SAR Government;
- *WBTC No. 12/2000, Fill Management*; Works Bureau, Hong Kong SAR Government;
- *ETWBTC No. 33/2002, Management of Construction and Demolition Material Including Rock*; Environment, Transport and Works Bureau, Hong Kong SAR Government;
- *ETWBTC No. 15/2003, Waste Management on Construction Sites;* Environment, Transport and Works Bureau, Hong Kong SAR Government; and
- *ETWBTC No. 31/2004, Trip Ticket System for Disposal of Construction & Demolition Materials*, Environment, Transport and Works Bureau, Hong Kong SAR Government.

7.3 EXPECTED WASTE ARISINGS

7.3.1 Construction Phase

During the construction phase, the main activities, which will potentially result in the generation of waste, include site clearance, excavation, track

paving, and renovation of the existing vacant village house for office use. The typical waste types associated with these activities include:

- Construction and Demolition Materials (C&DM);
- Chemical waste;
- Sewage; and
- General refuse.

7.3.2 Operational Phase

The following wastes will be generated from the operation of the karting track:

- Chemical waste;
- Sewage; and
- General refuse.

7.4 WASTE IMPACT ASSESSMENT

7.4.1 Construction Phase

C&D Materials

The proposed development site is currently dominated by wasteland (see *Figure 7.1*). Site clearance will be required before track paving, but no excavation or slope cutting will be involved. Site clearance waste, which mainly comprised vegetation, will be produced. The maximum quantity to be generated is expected to be less than 10m^3 which should be disposal of to WENT Landfill. About 20m^3 of inert construction materials, including concrete, brick, rubble, sand etc., are currently dumped on site (see *Figure 7.2*). These materials will be reused on-site.

An existing vacant village house within the site boundary will be renovated and used as the office of the karting track without any modification of the structure (see *Figure 7.3*). A small amount of construction waste (expected to be less than one truck load, ie < 7 m^3) consisting of packing materials, plastics, metal, concrete, wood etc will be produced which should be sorted on-site for recycling or disposal of at landfill. The kart maintenance yard / store rooms are to be built by ISO containers. No demolition of existing buildings or new building construction works will be required and hence construction waste generation will be minimal.

Figure 7.1 Current Site Condition

Figure 7.2 Construction Material Dumped Onsite

Figure 7.3 Existing Vacant Village House

The 900 m long and 8 m wide karting track will be paved by asphaltic concrete and an area of 3,500 m^2 of the site will be paved by concrete. It is estimated that not more than 20m^3 of inert construction waste (or public fill) will be generated. The public fill should be transported to public filling facilities (ie the Tuen Mun Area 38 Public Fill) for reuse.

In view of the relative small scale of the Project and the nature of construction activities, potential environmental (ie noise, dust, and water quality) and traffic impacts arising from handling and disposal of the C&D materials will be minimal provided that good construction site practices and mitigation measures recommended in *Section 7.5* are properly implemented.

Chemical Wastes

Chemical waste, as defined under the *Waste Disposal (Chemical Waste) (General) Regulation*, includes any unwanted substances specified under *Schedule 1* of the *Regulation*. Substances likely to be generated from the construction of the karting track may include:

- Residual paint from building renovation; and
- Used lubricant oil from construction plants.

Chemical wastes may pose environmental, health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the *Waste Disposal (Chemical Waste) (General) Regulation* and the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.* These hazards may include:

- Toxic effects to workers;
- Adverse effects on air, water and land from spills; and
- Fire hazards.

It is not possible to quantify the amount of chemical waste which will arise from the construction activities since it will be highly dependent on the Contractor's on-site operation and maintenance requirements. In the view of the small scale of the Project, it is expected that the amount of chemical waste (eg left over paints and used lubricant oil) to be generated will be in the order of a few litres. With the incorporation of suitable arrangements for the storage, handling, transportation and disposal of chemical wastes under the requirements stated in the *Code of Practice on the Packaging, Labelling and Storage of Chemical Waste*, no adverse environmental and health impacts will result from the handling, transportation and disposal of a small quantity of chemical waste arising from the Project.

Sewage

Sewage will arise from the construction workforce and night soil from chemical toilets. If not properly managed, these materials could cause odour and potential health risks to the workforce by attracting pests and other disease vectors.

An adequate number of portable toilets will be provided at the site to ensure that sewage from site staff is properly collected. No adverse environmental impacts are envisaged provided that the portable toilets are properly maintained by a licensed contractor and the collected sewage is disposed at the designated Sewage Treatment Works (eg Pillar Point Sewage Treatment Works).

General Refuse

The presence of a construction site with workers and associated site office will result in the generation of a variety of general refuse requiring disposal. General refuse will mainly consist of food waste, aluminium cans and waste paper.

The storage of general refuse has the potential to give rise to adverse environmental impacts. These include odour if the waste is not collected frequently (for example, daily), windblown litter, water quality impacts if waste enters water bodies, and visual impact. The site may also attract pests, vermin, and other disease vectors if the waste storage areas are not well maintained and cleaned regularly. In addition, disposal of wastes at sites other than licensed landfills, can also lead to similar adverse impacts at those sites.

It is estimated that a maximum of about 30 workers will be working at the site at any one time. The amount of general refuse to be generated will be about 19.2 kg per day. Recyclable materials (ie paper, plastic bottle and aluminium can) should be separated and disposed of at the recycling bins (ie the Government 3 bins recycling programme) in order to minimise the amount of general refuse to be disposed of at landfill. Provided that the mitigation measures recommended in *Section 7.5.4* are adopted, the environmental impacts caused by the storage, handling, transport and disposal of general refuse are expected to be negligible.

The potential traffic associated with the off-site disposal of construction waste, chemical waste, sewage and general refuse will be less than 4 vehicles per day. It is not anticipated that it will cause adverse traffic impact to the local road network.

7.4.2 Operational Phase

Chemical Waste

No major maintenance works will be conducted on-site. Karts operation will be the primary source of chemical waste which may include lubricants, chain oil, and brake cleaner. From the past experience of HKKC and the number of karts operated on-site, the quantity of chemical waste to be generated will be in the order of 3 m^3 per month. Provided that the handling, storage and disposal of chemical wastes are in accordance with the *Code of Practice on the Packaging, Labelling and Storage of Chemical Waste*, adverse environmental impacts would not be expected. Detailed mitigation and control requirements are listed in *Section 7.5*.

Sewage

Sewage will arise from the operation staff and visitors. 4 mobile toilets would be provided for the use of staff and visitors to ensure that all sewage are properly collected. It is anticipated that about 20 of staff and maximum 200 visitors will use the site per day. The maximum quantity of sewage to be generated will be about 6.2 m^3 per day. No adverse environmental impacts are envisaged provided that the portable toilets are properly maintained by a licensed contractor and the collected sewage is disposed at the designated Sewage Treatment Works.

General Refuse

General refuse will arise from the operation staff and visitors. General refuse may consist of food waste, plastic, aluminium can and waste paper. Based on the number of staff and visitor using the site, it is estimated that maximum 140 kg of general refuse will be generated per day. Recyclable materials (ie paper, plastic bottle and aluminium can) should be separated and disposed of at the recycling bins (ie the Government 3 bins recycling programme) in order to minimise the amount of general refuse to be disposed of at landfill. The non-recyclable general refuse should be disposed of at the nearest refuse collection point on a daily basis. With respect to the small quantity of general refuse to be disposed of, no adverse environmental impact associated with the handling and disposal of the refuse is anticipated.

The potential traffic associated with the off-site disposal of chemical waste, sewage and general refuse will be less than 3 vehicles per day. It is not anticipated that it will cause adverse traffic impact to the local road network.

7.5 MITIGATION MEASURES

This section recommends the mitigation measures or good practices to avoid or minimize potential adverse environmental impacts associated with handling, collection and disposal of waste arising from the construction and operation of the proposed karting track.

It is the Contractor's responsibility to ensure that only reputable licensed waste collectors are used and that appropriate measures to minimize adverse impacts, including windblown litter and dust from the transportation of these wastes, are employed. In addition, the Contractor must ensure that all the necessary waste disposal permits are obtained for the construction and operational phases.

7.5.1 C&D Materials

Wherever practicable, inert materials should be segregated from other wastes to avoid contamination thereby ensuring acceptability at public filling areas and avoiding the need for disposal at landfill.

Measures taken in the Planning Design Stages to Reduce the Generation of C&DM

The various waste management options can be categorized in terms of preference from an environmental viewpoint. The options considered to be more preferable have the least impacts and are more sustainable in the long term. Hence, the waste management hierarchy is as follows:

- Avoidance and minimization, that is, reduction of waste generation through changing or improving practices and design;
- Reuse of materials, thus avoiding disposal (generally with only limited reprocessing);
- Recovery and recycling, thus avoiding disposal (although reprocessing may be required); and
- Treatment and disposal, according to relevant law, regulations, guidelines and good practice.

This hierarchy should be used to evaluate the waste management options, thus allowing maximum waste reduction and often reduced disposal costs. Records of quantities of wastes generated, recycled and disposed (locations) shall be kept.

Recommended Construction Phase Measures for the Reduction of C&DM Generation

The Contractor should recycle as much of the C&DM as possible on-site. Public fill and construction waste should be segregated and stored in different containers or skips to facilitate reuse or recycling of materials and their proper disposal. Surplus public fill should be delivered to the adjacent Tuen Mun Area 38 Fill Bank or Tuen Mun Area 38 Temporary Construction Waste Sorting Facility for proper reuse while the construction waste should be delivered to the WENT Landfill.

7.5.2 Chemical Waste

The Contractor for the construction works and the operator of the karting track should be registered with the EPD. Chemical waste should be handled in accordance with the *Code of Practice on the Packaging, Handling and Storage of Chemical Wastes* as follows. Containers used for storage of chemical wastes should:

- be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed;
- have a capacity of less than 450 L unless the specifications have been approved by the EPD; and
- display a label in English and Chinese in accordance with instructions prescribed in *Schedule 2* of the *Regulations*.

The storage area for chemical wastes should:

- be clearly labelled and used solely for the storage of chemical waste;

- be enclosed on at least 3 sides;
- have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area, whichever is the greatest;
- have adequate ventilation;
- be covered to prevent rainfall entering (water collected within the bund must be tested and disposed of as chemical waste, if necessary); and
- be arranged so that incompatible materials are appropriately separated.

Disposal of chemical waste should be:

- via a licensed waste collector; and
- to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Facility which also offers a chemical waste collection service and can supply the necessary storage containers.

7.5.3 Sewage

An adequate number of portable toilets should be provided for the on-site construction workforce. 4 mobile toilets would be provided for the use of visitors during operational phase. All portable toilets should be maintained in a state that will not deter the users from using them. Night soil should be regularly collected by a licensed collector for disposal at the Pillar Point Sewage Treatment Works.

7.5.4 General Refuse

General refuse should be stored in enclosed bins separately from construction and chemical wastes. Recyclables (ie paper and aluminium can and plastic bottles) should be stored separately to facilitate subsequent recycling. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from construction and chemical wastes, on a daily basis to minimise odour, pest and litter impacts. The burning of refuse on construction sites is prohibited by law.

7.5.5 Management of Waste Disposal

The contractor should open a billing account with EPD in accordance with the *Waste Disposal (Charges for Disposal of Construction Waste) Regulation* for the payment of disposal charges. Every waste load transferred to government waste disposal facilities such as public fill, sorting facilities, landfills or transfer station would required a valid "chit" which contain the information of the account holder to facilitate waste transaction recording and billing to the waste producer. A trip-ticket system should also be established in accordance with *Works Bureau Technical Circular No.31/2004* to monitor the disposal of solid wastes at transfer station / landfills, and to control fly-tipping.

The billing "chit" and trip-ticket system will be included as one of the contractual requirements and implemented by the contractor.

A recording system for the amount of waste generated, recycled and disposed of (including the disposal sites) should be established during the construction stage.

7.5.6 Staff Training

Training should be provided to workers on the concepts of site cleanliness and on appropriate waste management procedures, including waste reduction, reuse and recycling at the beginning of the Contract.

7.6 RESIDUAL ENVIRONMENTAL IMPACTS

With the implementation of the recommended mitigation measures, minimal residual impacts are anticipated from the construction and operation of the karting track.

7.7 CONCLUSIONS

The anticipated quantities of C&D materials to be generated from site clearance and building renovation, and chemical wastes, sewage and general refuse to be generated during both the construction and operational phases will be minimal. With the implementation of the recommendations in *Section 7.5*, the storage, handling, collection, transport and disposal of C&D materials, chemical waste, sewage and general refuse will not cause adverse environmental impact with respect to the criteria specified in the *EIAO-TM* and traffic impact to local road network.

8 LAND CONTAMINATION

8.1 INTRODUCTION

This section presents the potential hazard and land contamination issues and impacts associated with the operation of the Project, including karting activities, re-fuelling activities and the repair and maintenance activities to be carried out on site. This section identifies potential sources of hazard and land contamination and where appropriate, proposes mitigation measures.

8.2 LEGISLATIVE REQUIREMENTS AND EVALUATION CRITERIA

Assessments of land contamination are guided by the EPD's guidance document the *Technical Memorandum on Environmental Impact Assessment Process (EIAOTM).*

The following legislation, documents and guidelines may also cover or have some bearing upon contamination and the handling, treatment and disposal of contaminated waste in Hong Kong:

- *Waste Disposal Ordinance* (Cap 354);
- *Waste Disposal (Chemical Waste) (General) Regulation* (Cap 354); and
- *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*, Environmental Protection Department (1992).

8.3 POTENTIAL SOURCES OF IMPACTS

8.3.1 Construction Phase

Site levelling, compacting, track paving works, planting and fence installation are the major construction works and these would take approximately two months. Potential sources of land contamination impacts associated with the construction of the karting tracks comprise:

- Use of fuel and lubricants for machinery; and
- Use of paints and improper handling of asphalt.

8.3.2 Operational Phase

Based on the desktop review, site survey and experience from the HKKC, the potential sources of soil and groundwater contamination with specific relevance to the Project were identified as summarised as follows:

- Use of fuel (petroleum) during karting activities and re-fuelling activities; and

- Use of lubricant and solvents during repair and maintenance activities.

In addition, the main operational hazard associated with the karting track is the use of petroleum for the karting activities. Also, it should be noted that all petrol kart drivers must have a licence issued by the HKKC. The licence is issued under the condition that adequate training on kart driving and safety is obtained. All drivers will have to follow standard safety regulations of kart racing.

Not withstanding the above, should there be an accident with fire, all the activities inside the track area will be stopped compulsorily and staff members will perform fire fighting using the extinguisher and / or the fire-fighting sand. Extinguisher and fire-fighting sand will be provided along the karting track at every 100m interval. Extinguishers will also be provided within the service area and the office.

In addition, the karts will be re-fuelled once or twice a day within the service area. As petrol is a highly flammable, explosive and volatile colourless or pale brown liquid, and presents a severe fire and explosion hazard when exposed to heat, flame or oxidisers, only limited quantities of petrol, a standard 18 litre safety petrol tank, will be stored on site during the daytime. A licence dangerous goods (DG) vehicle would transport the petrol tank to site for re-fuelling and the karts will be re-fuelled using hand pump. Any unused petrol will be collected by the DG vehicle after the operating time of the karting track.

8.4 ASSESSMENT OF LAND CONTAMINATION IMPACTS

8.4.1 Construction Phase

Potential sources of land contamination include:

- Use of fuel, oil and lubricants for construction machinery and vehicles;
- Release of grouting and cement materials with rain wash; and
- Wash water from dust suppression sprays and vehicle wheel washing troughs.

Land contamination may result if the construction site runoff and fuel / oil leakages are allowed to drain into the storm sewer or natural drainage. Nevertheless, with the proper implementation of the good site practices and housekeeping, as discussed in *Section 6.6.1*, unacceptable land contamination impacts are not expected.

General Construction Site Activities

On-site construction site activates may cause land contamination due to spillages of liquid stored on-site, such as oil, diesel and solvents etc. The spillage of liquid may result in soil and groundwater contamination.

However, the effects on land contamination from the construction activities are likely to be limited, provided that the site are well maintained and good construction practices are implemented to ensure that oil, fuel and solvents are managed, stored and handled properly.

8.4.2 Operational Phase

Potential leakage of fuel or lubricants during servicing

The main identified source of potential impact on land contamination during the operation phase will be leakage of fuel or lubricants during servicing, maintenance or refuelling activities. There would be a vehicle and plant servicing area and repair / maintenance area at where maintenance of karts and oil filling activities would take place (see *Figure 8.1*). Both the service and repair / maintenance areas will be concrete-paved. In addition, karting activities will be undertaken on asphalt-paved tracks. Any leakage of minimal amounts of oil, grease and grit may cause land contamination if uncontrolled.

Potential operational hazard

As discussed in Section 8.3.2, the main identified source of potential hazard during the operation phase includes re-fuelling of the kart vehicles.

Petrol is a highly flammable, explosive and volatile colourless or pale brown liquid, and presents a severe fire hazard when exposed to heat, flame or oxidisers. If immediately ignited a flammable liquid will form a burning pool whilst delayed ignition of the vapour may result in a flash fire. However, in view of the limited quantities, the potential hazard is not expected to be a concern. However, mitigation measures are recommended to further minimise the risk of any fire hazard.

8.5 MITIGATION MEASURES

8.5.1 Construction Phase

The following mitigation measures should be implemented during the construction of the karting track:

Construction Runoff and Drainage

Construction site runoff and drainage should be prevented or minimized in accordance with the guidelines stipulated in the EPD Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94), so as to prevent any potential spillage of fuel or oils from entering the soil or storm water drains. The practices include the following items:

- Maintenance of heavy-duty machinery shall be minimised and should be carried out off-site.

- Exposed soil surface shall be protected by paving as soon as possible to minimise exposure of soil to potential contaminating sources.

- Provision of perimeter channels to intercept storm-runoff from outside the site. These shall be constructed in advance of site formation works and earthworks.

- The section of the road between the wheel washing facilities and the public road shall be paved with backfall to prevent wash water or other site runoff from entering public road drains.

General Construction Activities

All fuel tanks and storage areas shall be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. Open storm water drains and culverts near the works area shall be covered to block the entrance of large debris and refuse.

8.5.2 Operational Phase

Although no unacceptable land contamination impact is anticipated during the operational phase, the following measures are recommended:

Paving of servicing area

The servicing area, vehicle washing bays, lubrication bays and repair / maintenance area would be properly paved by concrete. In addition, the servicing area should be located within roofed areas. The drainage serving the servicing area and oil filling point would be connected to storm drains via a petrol interceptor with peak storm bypass. Therefore, it is considered unlikely to produce any quantifiable adverse land contamination impacts.

Minimal and controlled re-fuelling activities

From the desktop review and site survey results, the fuel tank capacity of the kart is relatively small, i.e., about 3 litres, and re-fuelling is required once or twice a day. The re-fuelling time would be about 15 seconds. The maximum number of karts allowed on the track for training or rental run is 40 and 34 for match. Given the small tank capacity and infrequent re-fuelling activities, the quantities of petroleum hydrocarbon products to be used on site would be minimal.

All the re-fuelling activities and repair and maintenance activities will be carried out under concrete-paved areas.

Other mitigation measures

- All karting activities should only be undertaken on asphaltic concrete paved tracks.

