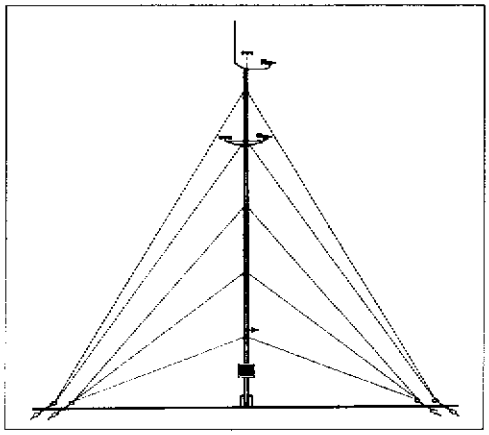
PROJECT PROFILE:
REVISION A: January 2001

Proposal to establish one temporary wind monitoring station on

Lamma Island

for evaluating wind power as a renewable energy source.



Friends of the Earth, Hong Kong (Charity)

Contents

1. Basic project information.

A. Project Title.

Establish one temporary wind monitoring station on Lamma Island for the purpose of evaluating wind power as a renewable energy source.

B. Purpose and nature of the project.

Background.

As Hong Kong reaches the 21st century, the investigation and development of renewable energy sources should be receiving a much higher profile than they presently are. Renewable energy offers the opportunity to reduce harmful pollution, improve resource security, and increase employment. Wind power is presently one of the most competitively priced renewable energy sources. At favourable sites, wind power can be equal or cheaper in price than fossil or nuclear power, even if pollution costs are ignored. Wind is presently the most rapidly growing renewable energy in terms of installed capacity, and the trend in technology is moving toward larger turbines and off-shore installation to take advantage of more steady winds and less disturbance to land based activities.

Objective

In order to evaluate the potential for wind power in Hong Kong, Friends of the Earth (HK) are undertaking a modelling study which will provide map-based data from which to judge the practical application of wind power technologies to Hong Kong. Data from the proposed temporary monitoring station on Lamma as well as data from all other available stations will be processed into a **Wind Atlas** using standard, internationally recognised modelling software. The wind atlas is a map of wind energy potential at a standard height, showing the power available per square metre of swept blade area. This allows costs, power yields, and environmental impacts to be estimated for various wind technologies and different siting and inter-connection options. More informed decisions can then be made on wind development potential.

Need for monitoring station on Lamma Island.

The existing meteorological stations in Hong Kong provide a valuable data set that will be used in the study. In addition, two temporary stations are proposed to be set up, one on Po Toi Island, and one on southern Lamma Island for three reasons:

1. Wind speed and direction data need to be taken at the representative height of modern wind turbines (30 - 80 metres above ground level), to be sampled at multiple heights in the same location (for wind shear and turbulence), and to be away from urban obstructions. There are no monitoring stations with these features on Lamma Island presently.

2. With Hong Kong's tight land use constraints, wind power development and data collection should focus on off-shore wind flow. A monitoring station on southern Lamma Island will give valuable information about the wind potential in Hong Kong's southern coastal regions.

3. Lamma Island provides Hong Kong with valuable assets of non-urban lifestyle (figure 1) and a dedication to sustainable development patterns such as renewable energy, organic farming, mariculture, and eco-tourism (figure 2). However, more support is required to make Lamma a sustainable community, and wind energy can be an essential part to expand its green development. Lamma Island has several potential benefits from wind power technology and is therefore a high priority site for detailed wind monitoring to assess the opportunities.