- Maintenance of karts should be performed regularly to avoid leakage of fuel on tracks;

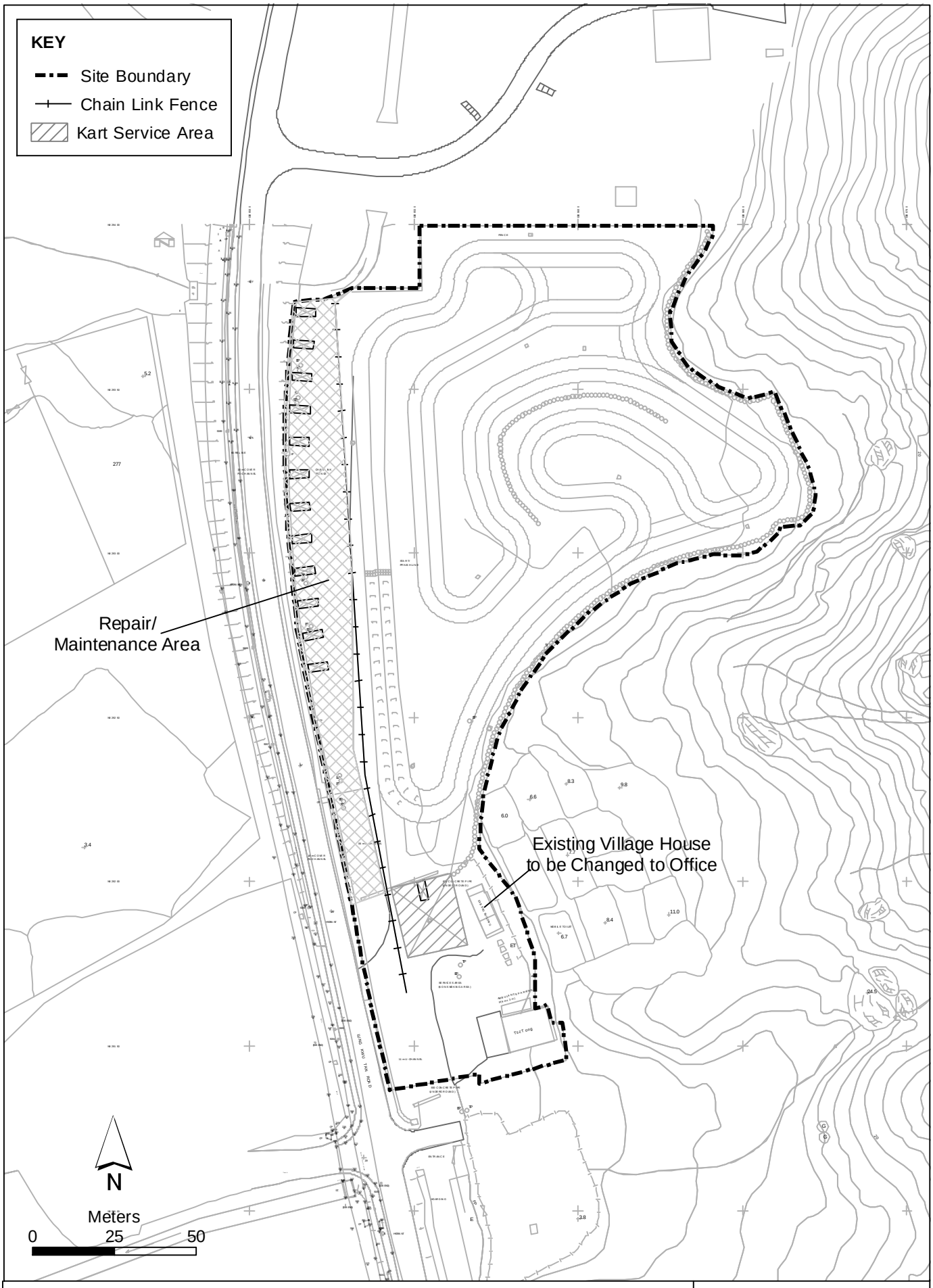

FIGURE 8.1

Site Layout Plan

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- Proper handling of petrol storage tank to avoid leakage of petrol, including the use of a secondary containment of a capacity equal to 110% of the storage capacity of the largest tank and a roof cover to separate rainfall.

- Service area and repair / maintenance area should be concrete-paved.

- Drainage serving the open oil filling point should be connected to storm drains via a petrol interceptor with peak storm bypass.

- Vehicle and plant servicing areas, vehicle wash bays and lubrication bays should be located within roofed areas. The drainage in these covered areas should be connected to foul sewers via a petrol interceptor.

- 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*.

To further minimise the operational hazard associated with the karting track, the following mitigation measures are recommended.

- Smoking is prohibited within the site area;

- Extinguishers and fire-fighting sand are located along the track at 100m interval;

- Extinguishers are provided in the office and the service area;

- Re-fuelling should only be undertaken within the service area;

- Only one tank of petrol with a maximum 18 litre is to be stored in a safety petrol tank within the servicing area;

- No petrol should be stored on site overnight; and

- Maintenance of karts should be performed regularly to avoid leakage of fuel on tracks.

Should there be an accident with fire, all the activities within the track would be stopped compulsorily and staff members will perform fire fighting using the extinguisher and / or the fire-fighting sand.

8.6 ENVIRONMENTAL MONITORING AND AUDIT

8.6.1 Construction Phase

No monitoring on land contamination is required as no unacceptable impact on land contamination is expected.

8.6.2 Operational Phase

No operational monitoring on land contamination is required as no adverse impact on land contamination is anticipated.

8.7 CONCLUSIONS

Given the small scale of the construction works, short duration of construction period and minimal use of heavy-duty construction machinery, fuel and oils, land contamination impacts are negligible during construction phase of the Project provided that good site practices and housekeeping are implemented as suggested in *Section 8.5.1*. Hence, it is considered that no land contamination monitoring would be necessary to carry out during construction phase.

For the operation of the Project, the main concern is the potential land contaminations caused by the karting activities, servicing, repairing and oil filling activities. Nevertheless, all the above activities will be carried out on paved areas. Any leakage can be well controlled by secondary containments or a proper drainage system with peripheral channel and petrol interceptor. With consideration of the infrequent refuelling activities and the minimal amount of fuel handled each time, as well as proper handling of petrol tank, precaution on refuelling activities and regular maintenance of karts, no adverse impacts on land contamination are anticipated. Therefore, it is suggested that no operational land contamination monitoring would be required.

9 LANDSCAPE AND VISUAL IMPACT ASSESSMENT

9.1 INTRODUCTION

This section presents the findings of the landscape and visual impact assessment (LVIA) for the Project and outlines the potential impacts to the existing landscape and visual context of the area together with the mitigation measures proposed to alleviate those impacts.

9.2 RELEVANT LEGISLATION AND GUIDELINES

- The methodology of the LVIA is based on *Annexes 10* and *18* of the *Technical Memorandum on the Environmental Impact Assessment Process* (*EIAO-TM)* under the *EIA Ordinance* (Cap.499, S16), entitled "Criteria for Evaluating Visual and Landscape Impact" and "Guidelines for Landscape and Visual Impact Assessment", respectively. Other relevant documents and guidelines applicable to this assessment are as follows: *EIAO Guidance Note No. 8/2002* "Preparation of Landscape and Visual Impact Assessment Under the Environmental Impact Assessment Ordinance.";
- *The Hong Kong Planning Standards and Guidelines* (HKPSG) Chapter 10 – Conservation;
- *WBTC No. 14/2002* on Management and Maintenance of Natural Vegetation and Landscape Works and Tree Preservation; and
- *WBTC No. 7/2002* on Tree Planting in Public Places.

9.3 ASSESSMENT METHODOLOGY

In accordance with the *EIAO Guidance Note No.8/2002*, the main components of the LVIA will be as follows:

- description of the Project;
- baseline study of landscape and visual resources;
- review of planning and development control framework;
- landscape impact assessment during construction and operation;
- visual impact assessment during construction and operation;
- recommendations for landscape and visual mitigation measures for both construction and operation stage; and
- assessment of residual impact and conclusion on the acceptability of the Project.

9.3.1 Description of the Project

For the LVIA, it is necessary to describe how the proposed karting track fits into the scope of the landscape and visual environment and to indicate what element of the Project may give rise to landscape or visual impacts.

9.3.2 Review of Planning and Development Control Framework

A review of the existing planning studies and documents has been undertaken as part of the assessment to gain and insight into the planned role of the site, its context and to help determine whether the Project fits into the wider existing and future landscape context. A review of the existing and development framework of the site and surrounding areas has been undertaken in order to identify any issue of conflict with the neighbouring planned land uses and to identify the full extent of the 'Visual Sensitive Receivers' (VSRs). For the purpose of this Study, the Outline Zoning Plans (OZPs) form the basis of getting an accurate picture of the future landscape setting and visual context of the Study Area. This will also ensure that the landscape proposals are compatible with the surrounding landscape character context.

9.3.3 Landscape Impact Assessment

The assessment of the potential impacts of the proposed karting track on the existing landscape comprises two distinct sections:

- Baseline survey; and
- Assessment of potential impacts to the existing landscape.

Baseline Survey

A baseline survey of the existing landscape character and resources has been undertaken from site inspections and desktop surveys. As required by the Study Brief (ESB-135/2005), a 100m boundary from the Project Area forms the Study Area for the landscape impact assessment (LIA). The baseline study describes the landscape resources by identifying broadly landscape character areas (LCA) and key landscape elements within the Study Area. The landscape character is rated low, medium or high depending on the quality of elements present, its sensitivity to change and its importance at a local, district, regional or international level.

Landscape Impacts

The assessment of the potential landscape impacts of the proposed karting track will results from the following:

- Identification of the sources of impact, and their magnitude, that would be generated during the operation; and

- Identification of the principal impacts, primarily in consideration of the degree of change to the baseline conditions. The impacts are considered systemically in terms of the landscape elements, the site and its context.

Factors affecting the *magnitude of change* for assessing landscape impacts are:

- Compatibility of the project with the surrounding landscape;
- Scale of the development; and
- Reversibility of change.

The *magnitude of change* is classified as follows:

- *Large* – notable change in the landscape characteristics over an extensive area ranging to very intensive change over a more limited area;
- *Intermediate* – moderate changes to a local area;
- *Small* – changes to components;
- *Negligible* – no perceptible changes.

Factors affecting the sensitivity of change for evaluation of landscape are:

- Quality of landscape characters / resources;
- Importance and rarity of special landscape elements;
- Ability of the landscape to accommodate change;
- Significance of the change in local and regional context; and
- Maturity of the landscape.

The degree of *sensitivity* of the landscape is classified as follows:

- *High* – eg important components or landscape of particularly distinctive character susceptible to small changes;
- *Medium* – eg a landscape of moderately valued characteristics reasonably tolerant to change;
- *Low* – eg a relatively unimportant landscape which is able to accommodate extensive change.

The landscape impact is a product of the magnitude of change which the proposed karting track will create in the existing landscape context and its ability to tolerate the change, ie its quality and sensitivity. The significance threshold is derived from the Significant Threshold of Potential Landscape / Visual Impacts as described in *Table 9.1*. *Table 9.2* explains the terms used in *Table 9.1*.

Table 9.1 Significance Threshold of Potential Landscape/Visual Impact

Magnitude of Change caused by Proposals	**Large**	Moderate Impact	Moderate / Significant Impact	Significant Impact
	Intermediate	Slight / Moderate Impact	Moderate Impact	Moderate / Significant Impact
	Small	Slight Impact	Slight / Moderate Impact	Moderate Impact
	Negligible	Negligible Impact	Negligible Impact	Negligible Impact
		Low	**Medium**	**High**
	Sensitivity to Change			

Table 9.2 Adverse / Beneficial Impact of Landscape / Visual Impact

Significant:	**Moderate:**	**Slight:**	**Negligible**
Adverse / beneficial impact where the proposal would cause significant degradation or improvement in existing landscape baseline conditions	Adverse / beneficial impact where the proposal would cause noticeable degradation or improvement in existing landscape baseline conditions	Adverse / beneficial impact where the proposal would cause a barely noticeable degradation or improvement in existing landscape conditions or where the changes brought about by the project would not be apparent in visual terms	The proposal does not affect the existing landscape baseline conditions

9.3.4 Visual Impact Assessment

The assessment of the potential visual impact of the proposed karting track comprises two distinct parts:

- Baseline visibility survey; and
- Visual impact assessment.

For the visual impact assessment (VIA), the assessment area is defined by the visual envelope, within which the proposed karting track would be visible.

Baseline Survey

The baseline survey of all views towards the proposed karting track is undertaken by identifying:

- The visual envelope which is generally defined by the viewshed formed by natural / manmade features such as buildings and ridgelines; and
- The visual sensitive receivers (VSRs) within the visual envelope whose views will be affected by the proposed karting track.

Visual Sensitive Receivers

The potential receivers are considered as three groups including:

- Views from residences (the most sensitive of receivers due to the high potential of intrusion on the visual amenity and quality of life);
- Views from workplaces (less sensitive then residences due to visual amenity being less important within the work environment); and
- Views from public areas including areas such as Country Parks, recreational grounds, hiking trails, roads, cultural sites (sensitivity of this group depends on the transitory nature of the receiver).

The location and direction of views relative to the scheme also influence the sensitivity of each group. The baseline survey describes and records by photograph typical views from each of the visually sensitive groups within the visual envelope for low-level viewpoints (sea or street levels) and high level viewpoints (hillside vantage points). These will be used as a basis to describe the visual impact. The sensitivity of each VSR is therefore influenced by its location, both in relation to its proximity to the proposed development, and the direction and nature of the view relative to the proposed karting track.

Visual Impact Assessment

The baseline survey has formed the basis of the visual characterisation and quality of the site. The assessment of the potential visual impacts will result from:

- Identification of sources of visual impacts, and their magnitude, that would be generated during the operation; and
- Identification of the principal visual impacts primarily in considerations of the degree of change to the baseline conditions.

The impact assessment will relate to the typical views from the visually sensitive group, as identified previously, and their existing and potential views subsequent to the proposed karting track development. The visual impact will result from the magnitude of change of the baseline conditions. In assessing the magnitude of change, consideration of the following is required:

- Compatibility of the project with the surrounding landscape;
- Scale of the development;
- Reversibility of change;
- Viewing distance;
- Potential blockage of view; and

- Duration of impact under construction and operation phases.

Factors affecting the sensitivity of receivers for the evaluation of visual impacts are:

- Value and quality of existing views;
- Availability and amenity of alternative views;
- Type and estimated number of receiver population;
- Duration of frequency of view; and
- Degree of visibility.

The views available to the identified VSRs are rated in accordance with their sensitivity to change using low, medium or high and are defined as follows:

- High –
    i. The nature of the viewer groups expect a high degree of control over their immediate environment, (eg people residing in their homes); and
    ii. The viewer groups are in proximity to the Project.

- Medium -
    i. The nature of the viewer groups expect a high degree of control over their immediate environment, (eg people residing in their homes); or

The nature of the viewer groups expect some degree of control over their immediate environment, (eg teachers in schools);

    ii. People in transit (eg drivers and passengers in vehicles);
    iii. The transit viewer groups are in proximity to the Project, the others are not.

- Low –
    i. The nature of the viewer groups do not expect a high degree of control over their immediate environment, (eg people at their place of employment or temporarily in attendance at the VSR location); or

As the proposed development is to be located within an area that contains modified landscape areas, both to the north and south of the site, it is reasonable to assume that most transient visitors will have a medium sensitivity as they have already encountered a variety of landscape elements. The users also vary from tourists to truck drivers. Therefore 'medium' has been selected as an average.

The magnitude of change to the view is rated as negligible, small, intermediate or large and are defined as follows:

- *Large*: eg the majority of viewers affected / major change in view.
- *Intermediate*: eg many viewers affected / moderate change in view.
- *Small*: eg few viewers affected / minor change in view.
- *Negligible*: eg very few viewers affected / no discernible change in view.

The degree of visual impact or significance threshold is rated in a similar fashion to the landscape impact, ie significant, moderate, slight and negligible. The impacts may be beneficial or adverse.

Therefore, the visual impact is a product of the magnitude of change to the existing baseline conditions, the landscape context and the sensitivities of VSR's. The significance threshold of visual impact is rated for the construction phase and for Day 1 and Year 10 of the operation phase as described in *Table 9.1*.

9.3.5 Recommended Landscape and Visual Impact Mitigation Measures

The identification of the landscape and visual impacts will highlight those sources of conflict requiring design solutions or modifications to reduce the impacts, and, if possible, blend the development and associated activities in with the surrounding landscape.

Mitigation measures may include revisions / refinement to the engineering design, retention of vegetation, especially tree groups; and / or implementation of landscape design measures including screen tree planting to minimise adverse landscape and visual impacts. Mitigation measures should not be limited to a reduction of negative impacts, but also consider opportunities for visual enhancement. Any designs that enhance the landscape or visual quality should be adopted.

9.3.6 Defining the Residual Impacts

In accordance with Annex 10 of the EIAO-TM, the residual impacts are those, which remain after the proposed mitigation measures have been successfully implemented. The levels of significance threshold is classified as follows:

- The impact is beneficial if the project will complement the landscape and visual character of its setting, will follow the relevant planning objectives and will improve the overall and visual quality of the study area;
- The impact is acceptable if the assessment indicates that there will be no significant effects on the landscape, no significant visual effects caused by the appearance of the project, or no interference with key views;

- The impact is acceptable with mitigation measures if there will be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific measures;

- The impact is unacceptable if the adverse effects are considered too excessive and are unable to mitigate practically; and

- The impact is undetermined if significant adverse effects are likely, but the extent to which they may occur or may be mitigated cannot be determined from the study. Further detailed study will be required for the specific effects in question.

9.4 PROJECT DESCRIPTION

The project will comprise of the construction and operation of an outdoor karting track design to international standard for kart racing. The overall track length is about 900m, in a site of about 1.8 ha. The site is currently approximately 5 mPD and only very minor track levelling will be required. No slope cutting or major site formation is required as part of the construction and no superstructure will be constructed within the site. An existing village house within the site boundary will be used as an office for the karting track and four units of mobile toilets will be provided at the site. Due to the fact that the proposed site is on short term lease arrangement, this limits the options for structures. Thirteen maintenance and storage areas will be constructed on site. These will be constructed from modified ISO containers of 6m long and 2.4m high. The containers will have doors and windows cut into the walls, and will appear as small houses rather than containers that have been dumped on site. The structures will also be painted green to complement the surrounding landscape. *Figure 9.1* below shows an artists impression of the maintenance structures and the detailed design of a typical maintenance structures is shown in *Annex D*.

Figure 9.1 Maintenance Structures

Figure 9.2 Proposed Site Layout

The proposed site layout plan is shown in *Figure 9.2* above. Note that there are no viewing areas or viewing stands proposed.

9.5 REVIEW OF PLANNING AND DEVELOPMENT CONTROL FRAMEWORK

There are currently no OZPs covering the proposed karting track study area (see *Figure 9.3*) and hence potential conflict with future planned land uses

cannot be determined. It is understood through discussion with various government departments and the village representative, that a short term tenancy for a recycling factory has recently been granted and in addition, a few dangerous good (DG) stores are currently under short term tenancy application. As currently a large part of this area is occupied by several plastics recycling factories and open storage for construction plant equipment, it is considered that these planned facilities are compatible with the land use baseline condition of the area. The LVIA will be assessed against the land use baseline conditions of the area as well as the existing landscape baseline conditions and natural landscape setting outlined in *Section 9.6*

Figure 9.3 Coverage of OZPs

9.6 EXISTING LANDSCAPE BASELINE CONDITIONS

9.6.1 Existing Landscape Context

Landscape Character

The site is set at the base of Castle Peak with the coast further to the east. These natural surroundings have been modified by developments such as road works, transmission lines, power stations and storage areas. However, despite these modifications, the site experiences good natural amenity. The new Kart track development should aim to make a positive contribution to the site and the broader area.