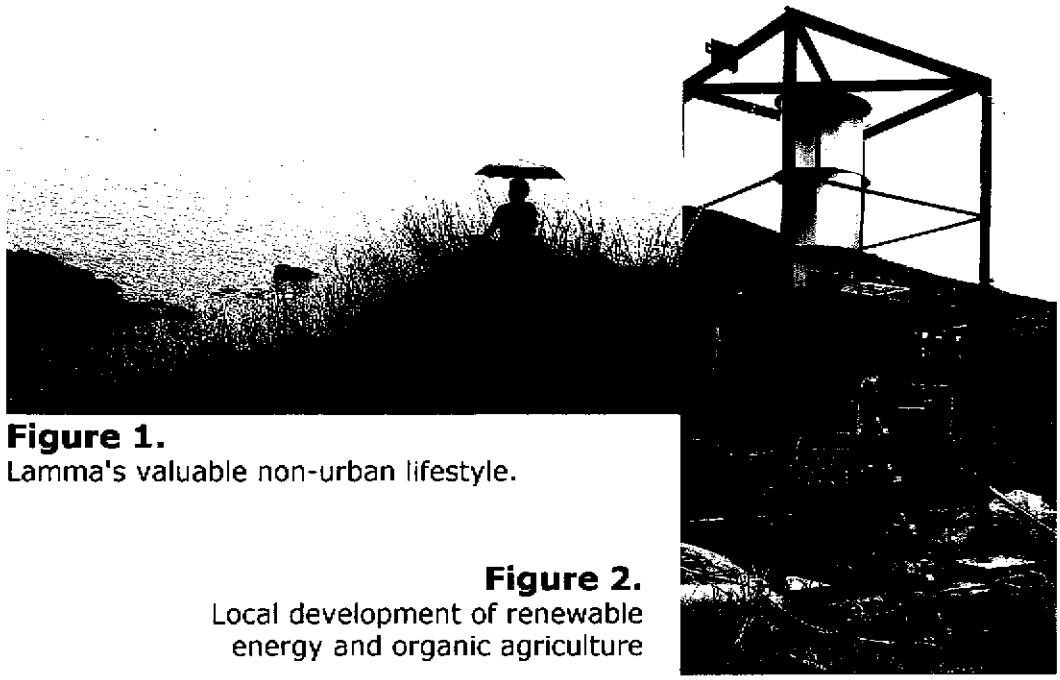


Figure 1.
Lamma's valuable non-urban lifestyle.

Figure 2.
Local development of renewable energy and organic agriculture

C. Name of the project proponent.

Friends of the Earth Hong Kong (Charity) Ltd.

D. Location and scale of project.

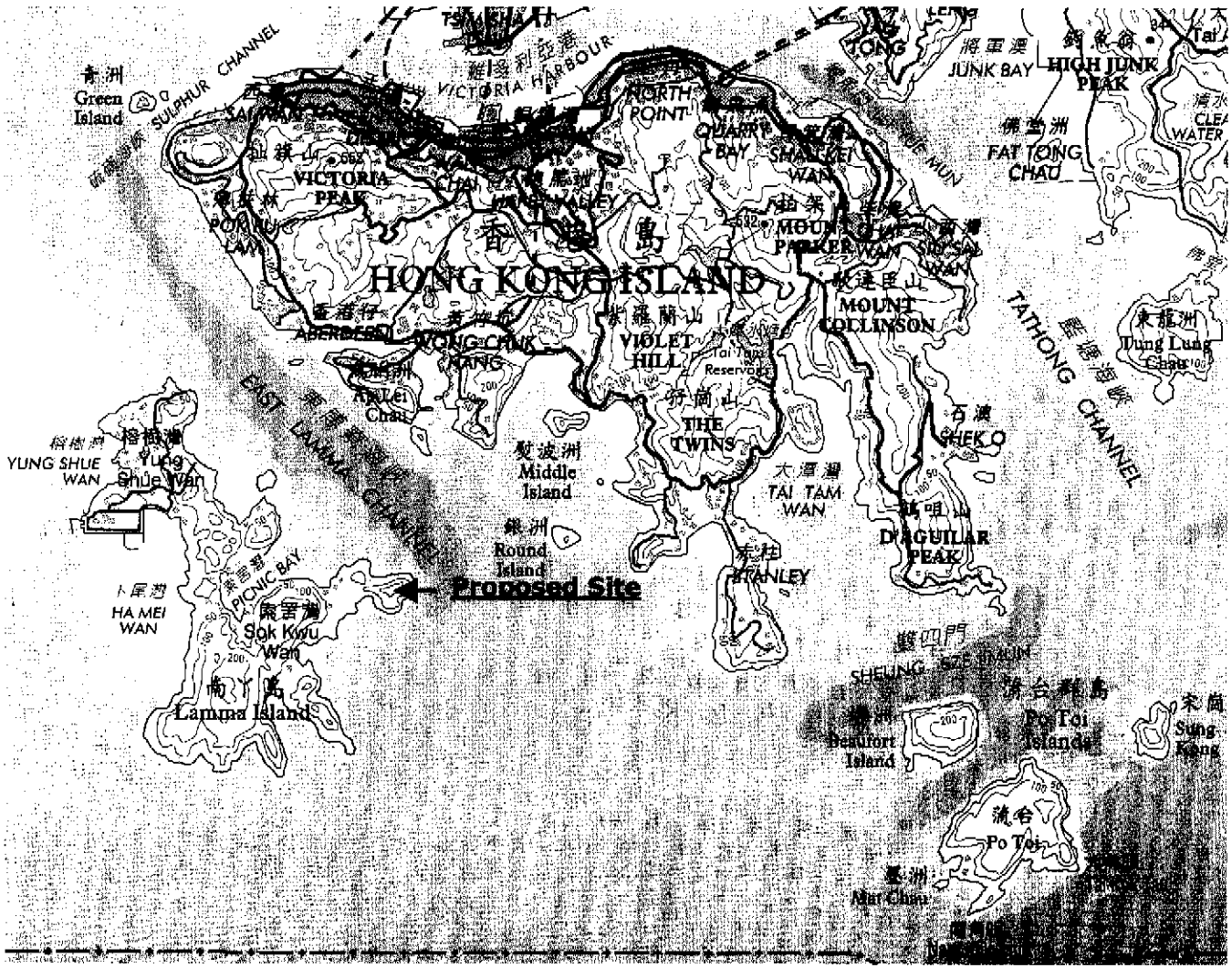
Location

The proposed site is on Ngai Tau, Lamma Island, as shown in figures 3 - 6.