The baseline landscape character is mapped and illustrated as Landscape Character Units (LCU) in *Figure 9.4a.* Details are discussed below.

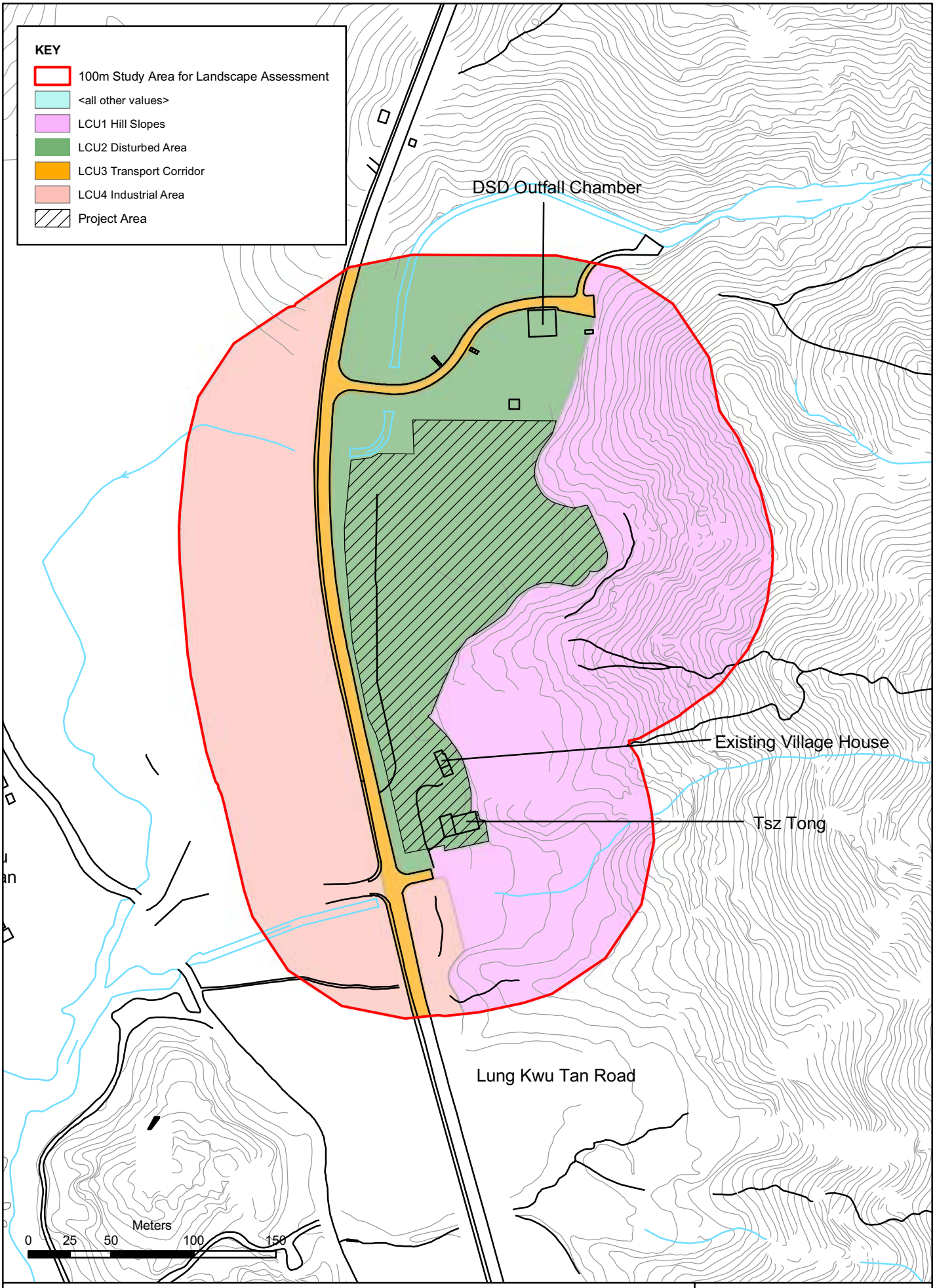

FIGURE 9.4a

Landscape Character Units of the Study Area

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The proposed karting track is located at Lung Kwu Sheung Tan and lies at the based of Castle Peak. It is bounded by the hilly ridges of Castle Peak located to the north, east and south (LCU 1 – hill slopes). The ridges of Castle Peak rises steeply from the proposed site to a height of about 310m PD. Castle Peak is formed of medium grained granite, which tends to generate poor and eroded soil. This is evident from the areas of bare hillside with relatively poor vegetation cover and scattered barren boulders (see *Figure 9.5*). An active orchard was found on the lower slope.

Figure 9.5 Existing landscape features at Lung Kwu Sheung Tan – LCU 1

The general site context for the proposed karting track is shown in *Figure 9.6*. The proposed tracking track occupied most of the disturbed area (LCU 2 – disturbed area), which was dominated by bare land with patches of weed plants occupied the western and the northern areas. Within the proposed site is a 2 storey high village house which will be used as an office for the karting track. In addition, the Tsz Tong (Lau's ancestral hall) will be kept and to be used only by the Lau's family members of Lung Kwu Tan village for private functions (see *Figure 9.7*).

Figure 9.6 Proposed Site for the Karting Track

Figure 9.7 Existing Village House and Tsz Tong Located at the South of the Site

To the west of the site lies the Lung Kwu Tang Road, which is on an embankment (LCU 3 – transport corridor). Located further west, on the other side of the road, is Lung Kwu Sheung Tan area (LCU 4 – industrial). Currently a large part of this area is occupied by industrial uses including several plastics recycling factories, open storage for construction plant equipment and dangerous goods, and a concrete batching plant (see *Figure 9.8*).

Figure 9.8 Existing landscape features at Lung Kwu Sheung Tan – Open Storage

Landscape Resources

In accordance with the Study Brief, the Study Area is defined as the area within 100m from the site boundary. To assist in the assessment of landscape resources in the study area, three landscape resources (LRs) have been identified (see *Figure 9.4a*). These include:

- Orchard;
- Disturbed Area; and
- Open Storage Area.

Colour photographs of all habitat types surveyed and the Project Area are presented in *Figures 9.9 to 9.11*. None of the recorded plant species are of conservation interest. *Table 9.3* lists the number of plant species and the area recorded in each habitat type.

Table 9.3 Landscape Resources Recorded Within the Study Area

Landscape Resources	Area (hectare)	Number of plant species recorded
LR1 - Orchard	4.9	10
LR2 - Disturbed area	3.8	14
LR3 - Open storage area	3.6	5

The botanical names of the species found on site are detailed in Annex C.

Orchard – LR1

Orchard was found on the original steeply shrubland to the west of the Proposed Site. The site is fenced off and under active management for cultivation of fruit plants including *Dimocarpus longan* and *Litchi chinensis*. These fruit trees were in good form at about 2.5 meters high and the understorey was well maintained as bare land. The fruit trees are of a high value as they are currently used for commercial cropping. The photographic records of the orchard are shown in *Figure 9.9*. Ten plant species were recorded in this landscape resource and no rare / protected species were found.

This Landscape Resource LR1 – Orchard has an overall *medium* landscape sensitivity.

Disturbed Area – LR2

The proposed site and the area to the north of the site comprised of mainly disturbed area. The photographic records of this landscape resource are presented in *Figure 9.10*. This landscape resource consisted mainly of flattened bare land, with a village house located at the south and a DSD outfall chamber at the north. Patches of weed plants dominated by *Pennisetum alopecuroides* and *Leucaena leucocephala* were found at the western and northern ends. A patch of Acacia plantation of about 3 meters high was found along the verge between the landscape resource and Lung Kwu Tan Road. These trees are of medium value as they screen the existing site from the Lung Kwu Tan Road. The disturbed area was highly developed in nature.

This Landscape Resource LR2 – Disturbed Area has an overall *low* landscape sensitivity.

Open Storage Area – LR3

Open storage area was found to the west of the proposed site, which mainly consisted of open area, recycling factories, construction plants and materials. The photographic records of the developed area are shown in *Figure 9.11*. Only patches of weed plants such as *Leucaena leucocephala* and *Ipomoea cairica*

were found occupying the edges of the storage areas. This landscape resource was highly developed with limited landscape significance and only 5 plant species were found in this landscape resource, without any rare or protected species recorded. No old or valuable trees were encountered within this landscape resource area.

This Landscape Resource LR3 – Open Storage Area has an overall *low* landscape sensitivity.

9.7 LANDSCAPE IMPACT ASSESSMENT

9.7.1 Prediction and Evaluation of Landscape Impacts during Construction

The proposed karting track, in a site of about 1.8ha, is located within the disturbed area and no felling of trees or slope cutting is required as part of the construction works. A 1.8 metre high chain link mesh fence will be erected along the length of the south-east boundary to prevent any damage to the trees in the adjacent orchard (landscape resource area 1). Similarly, the trees located within the disturbed area (landscape resource area 2) will be retained where possible to maintain the existing screen between the site and the road.

The karting track will be paved using asphaltic concrete and part of the site that will be used for regular maintenance work will also be paved using concrete. As the existing village house within the site boundary will be used as an office for the karting track, no superstructure will be constructed within the site. Four units of mobile toilets will be provided at the site together with thirteen double deck ISO container to be used as maintenance and storage area for the petrol kart. However, these structures will only be located to the site once the karting track and associated area are paved. Therefore impacts on the natural topography and loss of vegetation in connection with the construction work are not expected. No old or valuable trees will be removed.

Table 9.4 Summary of Disturbance to Various Landscape Resource During Construction

Landscape Resources	Quantification of LR within the Study Area (hectare)	Area in conflict with the proposed works	Magnitude of Change during Construction	Reversibility of Change during Construction
LR1 - Orchard	4.9	0	Negligible	N / A
LR2 - Disturbed area	3.8	1.8 ha	Intermediate	High
LR3 - Open storage	3.6	0	Negligible	N / A
LCU1 – Hillslopes	4.9	0	Negligible	N / A
LCU2–Disturbed area	3.8	1.8 ha	Intermediate	High
LCU3 – Transport	0.7	0	Intermediate	N / A
LCU4 – Industrial area	3.6	0	Intermediate	N / A

Table 9.4 above shows that there will be a negligible impact on LR1 and LR3. The magnitude of change on LR2 is considered intermediate. The reversibility of change during the construction period is not applicable to LR1 and LR3 as there will be no changes to those Landscape Resource areas. The

Orchard with fruit trees was fenced off and located at the west and north of the Study Area.

Fruit trees including *Dimocarpus longan* and *Litchi chinensis* were planted on the original steeply shrubland.
The site was under active management with the understorey was maintained as bare land.

Fruit trees were intermingled with the shrubs at the edges of orchard.

Figure 9.9

Photographic Records of Orchard

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Part of the disturbed area was fenced off and occupied by weeds including *Leucaena leucocephala* and *Neyraudia arundinacea*.

A patch of Acacia plantation was found at the verge between the Project Area and Lung Kwu Tan Road.

The Project Area was a flattened bare land with grasses and weed plants found at the north of the Project Area.

The overview of the Project Area. Apart from the grasses and weed plants, no trees were found within the Project Area.

Figure 9.10

Photographic Records of Disturbed Area and Project Area

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A storage site for construction materials was found at the east of the Study Area. Only weed plants were found outside the fences.

A open bare land was found at the west of the Study Area, which was used for car parking and loading of materials. No vegetation was found within the area.

Weeds including *Leucaena leucocephala* and *Neyraudia arundinacea* were found outside the fences of the open storage area.

Figure 9.11

Photographic Records of Open Storage Area

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reversibility of change for LR2 is considered high as it is easy to return the LR2 to its existing condition if the construction process was to be reversed.

9.7.2 Prediction and Evaluation of Landscape Impacts during Operation

During operation, the ISO container as well as the karting track will be the permanent features within the site area, and would change the characteristics of the existing landscape. In view of the scale of the project, the magnitude of change caused by the proposed karting track during operational phase is assessed as *intermediate* when considered in relation to the landscape context of the surrounding area. The significance threshold is *slight/moderate*.

However, most of the karting track and the double deck ISO container would be screened from the views by the patch of Acacia plantation of about 3 meters high adjacent Lung Kwu Tan Road and the embankment.

Table 9.5 Summary of Disturbance to Various Landscape Resources During Operation

Landscape Resources	LR area within the Study Area (ha)	Area in conflict with the proposed works (ha)	Magnitude of Change during Operation	Reversibility of Change during Operation	Impact day 1 no mitigation	Residual impact day 1 mitigation	Residual impact yr 10 mitigation
LR1 - Orchard	4.9	0	Negligible	N / A	Moderate	Moderate	Low
LR2 - Disturbed area	3.8	1.8 ha	Intermediate	High	Moderate	Moderate	Moderate
LR3 - Open storage area	3.6	0	Negligible	N / A	Moderate	Moderate	Low
LCU1 – Hillslopes	4.9	0	Negligible	N / A	Moderate	Moderate	Low
LCU2– Disturbed area	3.8	1.8 ha	Intermediate	High	Moderate	Moderate	Moderate
LCU3 – Transport	0.7	0	Intermediate	N / A	Moderate	Moderate	Low
LCU4 – Industrial area	3.6	0	Intermediate	N / A	Moderate	Moderate	Low

9.8 EXISTING VISUAL CONTEXT

In order to assess the impact of the proposed development on the visual amenity of the surrounding landscape, it is necessary to first identify what elements of the development would be visible from outside the site, where those elements would be seen from and, who would be able to see the development.

The visually significant elements of the proposed karting track are as follows:

- Maintenance and Storage structures;
- Karting track; and
- Associated lighting.

The visual envelope relates to the potential area within which the site and the proposed development would be visible. The site itself is well contained by the hillsides surrounding the site. Also, due to the fact that Lung Mun Road is elevated adjacent to the site, the nearby open storage and factories will have no view onto the proposed site. In addition, the hilly ridges of Castle Peak also provided screening such that the site itself is not visible from a majority of area. The extent of the visual envelope is shown in *Figure 9.12*.

9.8.1 Visually Sensitive Receivers

In accordance with the study methodology, the Visually Sensitive Receivers (VSRs) within the visual envelope are identified.

In summary, the VSRs can be classified into three main groups.

- VSR 1. Residential receivers are typically sensitive to visual impact because of the permanent impact on their daily outlook. Most people within the visual envelope enjoy views of a landscape which is of a high amenity value. This group of people may be regarded as having a high level of sensitivity to visual intrusion of this nature. There are none of these receivers in proximity to the project, therefore they have not been included in the table. However, it should be noted that agreement has been made between the land owner and the Project Proponent that the proposed site (including the village house to be used as an office for the karting track) will be leased to the Project Proponent for the development of an outdoor karting track. The village house within the site boundary will be used as an office for the karting track only. Residential use is not permitted at the village house while the land is used as an outdoor karting track. The Project Proponent also confirmed that the village house will only be used as an office of the karting track. In view that the village house will not be used as residential purpose during the karting track leasing period, for the purpose of this EIA, the village house has not been identified as a VSR. However, should this village house is to be used for residential purpose during the operation of the karting track, mitigation measures in terms of noise barriers have been proposed to mitigate the noise impacts. In the unlikely event that the office building is to be used for residential purpose, this group of people may regarded as having a high level of sensitivity to visual intrusion.

- VSR 2. Views from workplaces such as the nearby open storage and factory areas are less sensitive than residences due to visual amenity being less important within the work environment. The view within the work environment is typically of a heavily modified environment. Therefore this group of people may be regarded as having medium level of sensitivity to visual intrusion of this nature.

- VSR 3. Visitors and viewers in transit such as those on hiking tracks and along transport corridor. Although the visitors on hiking tracks will be more sensitive to the visual impact of the proposed karting track than users on transport corridor, people in transit are considered to be less sensitive to

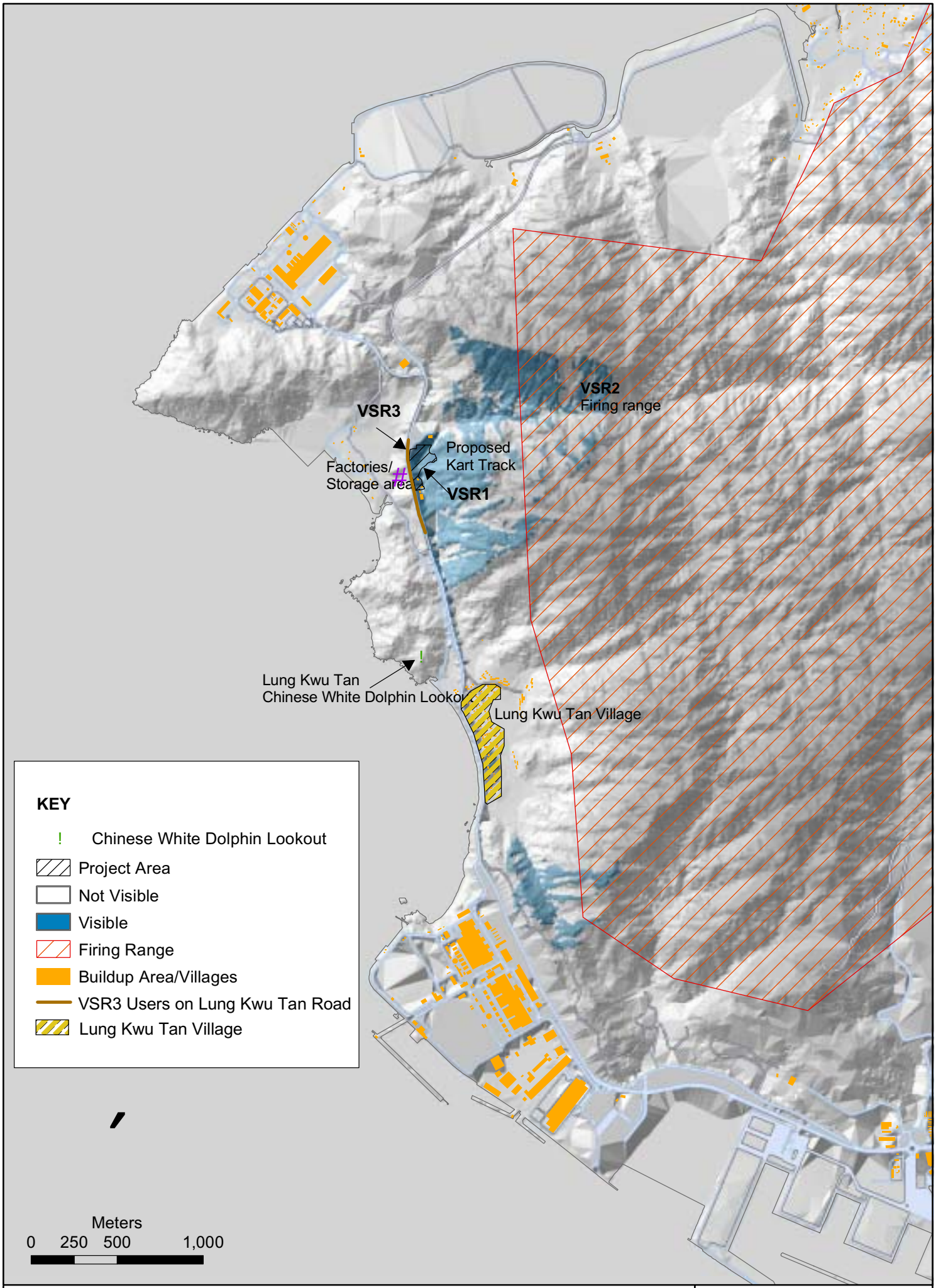

FIGURE 9.12

Visual Envelope and Visual Sensitive Receivers

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visual impact than people residing in their homes. This group of people may be regarded as having a medium level of sensitivity to visual intrusion.