Scale

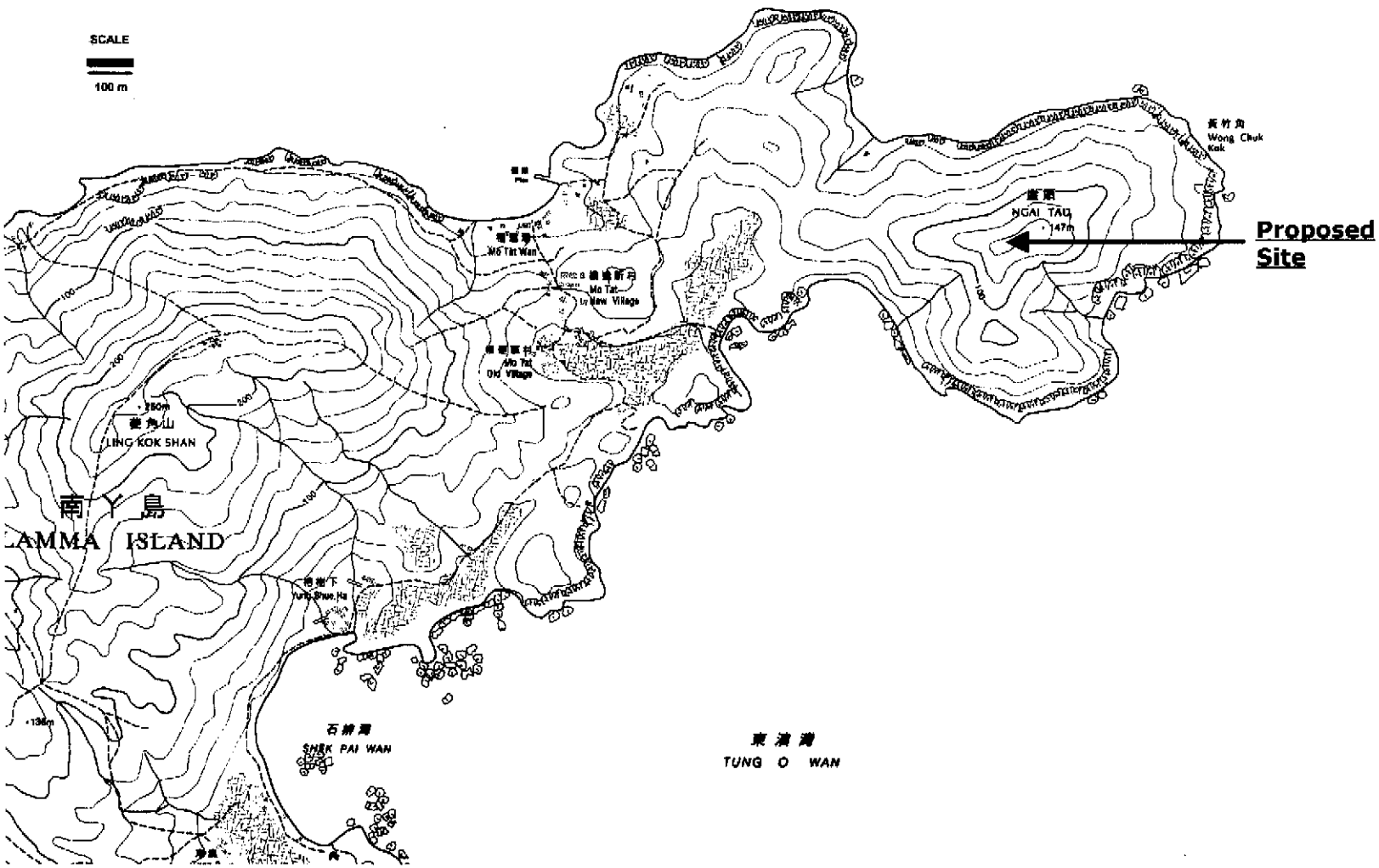
The monitoring station is a metal tube tower 15 cm (6 inches) in diameter and 30 metres (100 feet) tall. Small wind sensors, a data logger, and a warning lamp system are attached to the tower. The tower is held by cables attached to four corner anchors 18.3 metres (60 feet) from the tower base. Five holes of 45 mm (1.75 inch) diameter are drilled into the ground for anchor placement, which will be removed after use. The tower rests on a base plate that does not need a foundation. The four anchor corners form a square of 670 m^2. During set-up and take-down 150 m^2 of the site vegetation (mostly low shrub) will be disturbed in narrow cut-lines 0.5 or 2.0 m wide. During operation the site will be visited once a month. Access to the site requires 340 m of temporary footpath. This is a temporary installation and the station will be removed after approximately 13 months.

Figure 3. Lamma Island proposed site location: OVERVIEW.