It should be noted that our site investigation and GIS analysis (*Figure 9.12*) that the site will not be visible from the surrounding hiking trail and from Lung Kwu Tan Chinese White Dolphin lookout due to the rolling hill terrain and hill knoll located to the south of Lung Chung Tan Road. *Figure 9.13* show the existing view from the Chinese White Dolphin Lookout and the hiking trail looking towards the proposed site, and demonstrated that the proposed site is not visible from these locations. Some areas of Castle Peak do overlook the site, however, these areas are not accessible to visitors and are currently used as a firing range.

Table 9.6 lists the key VSRs found within the visual envelope. The locations of the VSRs are also shown in *Figure 9.12*.

Table 9.6 Visual Sensitive Receivers

VSR	Location	Viewer Type	Value/Qty of existing views	Availability of alternative views	Type and no. of receiver	Duration of view	Degree of visibility	Overall Sensitivity
VSR 1	Village house within the site boundary	Residential purpose	Moderate	Medium	<5	Up to 12 hrs	High	High
VSR 2	Firing Range	Range users	Moderate	High	<200	Up to 10 hrs	Medium	Medium
VSR 3	Lung Kwu Tan Rd	Road users	Moderate	High	Approx 500 / day	<60 sec	Medium	Medium

Table 9.6 above shows that the overall sensitivity of the VSR's is medium, expect for the unlikely event that the office building is to be used for residential purpose, the overall sensitivity of this VSR is high.

The degree of visibility is assessed as medium for VSR 2 as many views from the industrial areas are obscured by Lung Mun Road, however the firing range has some clearer views of the area. Given that there are fewer users of the firing range area, 'medium' for degree of visibility was selected as an average.

As illustrated in *Figure 9.12*, the proposed karting track would not be visible to the majority of the land-based VSR groups. This is due to the fact that Lung Kwu Tan road is elevated adjacent to the site and the road effectively screens the site from the areas to the west of Lung Kwu Tan road. In particular, the more sensitive receivers including Lung Kwu Tan Village and the Lung Kwu Tan Chinese White Dolphin Lookout, would be screened by hill slope of Castle Peak and the knoll located to the south of Lung Kwu Sheung Tan. Other visual sensitive receiver groups, including road users on Lung Kwu Tan Road and users on the Lung Kwu Tan firing range will have views of the site.

The existing views from the Lung Kwu Tan Chinese White Dolphin Lookout, the open storage, and along Lung Kwu Tan Road are shown in *Figure 9.13*.

9.9 VISUAL IMPACT ASSESSMENT

The proposed karting track is located adjacent to the DSD outfall chamber and has relatively few VSRs. As discussed in *Section 9.7*, no felling of trees or slope cutting is required as part of the construction works. In addition, only minimal construction works will be required including the paving of the karting track and part of the site that to be used for regular maintenance work and no superstructure will be constructed within the site. It is therefore considered that the magnitude of change caused by the construction stage would be small.

As discussed in *Section 9.8*, the nearest residential development is the Lung Kwu Tan village (over 1km away), but there are no views of the karting track from it. Other VSR groups would be the users of the Lung Kwu Tan firing range, however views from workplaces are considered to be less important within the work environment. The level of visual impact is considered to be negligible.

Other visual sensitive groups which would have a direct view of the site will be the road users on Lung Kwu Tan Road. However, in view of the transient nature of this sensitive group, and the partial screening from the existing vegetation, the level of visual impact is considered to be slight / moderate.

Considering the small number of potential viewers affecting and the partial screening from the existing vegetation, the level of visual impact is considered to be slight. A summary of the visual impacts are presented in *Table 9.8*. To illustrate the potential visual impacts, a typical view of the proposed karting track from a representative viewpoint (the road user) is presented in *Figures 9.14 to 9.17*. This view was selected as this road junction is the main access road leading to the main open storage area and also to the coastal area of Lung Kwu Sheng Tan. The photomontage shows that the visual impact will be very minor, and with the proposed planting measures proposed as part of the development the visual impact will be negligible. It should be noted that the duration of any visual impact during construction will be 3 months and 10 years for operation for both VSR's.

It should be noted that agreement has been made between the land owner and the Project Proponent that the village house within the site boundary will be used as an office for the karting track only. Residential use is not permitted at the village house while the land is used as an outdoor karting track. However, in the unlikely event that this village house is to be used for residential purpose during the operation of the karting track, the level of visual impact is considered to be significant.

View From Open Storage

View From Lung Kwu Tan Road

Black Point
Power Station

DSD Outfall Chamber

Existing Village House
to be Changed to Office

Open Storage
and Factories

Castle Peak

Hiking Track

Chinese White
Dolphin Lookout

Hill Knoll

Lung Kwu Tang Village

View From Hiking Track

View From Lung Kwu Tang Chinese
White Dolphin Lookout

Figure 9.13

Existing Views From Areas in the Vicinity of the Project Area

FILE: 0039968e
DATE: 24/11/2005

Environmental
Resources
Management

ERM

Figure 9.14

Existing Conditions

FILE: 0039968d1
DATE: 23/12/2005

Environmental
Resources
Management

ERM

Figure 9.15

Unmitigated

FILE: 0039968d2
DATE: 23/12/2005

Environmental
Resources
Management

ERM

Figure 9.16

Mitigated Day1

FILE: 0039968d3
DATE: 23/12/2005

Environmental
Resources
Management

ERM

Figure 9.17

Mitigated Year 10

FILE: 0039968d4
DATE: 23/12/2005

Environmental
Resources
Management

ERM

Table 9.7 Magnitude of Change

VSR	Sensi-tivity	Existing View	Project compatibility	Scale	Reversibility of change	Viewing Distance	Potential Blockage of view	Magnitude of Change		Significance Threshold	
								Const.	Opera-tion	Const.	Opera-tion
VSR 1	High	Disturbed Area	Moderate	High	High	<50m	Low	Inter.	Large	Mod / sign	Sign.
VSR 2	Medi um	Seascape Industry	Moderate	Mod.	High	500m	Low	Small	Small	Slight / Mod	Slight / Mod
VSR 3	Medi um	Hills / industry	Moderate	Mod.	High	10m	Low	Small	Small	Slight / Mod	Slight / Mod.

The project compatibility is considered moderately compatible with the surrounding as the natural surroundings have been modified by developments such as road works, transmission lines, man-made cut slope and open storage areas.

Table 9.8 Visual Impact

VSR	Sensitivity	Magnitude of Change		Visual Impact		Visual Impact after mitigation	
		Const.	Operation	Const.	Operation	Const.	Operation
VSR 1	High	Inter.	Large	Intermediate	Sign.	Sign.	Moderate
VSR 2	Medium	Small	Small	Slight / Moderate	Slight / Moderate	Slight	Slight
VSR 3	Medium	Small	Small	Slight / Moderate	Slight / Moderate	Slight	Slight

The above table shows that the visual impact of the proposed development will be slight / moderate, expect for the unlikely event that the office building is to be used for residential purpose (VSR 1), the visual impact of this VSR is significant.

For VSR 2 (Views from workplaces) the sensitivity has been assessed as medium given the viewer types, numbers and opportunities for alternatives. Similarly the magnitude of change was also rated as small due to the distance from the site and its moderate compatibility. Therefore the visual impact has been assessed as slight / moderate.

For VSR 3 (Views from road users) the sensitivity was medium due to the short duration of views, the high opportunity for alternatives and the degree of visibility. Similarly the magnitude of changes was small given the immediate surroundings that contain man modified elements of similar scale. Therefore the visual impact has been assessed as slight / moderate.

9.9.1 Lighting

The operating hours for the karting track is only until 19:00 hours. Some lighting is proposed, however it will only be required for a maximum of approximately 1.5 hrs in the winter months. Any potential impacts from the lighting will be minimal.

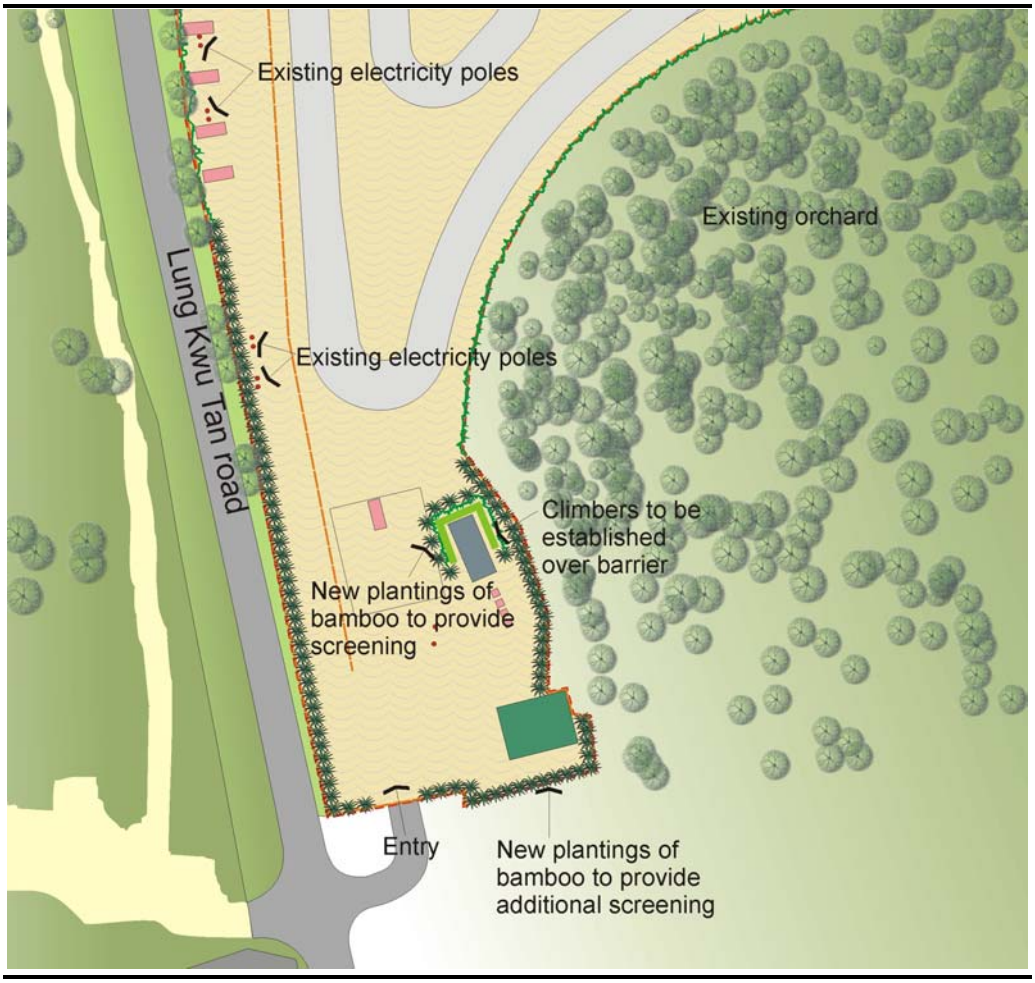
9.9.2 Proposed Noise Barriers

Section 5.3.2 of this report notes that during the operation of the kart track, the existing village house is not to be used for residential purposes. If the house was to be used as a residence noise mitigation measures are proposed (ref Annex B) in the form of a 7.5m high noise barrier to the north and part of the eastern and western sides of the house.

In the unlikely event that the noise barrier is required, some landscape improvement of this barrier is recommended. These improvements are proposed on the barrier surfaces facing away from the house and would involve the installation of tall growing Bamboo and establishing climbers up the barrier face.

These measures would ensure that any noise barriers would complement the existing development and minimise any potential visual impacts. The proposed mitigation measure is shown in *Figure 9.18.*

Figure 9.18 Proposed Mitigation Measure Recommended for the Noise Barrier



9.10 RECOMMENDED MITIGATION MEASURES

9.10.1 Construction

As no felling of trees or slope cutting is required as part of the construction works, the detailed tree survey is not required prior to the construction work. As the visual and landscape impacts associated during the construction stage are slight only some minor mitigation measures are necessary. These are detailed below and whilst these measures will mitigate any visual and landscape impacts during operation they will be installed as part of the construction.

The mitigation measures will be constructed and maintained by the proponent.

9.10.2 Operation

As there are no superstructures to be constructed as part of the proposed development, the visually significant elements of the proposed karting track include the double deck ISO container, the paved karting track and the associated lighting.

Most of the karting track and the double deck ISO container would be screened from the views by the existing plantation of about 3 meters high adjacent Lung Kwu Tan Road and the embankment. To reinforce this existing screening, climbers will be established on the external fence, and bamboo will be planted around the site boundaries in the southern area of the site.

The recommended plant species and sizes are as follows:

- Bamboo - *Bambusa vulgaris* or *Bambusa* textiles installed at a size of 1m height
- Climbers – *Bouganvillea* species installed in 15cm diameter pot size

The maintenance structures will also be painted green and constructed to appear as small houses as to minimize any potential visual impacts.

In the unlikely event that the noise barrier is required, some landscape improvement of this barrier is recommended. These improvements are proposed on the barrier surfaces facing away from the house and would involve the installation of tall growing Bamboo and establishing climbers up the barrier face. The recommended plant species and sizes will be similar to the one recommended for the karting track. These are as follows.

- Bamboo - *Bambusa vulgaris* or *Bambusa* textiles installed at a size of 1m height
- Climbers – *Bouganvillea* species installed in 15cm diameter pot size

9.11 RESIDUAL IMPACTS

Considering the small number of potential VSRs affected and the existing landscape character of the area, the residual landscape and visual impact of the proposed karting track is considered acceptable with mitigation measures.

9.12 IMPLEMENTATION AND MAINTENANCE

The proposed karting track including any landscape and visual mitigation works will be undertaken by a contractor to be appointed by HGH Ltd. The karting track will be managed by HGH Ltd and oversee by the Hong Kong Kart Club and will provide the funds for any maintenance works required. *Table 10.1* details the implementation schedule of the mitigation measures.

9.13 ENVIRONMENTAL MONITORING AND AUDIT

No environmental monitoring and audit is required for this Project as the extent of the landscape and visual impacts are considered to be acceptable. All works associated with the proposal will have to be constructed and maintained in accordance with the environmental permit.

9.14 CONCLUSIONS

Given that the proposed karting track is selected to be located within a remote and shielded area, the proposed karting track would be only visible from limited viewpoints, including the transient road users along Lung Kwu Tan Road and the users of the Lung Kwu Tan firing range. Project works would result in small losses of landscape character / resource areas confining to 1.8ha of disturbed area. Based on the above findings, the landscape and visual impact of the proposed karting track are considered to be acceptable.

10 CONCLUSIONS & ENVIRONMENTAL OUTCOMES

10.1 INTRODUCTION

This Section presents a summary of the key potential environmental outcomes associated with the construction and operation of the Project. Implementation schedule of the recommendations are shown in *Table 10.1*.

10.2 AIR QUALITY

Given the small scale of the construction works and separation distance from the Air Sensitive Receivers (ASRs), the dust impact at ASRs is minimal. In addition, due to the small scale of site area, the number of construction plant operating on site is limited, therefore, the gaseous emissions from the construction equipment is minimal and no adverse impact is anticipated.

In view of the limited emissions from karts on tracks and separation distances between ASR and tracks, air quality impact is not expected. Since the number of shuttle bus running between the karting track and Tuen Mun Centre, the air quality impacts due to additional traffic arising from karting track would not be anticipated. Besides, with the proper handling of petrol stores and re-fuelling and regular maintenance of karts, no odour nuisance is expected.

Based on the impact assessment, no EM&A measures are required.

10.3 NOISE

Due to the large separation distances, unmitigated construction activities associated with the Project will not cause adverse noise impact at the NSRs. The predicted construction noise levels are in the range of 35 – 37 dB(A), which complied with the stipulated noise criterion.

Based on the worst case scenario by adopting a maximum sound pressure level of 98 dB(A) at 1 m for 13-kart movement, the predicted facade noise levels for a maximum of 40-kart event is well below the daytime noise criterion of 55 dB(A) at all NSRs located at more than 1km from the site boundary.

Based on the impact assessment, no EM&A measures are required.

10.4 WATER QUALITY

Given the small scale of the construction works, short duration of construction period and no identified WSRs within the study area, water quality impacts are negligible and minimal during construction phase of the Project.

For the operation of karting, the main concern is the water quality impact may be caused by the servicing and petrol re-fuelling activities. Nevertheless, the surface runoff can be well controlled by adoption of a proper drainage system with peripheral channel and petrol interceptor. Addition to the proper handling of petrol tank and re-fuelling and regular maintenance of karts, no adverse water quality impacts are anticipated.

Based on the impact assessment, no EM&A measures are required.

10.5 WASTE ASSESSMENT

The anticipated quantities of C&D materials to be generated from site clearance and building renovation, and chemical wastes, sewage and general refuse to be generated during both the construction and operational phases will be minimal. Minimal residual impacts are anticipated from the construction and operation of the karting track.

10.6 LAND CONTAMINATION

Given the small scale of the construction works, short duration of construction period and minimal use of heavy-duty construction machinery, fuel and oils, land contamination impacts are negligible during construction phase of the Project.

For the operation of the Project, the main concern is the potential land contaminations caused by the karting activities, servicing, repairing and oil filling activities. Nevertheless, all the above activities will be carried out on paved areas. Any leakage can be well controlled by secondary containments or a proper drainage system with peripheral channel and petrol interceptor. With consideration of the infrequent refuelling activities and the minimal amount of fuel handled each time, as well as proper handling of petrol tank, precaution on refuelling activities and regular maintenance of karts, no adverse impacts on land contamination are anticipated.

Based on the impact assessment, no EM&A measures are required.

10.7 LANDSCAPE AND VISUAL

Given that the proposed karting track is selected to be located within a remote and shielded area, the proposed karting track would be only visible from limited viewpoints, including the transient road users along Lung Kwu Tan Road and the users of the Lung Kwu Tan firing range. Project works would result in small losses of landscape character / resource areas confining to 1.8ha of disturbed area. Based on the assessment, the landscape and visual impact of the proposed karting track are considered to be acceptable.

10.8 ENVIRONMENTAL OUTCOME

No unacceptable residual impacts are predicted for the construction and operation of the Project. This section presents the environmental outcome of the Project.

10.8.1 Population and Environmentally Sensitive Area Protected

The site at Lung Kwu Tan has been selected as the preferred location for the development of an outdoor karting track. The site is distant (>1000m) from any existing and planned residential developments and hence the potential air quality and noise impacts are anticipated to be small. As the site is currently a flatted wasteland, no further tree felling or slope excavation is required and thus minimise the impact on ecological resources.

10.8.2 Environmentally Friendly Designs Recommended

The servicing area, and repair / maintenance area would be properly paved by concrete to avoid any potential land contamination impacts. In addition, the village house and Tsz Tong within the site boundary will be kept and managed by the Project Proponent.

10.8.3 Key Environmental Problems Avoided

As discussed in *Section 10.8.1*, the proposed karting track has avoided densely populated residential developments. In addition, the footprint of the karting track is designed such that no slope cutting or tree felling are required as part of the construction works. The karting track location makes use of the existing vegetation and the natural topography, so the Project would only be visible from limited viewpoints.

10.9 OVERALL CONCLUSIONS

The EIA has critically assessed the overall acceptability of any environmental impacts likely to arise as a result of the construction and operation of the proposed karting track.

This EIA Study has predicted that the Project will comply with all environmental standards and legislation and thus demonstrated the acceptability of any residual impacts from the Project and the protection of the population and environmentally sensitive receivers. The Study concluded that there would be no adverse long term or cumulative effects / impacts on the environment.

Table 10.1 Implementation Schedule

EIA Ref.	Environmental Protection Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent	Implementation Stage				Relevant Legislation & Guidelines
				Des	C	O	Dec	
AIR QUALITY – CONSTRUCTION PHASE The following good site practices are recommended to minimize the dust nuisance during the construction of the karting track:								
S.4.5.1	• Stockpiling of dusty materials should be entirely covered or watered to avoid fugitive dust;	Within the construction site / Throughout the construction period	Contractor		✓			Air Pollution Control (Construction Dust) Regulation
S 4.5.1	• Site area should be kept wet during excavation;	Within the construction site / Throughout the construction period	Contractor		✓			Air Pollution Control (Construction Dust) Regulation
S 4.5.1	• Dusty materials carried by truck leaving the construction site should be covered by tarpaulin sheet to ensure no leakage of dusty materials from trucks;	Within the construction site / Throughout the construction period	Contractor		✓			Air Pollution Control (Construction Dust) Regulation
S 4.5.1	• Regularly maintenance should be provided for the diesel-powered mechanical equipment especially black smoke is emitted; and	Within the construction site / Throughout the construction period	Contractor		✓			Air Pollution Control (Construction Dust) Regulation
S 4.5.1	• The engine of the equipment should be switched off when it is not in operation.	Within the construction site / Throughout the construction period	Contractor		✓			Air Pollution Control (Construction Dust) Regulation
AIR QUALITY – OPERATIONAL PHASE Although no exceedance of air quality impact is anticipated during the operation of karting track, the following measures are recommended:								
S4.5.2	• Maintenance of karts should be performed regularly to avoid incomplete combustion or fuel leakage;	At karting track / throughout the operational year	HGH Limited			✓		-
S 4.5.2	• Proper handling of petrol storage tank and during refuelling to avoid leakage of petrol; and	At refilling area and petrol storage area / throughout the operational year	HGH Limited			✓		-

EIA Ref.	Environmental Protection Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent	Implementation Stage				Relevant Legislation & Guidelines
				Des	C	O	Dec	
S 4.5.2	• Only limited quantities of petrol, a standard 18 litre safety petrol tank, will be stored on site during the daytime. Any unused petrol will be collected by the DG vehicle after the operating time of the karting track. Only minor maintenance works will be conducted on-site, including the use of lubricants, chain oil, and brake cleaner. If any engine maintenance works are required, the kart vehicle will be transport to a garage.	At refilling area and petrol storage area / throughout the operational year	HGH Limited			✓		-
NOISE – CONSTRUCTION PHASE Though the predicted construction noise levels comply with the stipulated noise criterion, good site practice and noise management is recommended for minimising the construction noise impact on nearby NSRs.								
S 5.6.1	• Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction works;	Within the construction site / Throughout the construction period	Contractor		✓			Noise from Construction Activities - Non-statutory Controls (Practice Note PN 2/93)
S 5.6.1	• Machines and plant that may be use intermittently, such as vibratory poker, should be shut down between work periods or should be throttled down to a minimum;	Within the construction site / Throughout the construction period	Contractor		✓			Noise from Construction Activities - Non-statutory Controls (Practice Note PN 2/93)
S 5.6.1	• Plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from nearby NSRs; and	Within the construction site / Throughout the construction period	Contractor		✓			Noise from Construction Activities - Non-statutory Controls (Practice Note PN 2/93)
S 5.6.1	• Mobile plant should be sited as far away from NSRs as possible.	Within the construction site / Throughout the construction period	Contractor		✓			Noise from Construction Activities - Non-statutory Controls (Practice Note PN 2/93)
NOISE – OPERAITONAL PHASE No mitigation measures are required as no exceedance of noise during operation is anticipated.								

WATER QUALITY – CONSTRUCTION PHASE The following mitigation measures should be implemented during the construction of the karting track:								
<u>Construction Runoff and Drainage</u>								
S 6.6.1	• Provision of perimeter channels to intercept storm-runoff from outside the site. These shall be constructed in advance of site formation works and earthworks; • Exposed soil surface shall be covered by tarpaulin as soon as possible to reduce the potential of soil erosion. • Open stockpiles of construction materials on site shall be covered with tarpaulin or similar fabric during rainstorms.	Within the construction site / Throughout the construction period	Contractor		✓			*EPD* Practice Note for Professional Persons, Construction Site Drainage *(ProPECC PN 1/94)*
<u>General Construction Activities</u>								
S 6.6.1	• Debris and rubbish generated on-site shall be collected, handled and disposed of properly to avoid entering the nearby stormwater drains and open drainage channels. All fuel tank and storage areas shall be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. Open storm water drains and culverts near the works area shall be covered to block the entrance of large debris and refuse.	Within the construction site / Throughout the construction period	Contractor		✓			-
<u>Sewage from Workforce</u>								
S 6.6.1	• Temporary sanitary facilities, such as portable chemical toilets, shall be employed at the areas where the temporary connection is not feasible. A licensed contractor would be responsible for appropriate disposal and maintenance of these facilities.	Within the construction site / Throughout the construction period	Contractor		✓			-

WATER QUALITY – OPERATIONAL PHASE Although no unacceptable water quality impact is anticipated during the operational phase, the following measures are recommended:								
<u>Surface Runoff</u>								
S 6.6.2	• Maintenance of karts should be performed regularly to avoid leakage of fuel on tracks;	At karting track / throughout the operational year	HGH Limited			✓		-
S 6.6.2	• Proper handling of petrol storage tank to avoid leakage of petrol;	At refilling area and petrol storage area / throughout the operational year	HGH Limited			✓		-
S 6.6.2	• Drainage serving the open petrol refilling point should be connected to storm drains via a petrol interceptor with peak storm bypass;	At refilling area and petrol storage area / throughout the operational year	HGH Limited			✓		-
S 6.6.2	• The servicing areas should be located within roofed areas and concrete paved area. The drainage in the concrete paved areas should be connected to foul sewers via a petrol interceptor. 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*.	At refilling area and petrol storage area / throughout the operational year	HGH Limited			✓		Waste Disposal Ordinance
<u>Sewage Treatment</u>								
S 6.6.2	• Temporary sanitary facilities, such as portable chemical toilets, shall be employed. A licensed contractor would be responsible for appropriate disposal and maintenance of these facilities.	At karting track / throughout the operational year	HGH Limited			✓		-

WASTE MANAGEMENT – CONSTRUCTION PHASE Wherever practicable, inert materials should be segregated from other wastes to avoid contamination thereby ensuring acceptability at public filling areas and avoiding the need for disposal at landfill.								
C&D Materials								
S 7.5.1	Measures taken in the Planning Design Stages to Reduce the Generation of C&DM • Avoidance and minimization, that is, reduction of waste generation through changing or improving practices and design;	Within the construction site / Throughout the construction period	Contractor		✓			Waste Disposal Ordinance WBTC No. 25/99 Incorporation of Information on Construction and Demolition Material management in PWSC Papers
S 7.5.1	• Reuse of materials, thus avoiding disposal (generally with only limited reprocessing);	Within the construction site / Throughout the construction period	Contractor		✓			WBTC No. 25/99 Incorporation of Information on Construction and Demolition Material management in PWSC Papers
S 7.5.1	• Recovery and recycling, thus avoiding disposal (although reprocessing may be required); and	Within the construction site / Throughout the construction period	Contractor		✓			WBTC No. 25/99 Incorporation of Information on Construction and Demolition Material management in PWSC Papers

S 7.5.1	• Treatment and disposal, according to relevant law, regulations, guidelines and good practice.	Within the construction site / Throughout the construction period	Contractor		✓			WBTC No. 25/99 Incorporation of Information on Construction and Demolition Material management in PWSC Papers
S 7.5.1	<u>Recommended Construction Phase Measures for the Reduction of C&DM Generation</u> • The Contractor should recycle as much of the C&DM as possible on-site. Public fill and construction waste should be segregated and stored in different containers or skips to facilitate reuse or recycling of materials and their proper disposal. Surplus public fill should be delivered to the adjacent Tuen Mun Area 38 Fill Bank or Tuen Mun Area 38 Temporary Construction Waste Sorting Facility for proper reuse while the construction waste should be delivered to the WENT Landfill.	Within the construction site / Throughout the construction period	Contractor		✓			Waste Disposal Ordinance WBTC 32/92, The Use of Tropical Hard Wood on Construction Site WBTC No. 2/93, Public Dumps WBTC 33/2002 Management of C&D Material including Rock WBTC 15/2003 Waste Management on Construction Sites
<u>Chemical Waste</u> The Contractor for the construction works and the operator of the karting track should be registered with the EPD. Chemical waste should be handled in accordance with the *Code of Practice on the Packaging, Handling and Storage of Chemical Wastes* as follows. Containers used for storage of chemical wastes should:								
S 7.5.2	• be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed; • have a capacity of less than 450 L unless the specifications have been approved by the EPD; and • display a label in English and Chinese in accordance with instructions prescribed in *Schedule 2* of the *Regulations.*	Within the construction site / Throughout the construction period	Contractor		✓			Waste Disposal (Chemical Waste) (General) Regulation Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes

S 7.5.2	The storage area for chemical wastes should: • be clearly labelled and used solely for the storage of chemical waste; • be enclosed on at least 3 sides; • have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area, whichever is the greatest; • have adequate ventilation; • be covered to prevent rainfall entering (water collected within the bund must be tested and disposed of as chemical waste, if necessary); and • be arranged so that incompatible materials are appropriately separated.	Within the construction site / Throughout the construction period	Contractor		✓			Waste Disposal (Chemical Waste) (General) Regulation Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes
S 7.5.2	Disposal of chemical waste should be: • via a licensed waste collector; and • to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Facility which also offers a chemical waste collection service and can supply the necessary storage containers.	Within the construction site / Throughout the construction period	Contractor		✓			Waste Disposal (Chemical Waste) (General) Regulation Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes
<u>Sewage</u>								
S 7.5.3	• An adequate number of portable toilets should be provided for the on-site construction workforce. 4 mobile toilets would be provided for the use of visitors during operational phase. All portable toilets should be maintained in a state that will not deter the users from using them. Night soil should be regularly collected by a licensed collector for disposal at the Pillar Point Sewage Treatment Works.	Within the construction site / Throughout the construction period	Contractor		✓			-

General Refuse								
S 7.5.4	• General refuse should be stored in enclosed bins separately from construction and chemical wastes. Recyclables (ie paper and aluminium can and plastic bottles) should be stored separately to facilitate subsequent recycling. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from construction and chemical wastes, on a daily basis to minimise odour, pest and litter impacts. The burning of refuse on construction sites is prohibited by law.	Within the construction site / Throughout the construction period	Contractor		✓			Waste Disposal Ordinance
Management of Waste Disposal								
S 7.5.5	• The contractor should open a billing account with EPD in accordance with the *Waste Disposal (Charges for Disposal of Construction Waste) Regulation* for the payment of disposal charges. Every waste load transferred to government waste disposal facilities such as public fill, sorting facilities, landfills or transfer station would required a valid "chit" which contain the information of the account holder to facilitate waste transaction recording and billing to the waste producer. A trip-ticket system should also be established in accordance with *Works Bureau Technical Circular No. 31/2004* to monitor the disposal of solid wastes at transfer station / landfills, and to control fly-tipping. The billing "chit" and trip-ticket system will be included as one of the contractual requirements and implemented by the contractor.	Within the construction site / Throughout the construction period	Contractor		✓			WBTC No 31 / 2004, Trip Ticket System for Disposal of Construction & Demolition Materials
S 7.5.5	• A recording system for the amount of waste generated, recycled and disposed of (including the disposal sites) should be established during the construction stage.	Within the construction site / Throughout the construction period	Contractor		✓			WBTC No 31 / 2004, Trip Ticket System for Disposal of Construction & Demolition Materials

Staff Training								
S 7.5.6	• Training should be provided to workers on the concepts of site cleanliness and on appropriate waste management procedures, including waste reduction, reuse and recycling at the beginning of the Contract.	Within the construction site / Throughout the construction period	Contractor		✓			-
LAND CONTAMINATION –CONSTRUCTION PHASE								
The following mitigation measures should be implemented during the construction of the karting track:								
Construction Runoff and Drainage *Construction site runoff and drainage should be prevented or minimized in accordance with the guidelines stipulated in the EPD Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94)*, so as to prevent any potential spillage of fuel or oils from entering the soil or storm water drains. *The practices include the following items:*								
S 8.5.1	• Maintenance of heavy-duty machinery shall be minimised and should be carried out off-site.	Within the construction site / Throughout the construction period	Contractor		✓			Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94)
S 8.5.1	• Exposed soil surface shall be covered by tarpaulin as soon as possible to minimise exposure of soil to potential contaminating sources.	Within the construction site / Throughout the construction period	Contractor		✓			Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94)
S 8.5.1	• Provision of perimeter channels to intercept storm-runoff from outside the site. These shall be constructed in advance of site formation works and earthworks.	Within the construction site / Throughout the construction period	Contractor		✓			Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94)
S 8.5.1	• The section of the road between the wheel washing facilities and the public road shall be paved with backfall to prevent wash water or other site runoff from entering public road drains.	Within the construction site / Throughout the construction period	Contractor		✓			Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94)

General Construction Activities								
S 8.5.1	• All fuel tank and storage areas shall be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. Open storm water drains and culverts near the works area shall be covered to block the entrance of large debris and refuse.	Within the construction site / Throughout the construction period	Contractor		✓			-
LAND CONTAMINATION –OPERATIONAL PHASE								
Although no unacceptable land contamination impact is anticipated during the operational phase, the following measures are recommended:								
S 8.5.2	Paving of servicing area • The servicing area, vehicle washing bays, lubrication bays and repair / maintenance area would be properly paved by concrete. In addition, the servicing area should be located within roofed areas. The drainage serving the servicing area and oil filling point would be connected to storm drains via a petrol interceptor with peak storm bypass. Therefore, it is considered unlikely to produce any quantifiable adverse land contamination impacts.	At karting track / throughout the operational year	HGH Limited			✓		-
S 8.5.2	Minimal and controlled refilling activities • From the desktop review and site survey results, the fuel tank capacity of the kart is relatively small, i.e., about 3 litres, and refilling is required once or twice a day. The refilling time would be about 15 seconds. The maximum number of karts allowed on the track for training or rental run is 40 and 34 for match. Given the small tank capacity and infrequent refilling activities, the quantities of petroleum hydrocarbon products to be used on site would be minimal.	At karting track / throughout the operational year	HGH Limited			✓		-
S 8.5.2	• All the re-fuelling activities and repair and maintenance activities will be carried out under concrete-paved areas.	At karting track / throughout the operational year	HGH Limited			✓		-

S 8.5.2	<u>Other Measures</u> • All karting activities should only be undertaken on asphaltic concrete paved tracks; • Maintenance of karts should be performed regularly to avoid leakage of fuel on tracks; • Proper handling of petrol storage tank to avoid leakage of petrol, including the use of a secondary containment of a capacity equal to 110% of the storage capacity of the largest tank and a roof cover to separate rainfall; • Service area and repair / maintenance area should be concrete-paved; • Drainage serving the open oil filling point should be connected to storm drains via a petrol interceptor with peak storm bypass; • Vehicle and plant servicing areas, vehicle wash bays and lubrication bays should be located within roofed areas. The drainage in these covered areas should be connected to foul sewers via a petrol interceptor; and • 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.*	At karting track / throughout the operational year	HGH Limited			✓		-

S 8.5.2	<u>Hazard</u> • Smoking is prohibited within the site area; • Extinguishers and fire-fighting sand are located along the track at 100m interval; • Extinguishers are provided in the office and the servicing area; • Re-fuelling should only be undertaken within the service area; • Only one tank of petrol with a maximum 18 litre is to be stored in a safety petrol tank within the servicing area; • No petrol should be stored on site overnight; and • Maintenance of karts should be performed regularly to avoid leakage of fuels on tracks.	At karting track / throughout the operational year	HGH Limited			✓		-
	Should there be an accident with fire, all activities within the track would be stopped compulsorily and staff members will perform fire fighting using the extinguisher and / or the fire-fighting sand.	At karting track / throughout the operational year	HGH Limited			✓		-
LANDSCAPE AND VISUAL – CONSTRUCTION PHASE No mitigation measures are required as no felling of trees or slope cutting is required and the visual and landscape impacts are low.								
LANDSCAPE AND VISUAL - OPERATIONAL PHASE								
S 9.10.2	• To reinforce the existing screening, climbers will be established on the external fence and bamboo will be planted around the site boundaries in the southern area of the site.	At karting track / throughout the operational year	HGH Limited			✓		-
S 9.10.2	• The colour of the maintenance structures will be painted green to minimize any potential visual impacts.	At karting track / throughout the operational year	HGH Limited			✓		-

Annex A

Construction Noise Assessment

Annex A - Calculation of Construction Noise Impact at the NSRs

Noise Sensitive Receiver - No.32 Pak Long

Stage	Activities	Plant	CNP	Sound Power Level (SWL) of PME			Distance to NSR			Correction, dB(A)			Corrected Noise Level, dB(A)
				Basic SWL, dB(A)	No. of PME	Total SWL, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	Barrier[1] Attenuation	Facade	
1	Site Formation	20 ton Bulldozer	CNP 030	115	1	115	0	1153	1153.0	-69.2	-10	3	28.8
		20 ton Excavator	CNP 081	112	1	112	0	1153	1153.0	-69.2	-10	3	35.8
		Dump Truck	CNP 068	105	1	105	0	1153	1153.0	-69.2	-10	3	28.8
												Total Construction Noise Level, dB(A) =	**37.2**

Stage	Activities	Plant	CNP	Sound Power Level (SWL) of PME			Distance to NSR			Correction, dB(A)			Corrected Noise Level, dB(A)
				Basic SWL, dB(A)	No. of PME	Total SWL, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	Barrier/Enclosure Attenuation	Facade	
2	Track Paving	Asphalt Paver	CNP 004	109	1	109	0	1153	1153.0	-69.2	-10	3	31.8
		Road Roller	CNP 185	108	1	108	0	1153	1153.0	-69.2	-10	3	31.8
												Total Construction Noise Level, dB(A) =	**34.8**

Remark:

1) A 10 dB(A) screening effect is taken into account for the NSR due to topography shielding and no direct line of sight to the site.