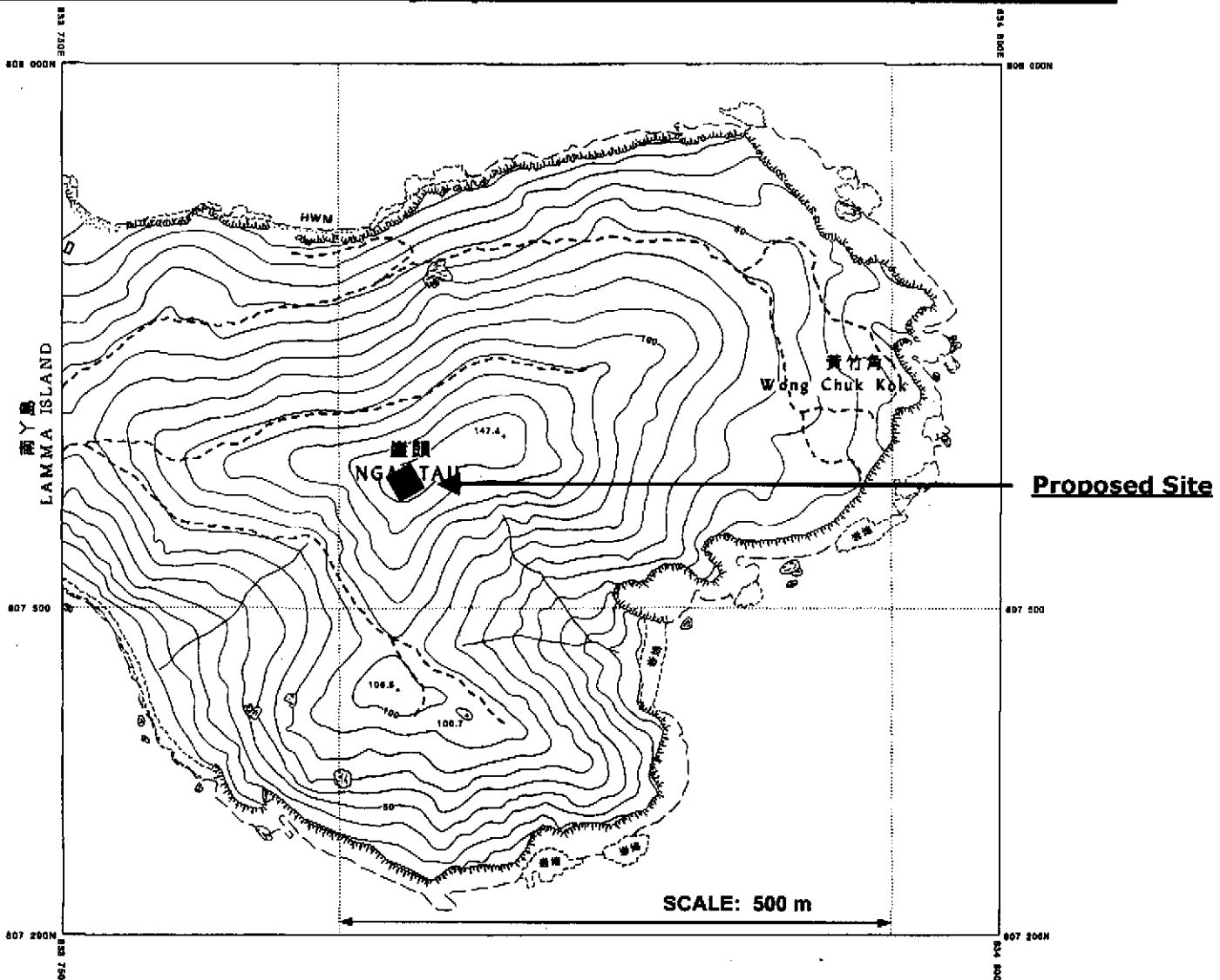
Hong Kong SAR Map; Series HM100SAR; Edition 1 (1997); © HK Survey and Mapping Office.