Annex B

Noise Data and Operational Noise Assessment

Figure B1

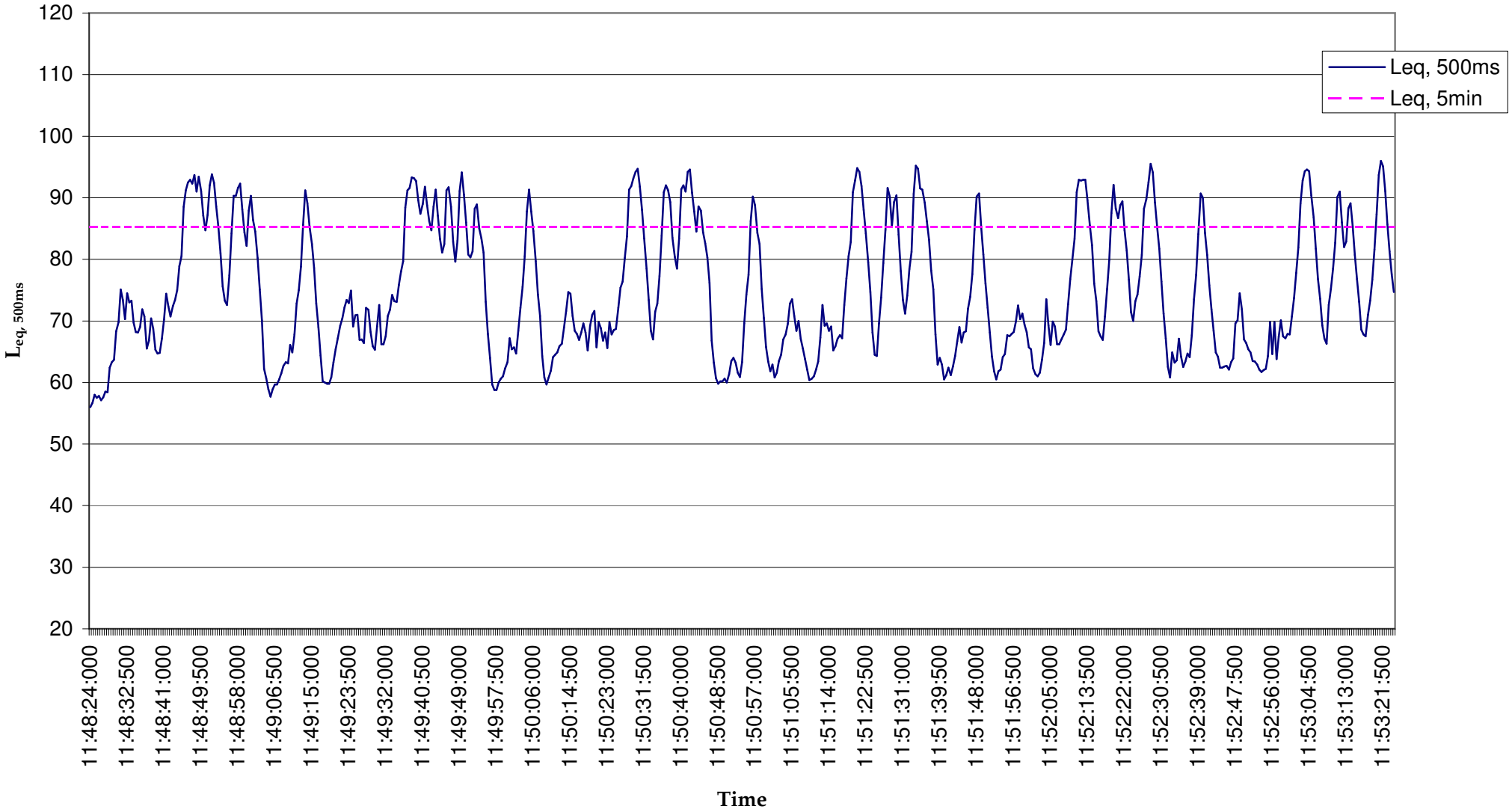
Noise Measurement Location

FILE: 0039968g
DATE: 19/12/2005

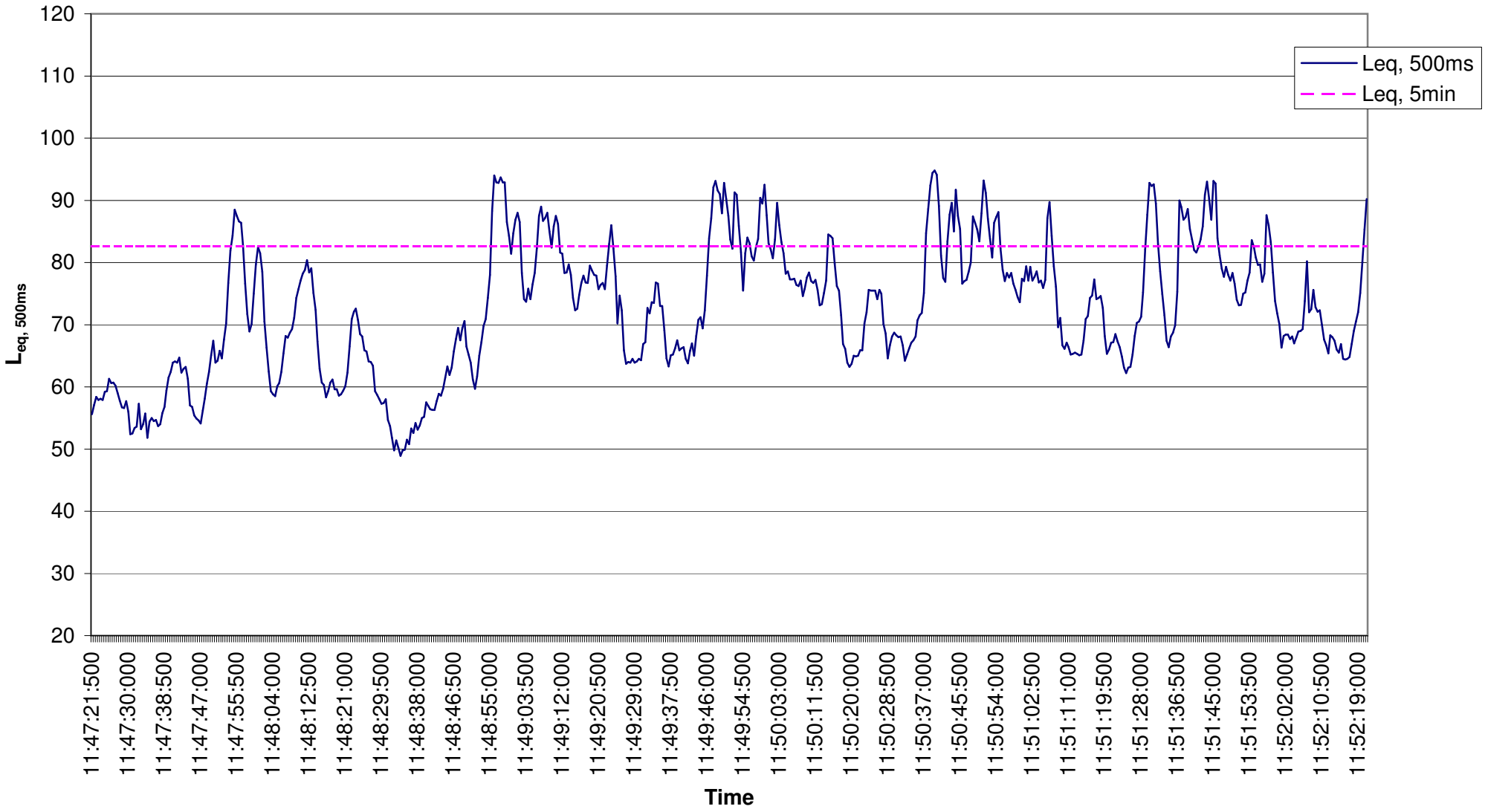
Environmental Resources Management

ERM

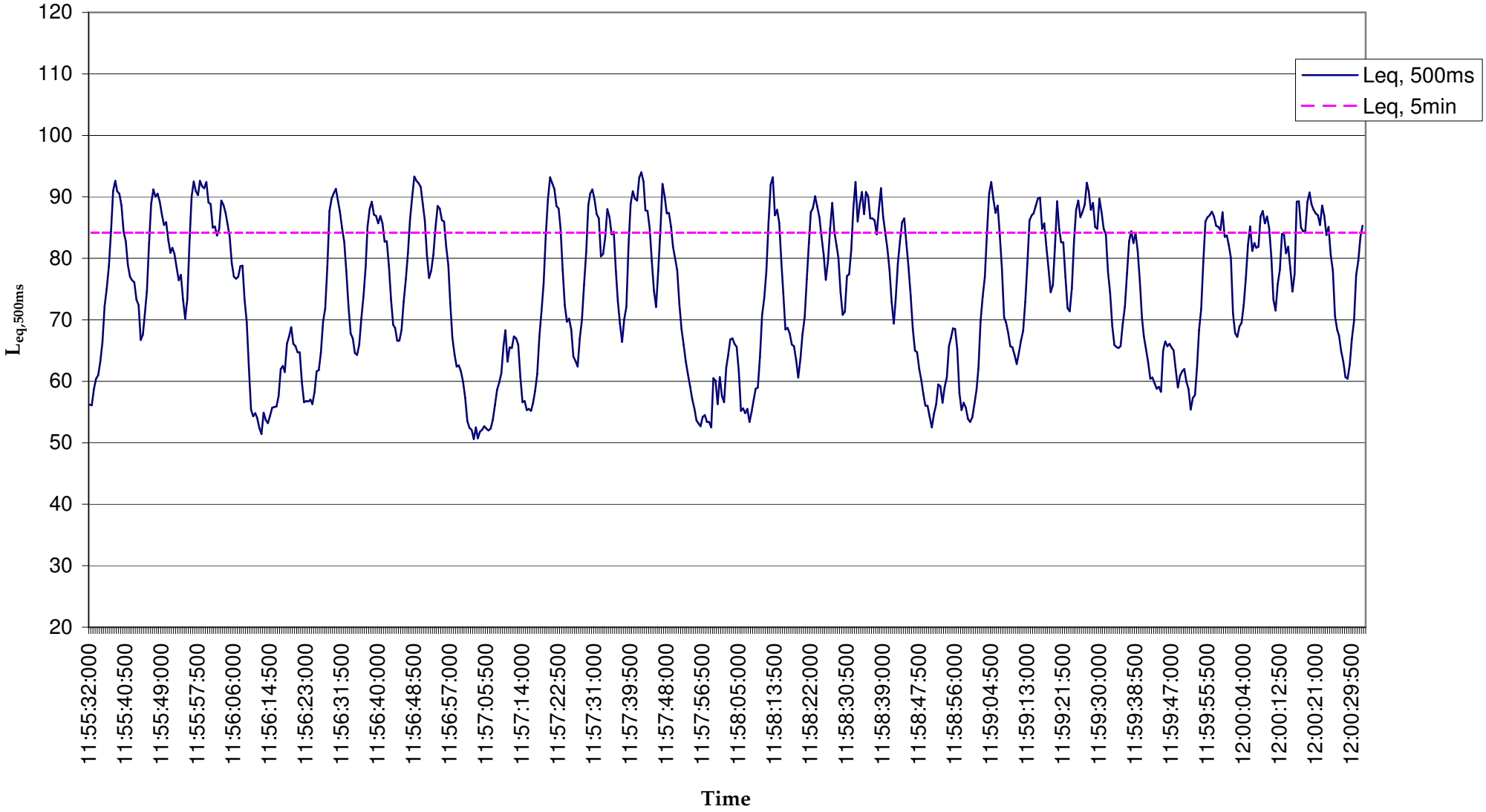
Annex B1 - Time History of kart Moving along a straight section of the track



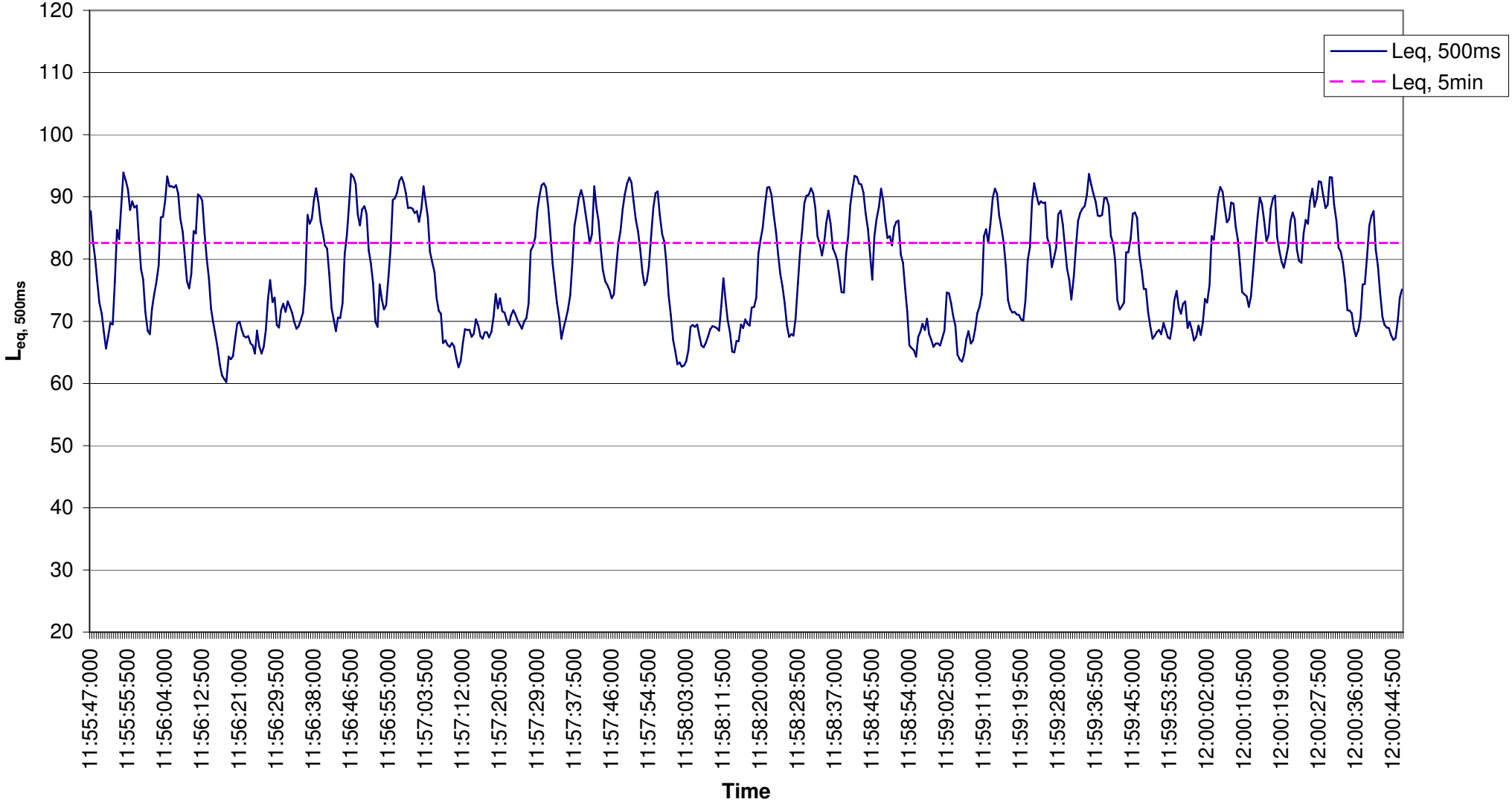
Annex B2 - Time History of kart Moving along 90° turning section of the track



Annex B3 - Time History of kart Moving along 120° turning section of the track



Annex B4 - Time History of kart Moving along 180° turning section of the track



Annex B5 - Calculation of Operational Noise Impact at the NSRs

Noise Sensitive Receiver - No.32 Pak Long

		Sound Pressure Level (SPL) of PME			Distance to NSR			Correction, dB(A)				Corrected
Stage	Noise Source	Basic $L_{eq, 5min}$ [(1)], dB(A)	No. of source	Total $L_{eq, 5min}$, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	Barrier Attenuation [(2)	Operating period [(3)]	Facade	Noise Level, dB(A)
Operational Stage	Kart Movement	98	40	103	0	1130	1130.0	-61.1	-10	0	3	35.0

		Sound Power Level (SWL) of PME			Distance to NSR			Correction, dB(A)				Corrected
Stage	Noise Source	Basic SWL, dB(A)	No. of source	Total SWL, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	Barrier Attenuation [(2	Operating period [(4)]	Facade	Noise Level, dB(A)
Operational Stage	PA system	104	5	111	0	1130	1130.0	-69.1	-10	-8	3	27.1

Total Operational Noise Level, dB(A) = 35.7

Remark:

1) Based on the noise measurement data, the maximum sound pressure level of different kart movements is 98 dB(A) at 1m for 13 karts moving on the track.

2) A 10 dB(A) screening effect is taken into account for the NSR due to topography shielding and no direct line of sight to the site.

3) The measured noise levels show regular pattern over the measured time period, and therefore the measured Leq,5 min represents a 30-minute continuous kart movement. for a conservative assessment, each run with up to 40 karts on the track is assumed to last for a full 30 minutes during any half hour.

4) The PA system will be used occasionally and it is assumed that the PA system will be used for 5 minutes in every 30 minutes.

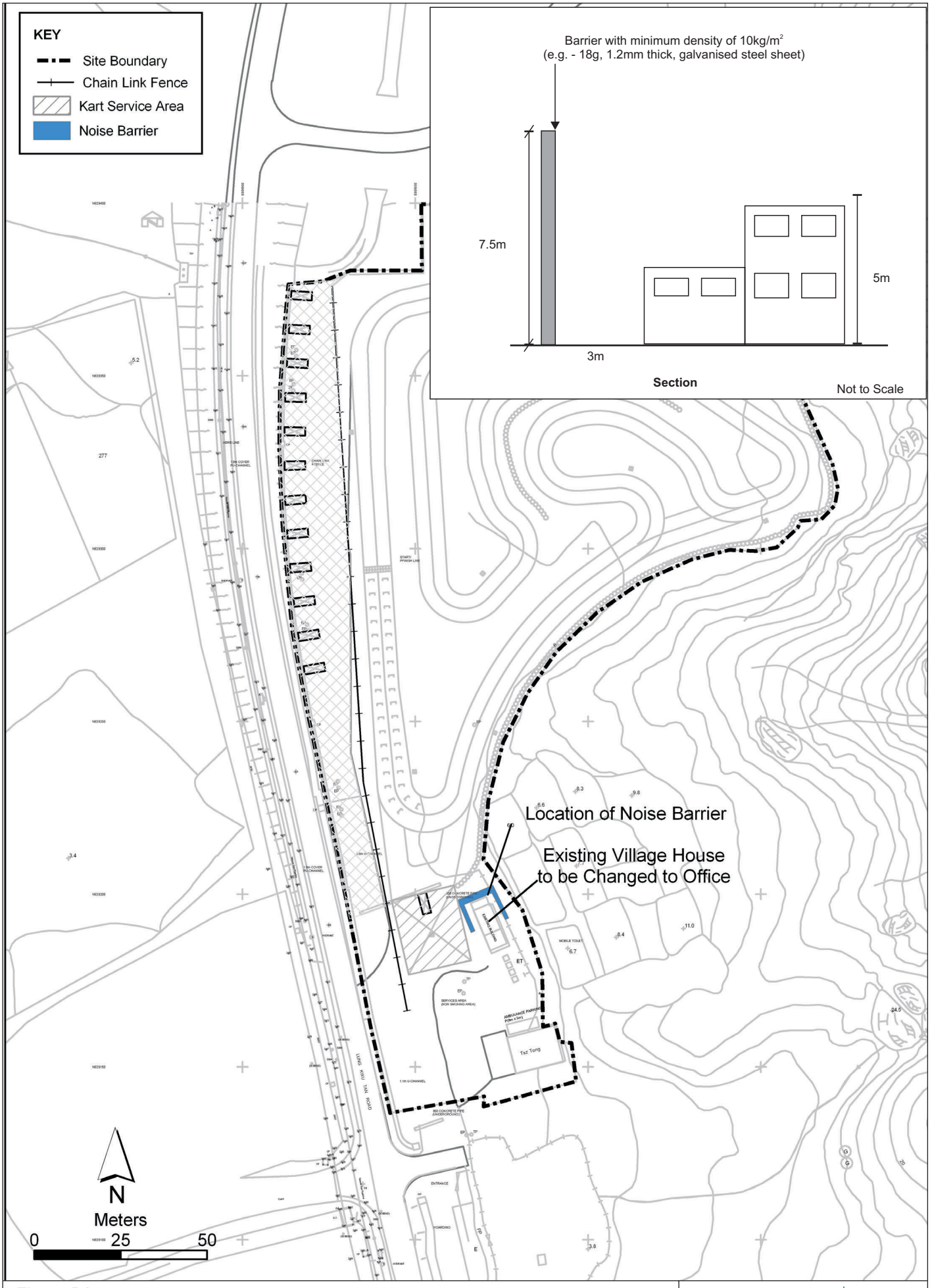


Figure B2

Location of Noise Barrier

FILE: 0039968h
DATE: 19/12/2005

Environmental
Resources
Management

ERM

Annex B6a - Calculation of Operational Noise Impact at the On-site Village House

Noise Sensitive Receiver - G/F of On-site Village House[(2)(3)]

Stage	Noise Source	Sound Pressure Level (SPL) of PME			Distance to NSR			Correction, dB(A)					Corrected Noise Level, dB(A)
		Basic $L_{eq, 5min}$[(1)], dB(A)	No. of source[(6)]	Total $L_{eq, 5min}$, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	View angle	Barrier Attenuation[(2)]	Operating period[(3)]	Facade	
Operational Stage	Kart Movement (1045-1046)	98	6	95	0	34	34.0	-15	-11.5	-20.2	-3.0	3	47.8
Operational Stage	Kart Movement (1046-1047)	98	6	95	0	31	31.0	-15	-11.7	-20.8	-3.0	3	47.4
Operational Stage	Kart Movement (1000-1001)	98	6	95	0	26	26.0	-14	-13.8	-23.8	-3.0	3	43.1
Operational Stage	Kart Movement (1001-1002)	98	6	95	0	21	21.0	-13	-15.1	-23.2	-3.0	3	43.3

Stage	Noise Source	Sound Power Level (SWL) of PME			Distance to NSR[(4)]			Correction, dB(A)					Corrected Noise Level, dB(A)
		Basic SWL, dB(A)	No. of source[(4)]	Total SWL, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	View angle	Barrier Attenuation[(2)]	Operating period[(5)]	Facade	
Operational Stage	PA system	104	3	109	2.5	81	81.0	-46.2	-	-20	-8	3	37.8

Total Operational Noise Level, dB(A) = 52

Noise Sensitive Receiver - 1/F of On-site Village House[(2)(3)]

Stage	Noise Source	Sound Pressure Level (SPL) of PME			Distance to NSR			Correction, dB(A)					Corrected Noise Level, dB(A)
		Basic $L_{eq, 5min}$[(1)], dB(A)	No. of source[(6)]	Total $L_{eq, 5min}$, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	View angle	Barrier Attenuation[(2)]	Operating period[(3)]	Facade	
Operational Stage	Kart Movement (1045-1046)	98	6	95	4	34	34.2	-15	-11.5	-17.2	-3.0	3	50.8
Operational Stage	Kart Movement (1046-1047)	98	6	95	4	31	31.3	-15	-11.7	-17.6	-3.0	3	50.6
Operational Stage	Kart Movement (1000-1001)	98	6	95	4	26	26.3	-14	-13.7	-20.6	-3.0	3	46.3
Operational Stage	Kart Movement (1001-1002)	98	6	95	4	21	21.4	-13	-16.3	-20.1	-3.0	3	45.1

Stage	Noise Source	Sound Power Level (SWL) of PME			Distance to NSR[(4)]			Correction, dB(A)					Corrected Noise Level, dB(A)
		Basic SWL, dB(A)	No. of source[(4)]	Total SWL, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	View angle	Barrier Attenuation[(2)]	Operating period[(5)]	Facade	
Operational Stage	PA system[(7)]	104	3	109	0	81	81.0	-46.2	-	-15	-8	3	42.8

Total Operational Noise Level, dB(A) = 55

Remark:

1) Based on the noise measurement data, the maximum sound pressure level of different kart movements is 98 dB(A) at 1m for 13 karts moving on the track.

2) Should the village house is to be used for residential purpose, a barrier will be constructed to enclose the north and west facing façade for reducing operational noise impact. A noise barrier will be constructed such that there will be no direct line of sight from the NSR to the karting track (approximately 7.5m high). The barrier will be constructed using materials with a density of not less than $10kg/m^2$.

3) Should the village house is to be used for residential purpose, to mitigate the noise impact, each run will be restricted to only 15 minutes during any half hour period.

4) Should the village house is to be used for residential purpose, the maximum no. of PA system should be reduced to 3 and the nearest PA system should be located at a minimum distance of 81m from the NSR.

5) The PA system will be used occasionally and it is assumed that the PA system will be used for 5 minutes in every 30 minutes.

6) Should the village house is to be used for residential purpose, maximum number of karts to be allowed to run on the track should be reduced to 24 at any time. For a worst case assessment, 6 karts were assumed to be loc 4 track sections at any time.

7) PA system will be located at the top of containers (4m above ground) which are within repair/maintenance area.

Annex B6b - Calculation of Operational Noise Impact at the On-site Village House

Noise Sensitive Receiver - G/F of On-site Village House[2][3]

Stage	Noise Source	Sound Pressure Level (SPL) of PME			Distance to NSR			Correction, dB(A)					Corrected Noise Level, dB(A)
		Basic $L_{eq, 5min}$[1], dB(A)	No. of source[6]	Total $L_{eq, 5min}$, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	View angle	Barrier Attenuation[2]	Operating period[3]	Facade	
Operational Stage	Kart Movement (1006-1007)	98	6	95	0	118	118.0	-21	-19.4	-20.0	-3.0	3	34.7
Operational Stage	Kart Movement (1007-1008)	98	6	95	0	195	195.0	-23	-16.8	-17.7	-3.0	3	37.4
Operational Stage	Kart Movement (1008-1009)	98	6	95	0	176	176.0	-22	-18.8	-18.0	-3.0	3	35.6
Operational Stage	Kart Movement (1009-1010)	98	6	95	0	10	10.0	-10	-27.5	-24.0	-3.0	3	33.3

Stage	Noise Source	Sound Power Level (SWL) of PME			Distance to NSR[4]			Correction, dB(A)					Corrected Noise Level, dB(A)
		Basic SWL, dB(A)	No. of source[4]	Total SWL, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	View angle	Barrier Attenuation[2]	Operating period[5]	Facade	
Operational Stage	PA system	104	3	109	2.5	81	81.0	-46.2	-	-20	-8	3	37.8

Total Operational Noise Level, dB(A) = 43

Noise Sensitive Receiver - 1/F of On-site Village House[2][3]

Stage	Noise Source	Sound Pressure Level (SPL) of PME			Distance to NSR			Correction, dB(A)					Corrected Noise Level, dB(A)
		Basic $L_{eq, 5min}$[1], dB(A)	No. of source[6]	Total $L_{eq, 5min}$, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	View angle	Barrier Attenuation[2]	Operating period[3]	Facade	
Operational Stage	Kart Movement (1006-1007)	98	6	95	4	118	118.1	-21	-19.4	-16.3	-3.0	3	38.4
Operational Stage	Kart Movement (1007-1008)	98	6	95	4	195	195.0	-23	-17.9	-14.3	-3.0	3	39.7
Operational Stage	Kart Movement (1008-1009)	98	6	95	4	176	176.0	-22	-18.8	-14.5	-3.0	3	39.1
Operational Stage	Kart Movement (1009-1010)	98	6	95	4	10	10.8	-10	-27.6	-20.8	-3.0	3	36.1

Stage	Noise Source	Sound Power Level (SWL) of PME			Distance to NSR[4]			Correction, dB(A)					Corrected Noise Level, dB(A)
		Basic SWL, dB(A)	No. of source[4]	Total SWL, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	View angle	Barrier Attenuation[2]	Operating period[5]	Facade	
Operational Stage	PA system[7]	104	3	109	0	81	81.0	-46.2	-	-15	-8	3	42.8

Total Operational Noise Level, dB(A) = 47

Remark:

1) Based on the noise measurement data, the maximum sound pressure level of different kart movements is 98 dB(A) at 1m for 13 karts moving on the track.

2) Should the village house is to be used for residential purpose, a barrier will be constructed to enclose the north and west facing façade for reducing operational noise impact. A noise barrier will be constructed such that there will be no direct line of sight from the NSR to the karting track (approximately 7.5m high). The barrier will be constructed using materials with a density of not less than $10kg/m^2$.

3) Should the village house is to be used for residential purpose, to mitigate the noise impact, each run will be restricted to only 15 minutes during any half hour period.

4) Should the village house is to be used for residential purpose, the maximum no. of PA system should be reduced to 3 and the nearest PA system should be located at a minimum distance of 81m from the NSR.

5) The PA system will be used occasionally and it is assumed that the PA system will be used for 5 minutes in every 30 minutes.

6) Should the village house is to be used for residential purpose, maximum number of karts to be allowed to run on the track should be reduced to 24 at any time. For a worst case assessment, 6 karts were assumed to be loca 4 track sections at any time.

7) PA system will be located at the top of containers (4m above ground) which are within repair/maintenance area.

Annex B6c - Calculation of Operational Noise Impact at the On-site Village House

Noise Sensitive Receiver - G/F of On-site Village House[(2)(3)]

Stage	Noise Source	Sound Pressure Level (SPL) of PME			Distance to NSR			Correction, dB(A)					Corrected Noise Level, dB(A)
		Basic $L_{eq, 5min}$[(1)], dB(A)	No. of source[(6)]	Total $L_{eq, 5min}$, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	View angle	Barrier Attenuation[(2)]	Operating period[(3)]	Facade	
Operational Stage	Kart Movement (1001-1002)	98	6	95	0	26	26.0	-14	-15.1	-23.2	-3.0	3	42.4
Operational Stage	Kart Movement (1002-1003)	98	6	95	0	21	21.0	-13	-16.0	-23.6	-3.0	3	42.0
Operational Stage	Kart Movement (1003-1004)	98	6	95	0	66	66.0	-18	-19.2	-21.4	-3.0	3	36.0
Operational Stage	Kart Movement (1004-1005)	98	6	95	0	174	174.0	-22	-17.3	-18.4	-3.0	3	36.7

Stage	Noise Source	Sound Power Level (SWL) of PME			Distance to NSR[(4)]			Correction, dB(A)					Corrected Noise Level, dB(A)
		Basic SWL, dB(A)	No. of source[(4)]	Total SWL, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	View angle	Barrier Attenuation[(2)]	Operating period[(5)]	Facade	
Operational Stage	PA system	104	3	109	2.5	81	81.0	-46.2	-	-20	-8	3	37.8

Total Operational Noise Level, dB(A) = 47

Noise Sensitive Receiver - 1/F of On-site Village House[(2)(3)]

Stage	Noise Source	Sound Pressure Level (SPL) of PME			Distance to NSR			Correction, dB(A)					Corrected Noise Level, dB(A)
		Basic $L_{eq, 5min}$[(1)], dB(A)	No. of source[(6)]	Total $L_{eq, 5min}$, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	View angle	Barrier Attenuation[(2)]	Operating period[(3)]	Facade	
Operational Stage	Kart Movement (1001-1002)	98	6	95	4	26	26.3	-14	-15.2	-19.9	-3.0	3	45.5
Operational Stage	Kart Movement (1002-1003)	98	6	95	4	21	21.4	-13	-16.0	-20.2	-3.0	3	45.3
Operational Stage	Kart Movement (1003-1004)	98	6	95	4	66	66.1	-18	-19.2	-17.7	-3.0	3	39.7
Operational Stage	Kart Movement (1004-1005)	98	6	95	4	174	174.0	-22	-19.4	-14.7	-3.0	3	38.3

Stage	Noise Source	Sound Power Level (SWL) of PME			Distance to NSR[(4)]			Correction, dB(A)					Corrected Noise Level, dB(A)
		Basic SWL, dB(A)	No. of source[(4)]	Total SWL, dB(A)	Vertical, m	Horizontal, m	Slant, m	Distance Attenuation	View angle	Barrier Attenuation[(2)]	Operating period[(5)]	Facade	
Operational Stage	PA system[(7)]	104	3	109	0	81	81.0	-46.2	-	-15	-8	3	42.8

Total Operational Noise Level, dB(A) = 50

Remark:

1) Based on the noise measurement data, the maximum sound pressure level of different kart movements is 98 dB(A) at 1m for 13 karts moving on the track.

2) Should the village house is to be used for residential purpose, a barrier will be constructed to enclose the north and west facing façade for reducing operational noise impact. A noise barrier will be constructed such that there will be no direct line of sight from the NSR to the karting track (approximately 7.5m high). The barrier will be constructed using materials with a density of not less than $10kg/m^2$.

3) Should the village house is to be used for residential purpose, to mitigate the noise impact, each run will be restricted to only 15 minutes during any half hour period.

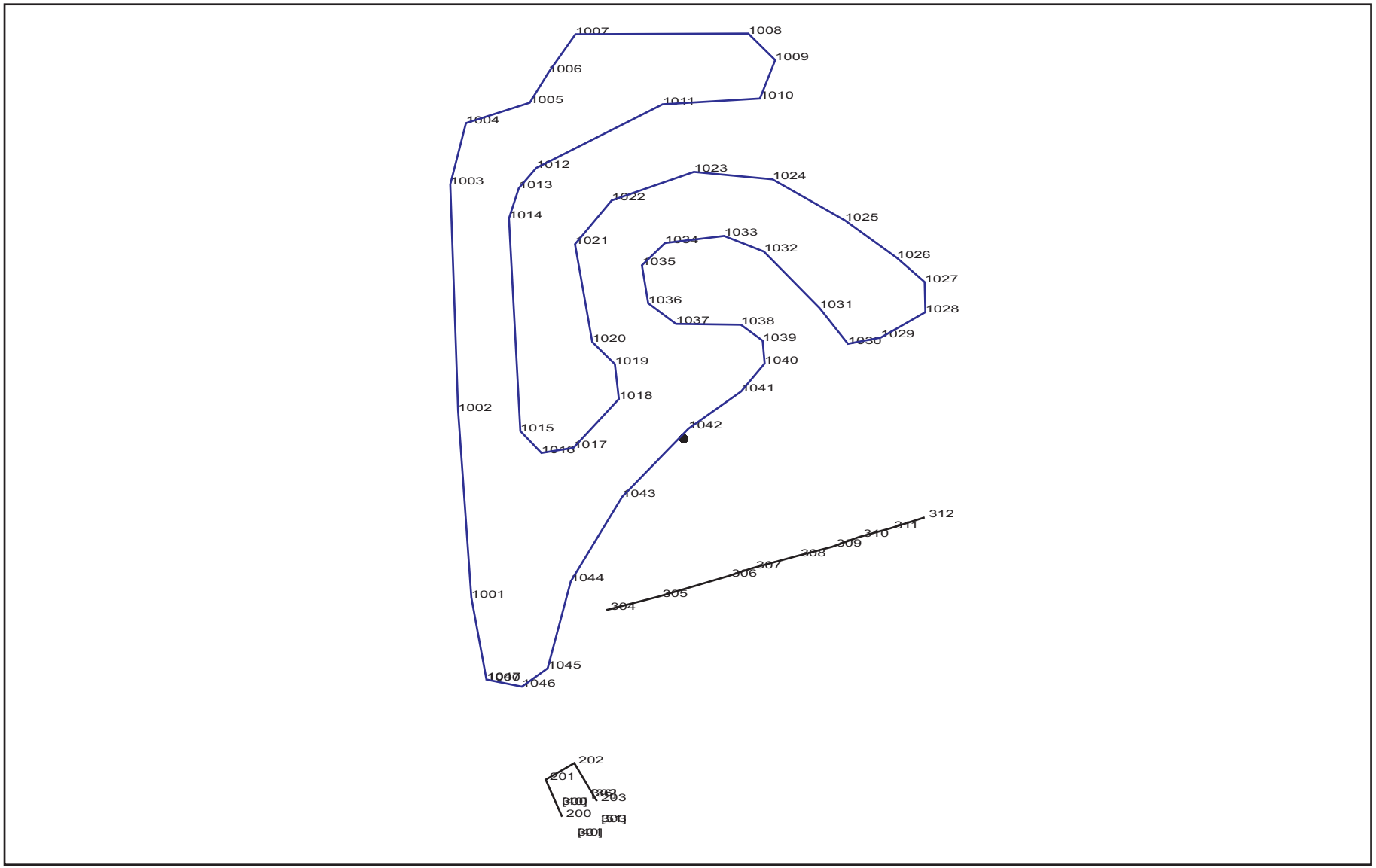
4) Should the village house is to be used for residential purpose, the maximum no. of PA system should be reduced to 3 and the nearest PA system should be located at a minimum distance of 81m from the NSR.

5) The PA system will be used occasionally and it is assumed that the PA system will be used for 5 minutes in every 30 minutes.

6) Should the village house is to be used for residential purpose, maximum number of karts to be allowed to run on the track should be reduced to 24 at any time. For a worst case assessment, 6 karts were assumed to be loc 4 track sections at any time.

7) PA system will be located at the top of containers (4m above ground) which are within repair/maintenance area.