Figure 4. Lamma Island proposed site location: 1:10,000 SCALE



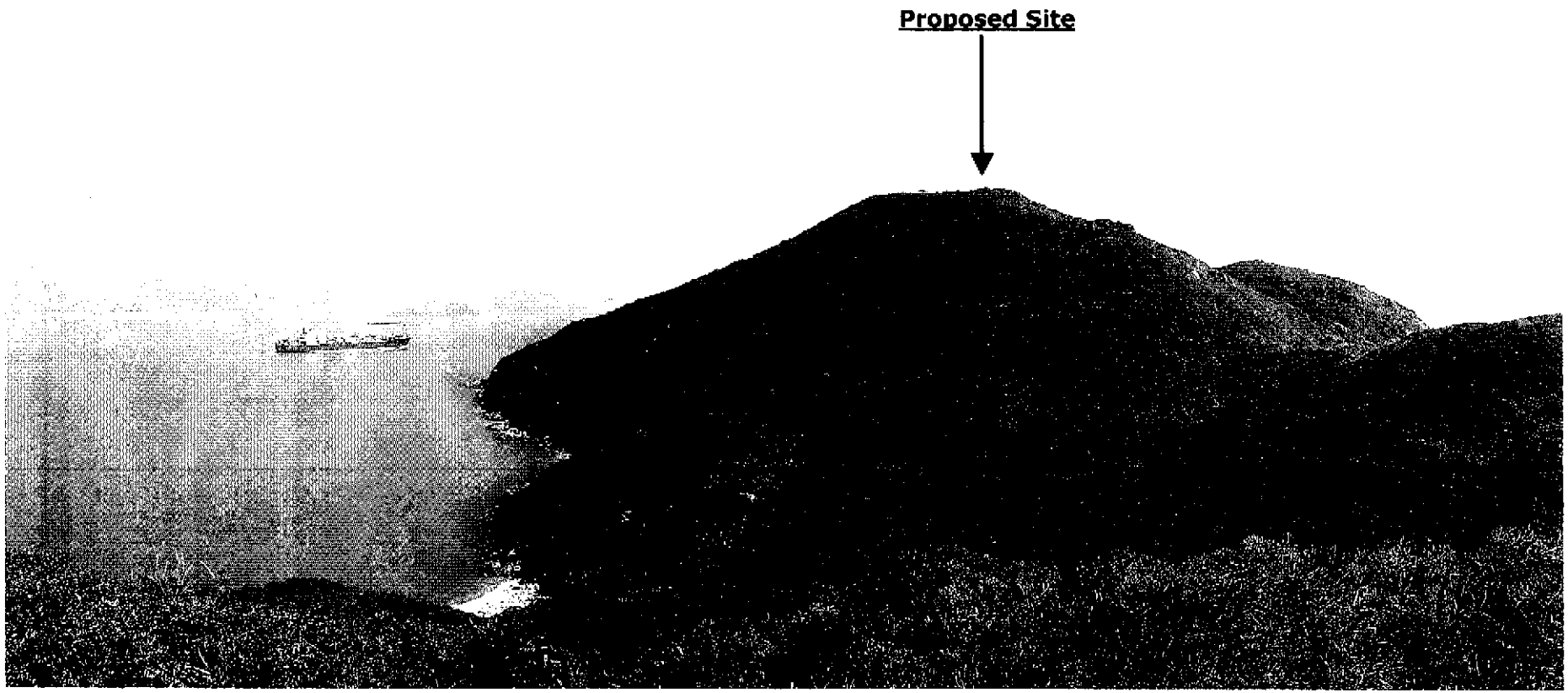
Map Series SM10C; Lamma Island Sheet; Edition 1 (4/1999); © HK Survey and Mapping Office.

Figure 5. Lamma Island proposed site location: 1:5,000 SCALE



Map Series HP5C; Sheet 15NW C (inset 15NW D); Edition (4/1999); © HK Survey and Mapping Office.

Figure 6. Lamma Island proposed site location: PHOTOGRAPH



View of Ngai Tau. In the background, East Lamma Channel and Stanley Peninsula.

E. History of site.

Lamma Island proposed site

The site is on the top of Ngai Tau (Cliff Head). The hill top is covered with boulders and a mixture of short and tall shrub vegetation. There is no habitation on Ngai Tau, the closest community is the village of Mo Tat, 1 km to the west. Old access paths around the hill are no longer used and are not visible.

Choice of site

Ngai Tau was selected as a wind monitoring site on Lamma Island because this location meets the basic requirement of excellent exposure to the prevailing wind directions (between N and ESE). This location also best optimised the criteria of ***not being close to***:

a. Village development.
b. SSSI.
c. Cultural features such as graves.
d. Tourist footpaths.
e. Active development zones.

The wind monitoring station was considered at the following alternate sites, but these were rejected in favour of Ngai Tau for these reasons:

Yuen Kok Peninsula (too close to Sham Wan SSSI).
Ling Kok Shan (too close to tourist footpaths).
Lamma Island Youth Hostel Area (too close to grave sites and tourist area).
Luk Chau Shan (too close to active quarry and future development area).

F. Number and types of designated projects to be covered by the project profile.

This project profile covers one project.

Lamma Island site
The proposed Lamma Island wind monitoring station is considered to be a Designated Project because the proposed location has been zoned as Conservation Area on the Lamma Island Outline Zoning Plan S/I-LI/1 as issued by the Hong Kong Town Planning Board on 25 August, 2000.

G. Name and telephone number of contact person.

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2. Outline of planning and implementation program.

A. Planning.

The goal of the monitoring program is to obtain 12 months of wind data at the station. It is estimated that the maximum time required for commissioning and decommissioning of the monitoring station would each be about two weeks. Therefore the total time for the station to be installed is 13 months. Data processing and wind atlas production will be done in parallel with the 12 month data collection phase.