Figure B3 - Plot of HFA Noise Model



ANNEX B6D - OUTPUT FILE OF HFA NOISE MODEL - Calculation of barrier attenuation

HFA Noise V1.10 Results File: Full Output

File : 968_A.DAT

Receiver No : 300
X=809575.5 Y=829198.5 Z = 5 **Height =1.5**

Road Segment	Road Segment	Sub Segment	Flow	Speed	%Heavy Veh	Gradient	Basic Noise Level	< corrections									> Segment Total
								Speed	Gradient	Surface	Distance	Angle of View	**Barrier**	Ground Cover	Facade	Reflection	
1044	1045	1	2000	50	20	0	98	0	0	0	0	-13.4	**-23.8**	0	2.5	0	63.3
1000	1001	1	2000	50	20	0	98	0	0	0	-0.2	-13.8	**-23.8**	0	2.5	0	62.7
1001	1002	1	2000	50	20	0	98	0	0	0	-1.8	-15.1	**-23.2**	0	2.5	0	60.4
1001	1002	2	2000	50	20	0	98	0	0	0	-1.8	-17.4	**-23.6**	0	2.5	0	57.7
1046	1047	1	2000	50	20	0	98	0	0	0	-3.3	-11.7	**-20.8**	0	2.5	0	64.7
1045	1046	1	2000	50	20	0	98	0	0	0	-3.7	-11.5	**-20.2**	0	2.5	0	65.1
1043	1044	1	2000	50	20	0	98	0	0	0	-3.3	-13.1	**-21.7**	0	2.5	0	62.4
1002	1003	1	2000	50	20	0	98	0	0	0	-2.5	-16	**-23.6**	0	2.5	0	58.4
1042	1043	1	2000	50	20	0	98	0	0	0	-5.2	-19	**-20.4**	0	2.5	0	55.9
1042	1043	2	2000	50	20	0	98	0	0	0	-5.2	-15.4	**-20.7**	0	2.5	0	59.2
1017	1018	1	2000	50	20	0	98	0	0	0	-6.6	-14.7	**-20**	0	2.5	0	59.2
1020	1021	1	2000	50	20	0	98	0	0	0	-3.3	-18.7	**-23**	0	2.5	0	55.5
1041	1042	1	2000	50	20	0	98	0	0	0	-6.6	-15.7	**-20.2**	0	2.5	0	58
1011	1012	1	2000	50	20	0	98	0	0	0	-10.4	-16.8	**-18.6**	0	2.5	0	54.7
1011	1012	2	2000	50	20	0	98	0	0	0	-10.4	-18.7	**-18.6**	0	2.5	0	52.8
1011	1012	3	2000	50	20	0	98	0	0	0	-10.4	-16.2	**-18.6**	0	2.5	0	55.3
1007	1008	1	2000	50	20	0	98	0	0	0	-11.7	-18.2	**-18.1**	0	2.5	0	52.5
1007	1008	2	2000	50	20	0	98	0	0	0	-11.7	-17.6	**-18**	0	2.5	0	53.2
1007	1008	3	2000	50	20	0	98	0	0	0	-11.7	-17.9	**-17.9**	0	2.5	0	53
1007	1008	4	2000	50	20	0	98	0	0	0	-11.7	-16.8	**-17.7**	0	2.5	0	54.3
1037	1038	1	2000	50	20	0	98	0	0	0	-9.6	-17.8	**-17.8**	0	2.5	0	55.3
1037	1038	2	2000	50	20	0	98	0	0	0	-9.6	-16.4	**-17.9**	0	2.5	0	56.6
1016	1017	1	2000	50	20	0	98	0	0	0	-8.3	-15.4	**-18.5**	0	2.5	0	58.3
1031	1032	1	2000	50	20	0	98	0	0	0	-10.1	-17.5	**-18.2**	0	2.5	0	54.7
1031	1032	2	2000	50	20	0	98	0	0	0	-10.1	-16.4	**-18.3**	0	2.5	0	55.7
1022	1023	1	2000	50	20	0	98	0	0	0	-6.5	-17.8	**-20.2**	0	2.5	0	56
1022	1023	1	2000	50	20	0	98	0	0	0	-10.2	-19	**-18.4**	0	2.5	0	52.9
1015	1016	2	2000	50	20	0	98	0	0	0	-10.2	-15.8	**-18.3**	0	2.5	0	56.2
1024	1025	1	2000	50	20	0	98	0	0	0	-10.9	-15.8	**-17.9**	0	2.5	0	55.9
1024	1025	2	2000	50	20	0	98	0	0	0	-10.9	-18.6	**-17.9**	0	2.5	0	53.1
1010	1011	1	2000	50	20	0	98	0	0	0	-11.2	-19	**-17.9**	0	2.5	0	52.4
1010	1011	2	2000	50	20	0	98	0	0	0	-11.2	-18.7	**-17.8**	0	2.5	0	52.8
1010	1011	3	2000	50	20	0	98	0	0	0	-11.2	-18.1	**-17.7**	0	2.5	0	53.5
1023	1024	1	2000	50	20	0	98	0	0	0	-10.9	-16.3	**-17.7**	0	2.5	0	55.6
1023	1024	2	2000	50	20	0	98	0	0	0	-10.9	-18.3	**-17.6**	0	2.5	0	53.7
1033	1034	1	2000	50	20	0	98	0	0	0	-10.2	-18.5	**-18**	0	2.5	0	53.8
1033	1034	2	2000	50	20	0	98	0	0	0	-10.2	-17.8	**-17.9**	0	2.5	0	54.6
1021	1022	1	2000	50	20	0	98	0	0	0	-8.3	-17.3	**-19.9**	0	2.5	0	55
1019	1020	1	2000	50	20	0	98	0	0	0	-8.3	-17.6	**-19**	0	2.5	0	55.6
1025	1026	1	2000	50	20	0	98	0	0	0	-10.9	-15	**-18.3**	0	2.5	0	56.3
1030	1031	1	2000	50	20	0	98	0	0	0	-9.9	-16.1	**-18.6**	0	2.5	0	55.9
1028	1029	1	2000	50	20	0	98	0	0	0	-6.8	-19.3	**-21.1**	0	2.5	0	53.3
1003	1004	1	2000	50	20	0	98	0	0	0	-7	-19.2	**-21.4**	0	2.5	0	52.9
1036	1037	1	2000	50	20	0	98	0	0	0	-9.4	-17	**-18.2**	0	2.5	0	55.9
1004	1005	1	2000	50	20	0	98	0	0	0	-11.1	-19.4	**-18.4**	0	2.5	0	51.6
1004	1005	2	2000	50	20	0	98	0	0	0	-11.1	-17.3	**-18.4**	0	2.5	0	53.7
1014	1015	1	2000	50	20	0	98	0	0	0	0	0	**0**	0	2.5	0	100.5
1032	1033	1	2000	50	20	0	98	0	0	0	-10.5	-16.4	**-17.6**	0	2.5	0	56
1029	1030	1	2000	50	20	0	98	0	0	0	-8.8	-18.6	**-19.6**	0	2.5	0	53.5
1038	1039	1	2000	50	20	0	98	0	0	0	-9.7	-17.8	**-18.1**	0	2.5	0	54.9
1026	1027	1	2000	50	20	0	98	0	0	0	-10.8	-17.4	**-18.4**	0	2.5	0	53.9
1006	1007	1	2000	50	20	0	98	0	0	0	-9.2	-19.4	**-20**	0	2.5	0	51.9
1008	1009	1	2000	50	20	0	98	0	0	0	-11.1	-18.8	**-18**	0	2.5	0	52.6
1018	1019	1	2000	50	20	0	98	0	0	0	-3	-22.1	**-22.8**	0	2.5	0	52.6
1040	1041	1	2000	50	20	0	98	0	0	0	-4	-21.7	**-22.5**	0	2.5	0	52.3
1035	1036	1	2000	50	20	0	98	0	0	0	-5.1	-21.3	**-21.8**	0	2.5	0	52.3
1039	1040	1	2000	50	20	0	98	0	0	0	-6.6	-21.5	**-20.7**	0	2.5	0	51.7
1034	1035	1	2000	50	20	0	98	0	0	0	-8	-19.6	**-19.7**	0	2.5	0	53.2
1013	1014	1	2000	50	20	0	98	0	0	0	-6.5	-21.9	**-21.5**	0	2.5	0	50.6
1009	1010	1	2000	50	20	0	98	0	0	0	-1.9	-27.5	**-24**	0	2.5	0	47.1
1027	1028	1	2000	50	20	0	98	0	0	0	-8.6	-20.3	**-20.3**	0	2.5	0	51.3

ANNEX B6D - OUTPUT FILE OF HFA NOISE MODEL - Calculation of barrier attenuation

HFA Noise V1.10 Results File: Full Output

File: 968_2F.DAT

Receiver No : 300
X=809575.5 Y=829198.5 Z = 5 **Height = 4**

Road Segment	Road Segment	Sub Segment	Flow	Speed	%Heavy Veh	Gradient	Basic Noise Level	< Speed	Gradient	Surface	Distance	Angle of View	corrections **Barrier**	Ground Cover	Facade	Reflection	> Segment Total
1044	1045	1	2000	50	20	0	61.6	2	0	-3.5	-0.1	-13.4	**-20.6**	0	2.5	0	28.5
1000	1001	1	2000	50	20	0	61.6	2	0	-3.5	-0.4	-13.7	**-20.6**	0	2.5	0	27.9
1001	1002	1	2000	50	20	0	61.9	2	0	-3.5	-1.8	-15.2	**-19.9**	0	2.5	0	26
1001	1002	2	2000	50	20	0	61.9	2	0	-3.5	-1.8	-17.4	**-20.3**	0	2.5	0	23.4
1046	1047	1	2000	50	20	0	62.1	2	0	-3.5	-3.3	-11.7	**-17.6**	0	2.5	0	30.5
1045	1046	1	2000	50	20	0	62.1	2	0	-3.5	-3.7	-11.5	**-17.2**	0	2.5	0	30.7
1043	1044	1	2000	50	20	0	62.1	2	0	-3.5	-3.3	-13.1	**-18.3**	0	2.5	0	28.4
1002	1003	1	2000	50	20	0	62	2	0	-3.5	-2.6	-16	**-20.2**	0	2.5	0	24.2
1042	1043	1	2000	50	20	0	62.1	2	0	-3.5	-5.2	-18.9	**-16.9**	0	2.5	0	22.1
1042	1043	2	2000	50	20	0	62.1	2	0	-3.5	-5.2	-15.4	**-17.1**	0	2.5	0	25.4
1017	1018	1	2000	50	20	0	62.1	2	0	-3.5	-6.6	-14.7	**-16.4**	0	2.5	0	25.4
1020	1021	1	2000	50	20	0	62.1	2	0	-3.5	-3.4	-18.8	**-19.5**	0	2.5	0	21.4
1041	1042	1	2000	50	20	0	62.1	2	0	-3.5	-6.6	-15.7	**-16.5**	0	2.5	0	24.3
1011	1012	1	2000	50	20	0	62.1	2	0	-3.5	-10.4	-16.7	**-15**	0	2.5	0	21
1011	1012	2	2000	50	20	0	62.1	2	0	-3.5	-10.4	-18.8	**-15**	0	2.5	0	18.9
1011	1012	3	2000	50	20	0	62.1	2	0	-3.5	-10.4	-16.2	**-15**	0	2.5	0	21.5
1007	1008	1	2000	50	20	0	62.1	2	0	-3.5	-11.7	-18.2	**-14.5**	0	2.5	0	18.7
1007	1008	2	2000	50	20	0	62.1	2	0	-3.5	-11.7	-17.6	**-14.4**	0	2.5	0	19.4
1007	1008	3	2000	50	20	0	62.1	2	0	-3.5	-11.7	-17.9	**-14.3**	0	2.5	0	19.2
1007	1008	4	2000	50	20	0	62.1	2	0	-3.5	-11.7	-16.8	**-14.2**	0	2.5	0	20.4
1037	1038	1	2000	50	20	0	62.1	2	0	-3.5	-9.7	-17.6	**-14.4**	0	2.5	0	21.4
1037	1038	2	2000	50	20	0	62.1	2	0	-3.5	-9.7	-16.6	**-14.5**	0	2.5	0	22.3
1016	1017	1	2000	50	20	0	62.1	2	0	-3.5	-8.3	-15.4	**-15**	0	2.5	0	24.4
1031	1032	1	2000	50	20	0	62.1	2	0	-3.5	-10.1	-17.5	**-14.7**	0	2.5	0	20.8
1031	1032	2	2000	50	20	0	62.1	2	0	-3.5	-10.1	-16.4	**-14.8**	0	2.5	0	21.8
1022	1023	1	2000	50	20	0	62.1	2	0	-3.5	-10.2	-18.9	**-14.8**	0	2.5	0	19.2
1022	1023	2	2000	50	20	0	62.1	2	0	-3.5	-10.2	-15.8	**-14.8**	0	2.5	0	22.3
1015	1016	1	2000	50	20	0	62.1	2	0	-3.5	-6.5	-17.8	**-16.6**	0	2.5	0	22.2
1024	1025	1	2000	50	20	0	62.1	2	0	-3.5	-10.9	-15.8	**-14.4**	0	2.5	0	22
1024	1025	2	2000	50	20	0	62.1	2	0	-3.5	-10.9	-18.6	**-14.4**	0	2.5	0	19.2
1010	1011	1	2000	50	20	0	62.1	2	0	-3.5	-11.2	-19	**-14.4**	0	2.5	0	18.5
1010	1011	2	2000	50	20	0	62.1	2	0	-3.5	-11.2	-18.7	**-14.3**	0	2.5	0	18.9
1010	1011	3	2000	50	20	0	62.1	2	0	-3.5	-11.2	-18.1	**-14.3**	0	2.5	0	19.5
1023	1024	1	2000	50	20	0	62.1	2	0	-3.5	-10.9	-16.3	**-14.2**	0	2.5	0	21.7
1023	1024	2	2000	50	20	0	62.1	2	0	-3.5	-10.9	-18.3	**-14.2**	0	2.5	0	19.7
1033	1034	1	2000	50	20	0	62.1	2	0	-3.5	-10.2	-18.5	**-14.5**	0	2.5	0	19.9
1033	1034	2	2000	50	20	0	62.1	2	0	-3.5	-10.2	-17.9	**-14.5**	0	2.5	0	20.5
1021	1022	1	2000	50	20	0	62.1	2	0	-3.5	-8.3	-17.3	**-16.2**	0	2.5	0	21.3
1019	1020	1	2000	50	20	0	62.1	2	0	-3.5	-8.3	-17.6	**-15.5**	0	2.5	0	21.7
1025	1026	1	2000	50	20	0	62.1	2	0	-3.5	-10.9	-15	**-14.7**	0	2.5	0	22.5
1030	1031	1	2000	50	20	0	62.1	2	0	-3.5	-9.9	-16.1	**-15.2**	0	2.5	0	21.9
1028	1029	1	2000	50	20	0	62.1	2	0	-3.5	-6.8	-19.3	**-17.4**	0	2.5	0	19.6
1003	1004	1	2000	50	20	0	62.1	2	0	-3.5	-7	-19.2	**-17.7**	0	2.5	0	19.2
1036	1037	1	2000	50	20	0	62.1	2	0	-3.5	-9.4	-17	**-14.8**	0	2.5	0	21.9
1004	1005	1	2000	50	20	0	62.1	2	0	-3.5	-11.1	-19.4	**-14.7**	0	2.5	0	17.9
1004	1005	2	2000	50	20	0	62.1	2	0	-3.5	-11.1	-17.4	**-14.8**	0	2.5	0	19.8
1014	1015	1	2000	50	20	0	35.7	2	0	-3.5	0	0	**0**	0	2.5	0	36.7
1032	1033	1	2000	50	20	0	62.1	2	0	-3.5	-10.5	-16.4	**-14.2**	0	2.5	0	22
1029	1030	1	2000	50	20	0	62.1	2	0	-3.5	-8.8	-18.6	**-16.1**	0	2.5	0	19.6
1038	1039	1	2000	50	20	0	62.1	2	0	-3.5	-9.7	-17.8	**-14.6**	0	2.5	0	21
1026	1027	1	2000	50	20	0	62.1	2	0	-3.5	-10.8	-17.4	**-15**	0	2.5	0	19.9
1006	1007	1	2000	50	20	0	62.1	2	0	-3.5	-9.2	-19.4	**-16.3**	0	2.5	0	18.2
1008	1009	1	2000	50	20	0	62.1	2	0	-3.5	-11.1	-18.8	**-14.5**	0	2.5	0	18.7
1018	1019	1	2000	50	20	0	62	2	0	-3.5	-3	-22.1	**-19.4**	0	2.5	0	18.5
1040	1041	1	2000	50	20	0	62.1	2	0	-3.5	-4	-21.7	**-18.9**	0	2.5	0	18.5
1035	1036	1	2000	50	20	0	62.1	2	0	-3.5	-5.1	-21.3	**-18.1**	0	2.5	0	18.6
1039	1040	1	2000	50	20	0	62.1	2	0	-3.5	-6.6	-21.5	**-17**	0	2.5	0	18
1034	1035	1	2000	50	20	0	62.1	2	0	-3.5	-8.1	-19.6	**-16**	0	2.5	0	19.4
1013	1014	1	2000	50	20	0	62.1	2	0	-3.5	-6.5	-21.9	**-17.8**	0	2.5	0	16.9
1009	1010	1	2000	50	20	0	61.9	2	0	-3.5	-1.8	-27.6	**-20.8**	0	2.5	0	12.7
1027	1028	1	2000	50	20	0	62.1	2	0	-3.5	-8.6	-20.4	**-16.7**	0	2.5	0	17.4

Annex C

Plant Species Recorded Within the Study Area

Annex C

Table 1 Plant Species Recorded Within the Study Area

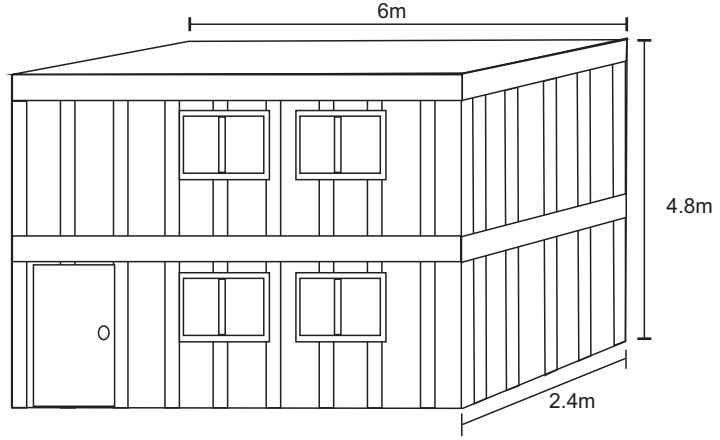
Species	Growth Form	Origin	Status	Local Abundance		
				Orchard	Open Storage Area	Disturbed Area
Acacia confusa	T	E	VC			O
Ageratum conyzoides	H	N	VC			F
Chloris barbata	G	E	VC			F
Citrus sinensis	T	E	C	O		
Clausena lansium	S	E	C	O		
Dimocarpus longan	T	N	C	D		
Eleusine indica	G	E	VC			F
Ipomoea brasiliensis	C	N	VC	O		O
Ipomoea cairica	C	N	VC		F	
Lantana camara	S	E	VC	O		O
Leucaena leucocephala	T	E	VC		F	F
Litchi chinensis	T	N	VC	D		
Mangifera indica	T	N	VC	O		
Mikania micrantha	C	E	VC	O	O	O
Mimosa pudica	S	N	VC			O
Miscanthus floridulus	G	N	VC			O
Miscanthus sinensis	G	N	VC			F
Musa paradisiaca	T	N	VC	O		
Neyraudia arundinacea	G	N	VC		O	F
Pennisetum alopecuroides	G	N	VC			A
Psidium guajava	S	E	C	F		
Rhynchelytrum repens	G	N	VC		O	F
Total no. of species				**10**	**5**	**14**

Code for abundance: A=Abundant; F=Frequent; O=Occasional; S=Scarce
Code for Status: C=Common; VC=Very Common; P=Protected
Code for Plant Form: G=Grass; Climber; H=Herb; Se=Sedge; G=Grass; S=Shrub; T=Tree
Code for Origin: N=Native; E=Exotic

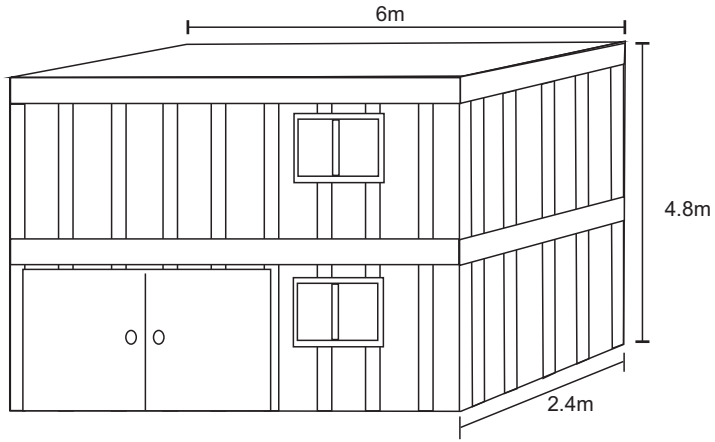
Annex D

Design of the Storage / Maintenance Structures

Typical Structure for Storage Purpose



Typical Structure for Kart Maintenance Purpose



Annex D1

Design of the Storage/Maintenance Structures

FILE: 0039968i
DATE: 20/01/2006

Environmental Resources Management

ERM