B. Implementation.

Number of Site Visits

It is proposed to move the required staff and equipment to the site by footpath. The following estimates are made for the total "person-visits":

Table 1.

Implementation Step	Person-Visits to Site
1. Site Preparation	10
2. Station Set-up	50
3. Station Operation	30
4. Station Take-down	50
5. Vegetation grow-back monitoring	10
TOTAL	**150**

Site Preparation

The site preparation step needs a team of about 5 people for two days, and should be completed several days before the station components are delivered to the site.

Three steps are implemented during site preparation:

1. The exact location of the five anchor holes, the base plate, and the cut-lines is marked using a survey instrument.
2. The cut lines are made.
3. The anchor holes are drilled with a hand held rock drill and the rock anchors are placed in the holes and the surface sealed with grout.

Material Transport to Site

Material transport is expected to need a team of 12 people for one day. The complete monitoring station and warning lamp systems would be packaged into a volume of approximately 2.6 m^3 (87 ft^3) and a weight of 700 kg (1,540 lb) to be delivered to the public pier at Mo Tat Wan and then hand carried in pieces to the site along the path indicated in figure 19. The longest components of the system are the 3m long tower sections. The heaviest components are the 40kg batteries for the warning lamp system.

Station Set-up

After the station materials have been delivered to the site, the components are assembled, the tower is pulled upright, and the data logging process is verified. This set-up stage is expected to require a team of 7 people for one day. As illustrated in figure 7, set up of the tower does not require any heavy equipment.

The Set-up steps include:

1. Assemble tower sections on the ground.
   Figure 7, step 1.
2. Attach wind sensors and other equipment onto the tower.
3. Attach 2 side guy wires from tower to anchors for stability when lifting.
4. Attach front guy wires to gin-pole, and attach gin pole to winch.
5. Pull tower half way to vertical using electric winch.
   Figure 7, step 2.
6. Attach the back guy wires to the back anchor.
7. Pull tower to vertical position, attach front guy wires to front anchor.
   Figure 7, step 3.
8. Remove winch.
9. Install data logger and warning lamp power supply at tower base.
10. Remove all tools and packaging from site.

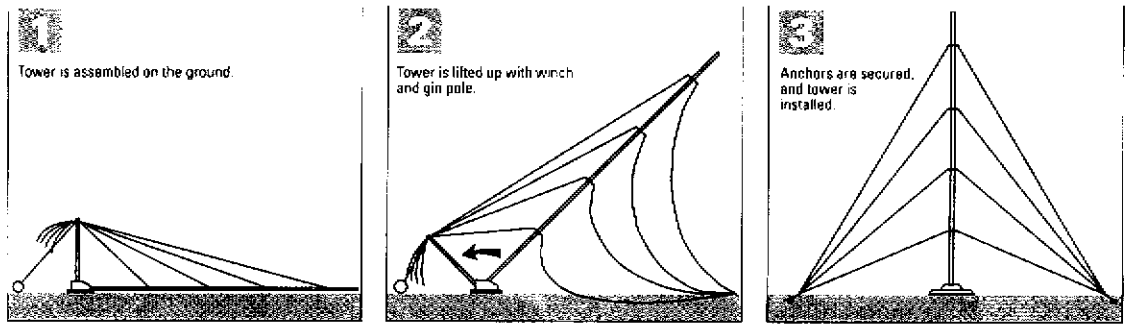


Figure 7. Raising of monitoring tower using an electric winch and gin-pole.

Station Take-down

The procedure for station take-down is the reverse of the set-up steps. All pieces of equipment will be removed from the site. The anchor points will be returned to their natural state by filling in the drill holes, and photographs of the site will be taken to document the re-vegetation process to ensure complete recovery of the site.

Vegetation Grow-back Monitoring

The site will be visited regularly after the station removal to monitor the state of vegetation along previous cut lines and the footpath.

3. Possible impacts on the environment.

A. Station components.

The temporary monitoring station intended for installation is manufactured as an integrated package by NRG Systems (www.nrgsystems.com) in Vermont, USA. The main technical specifications are as follows:

Table 2.

Tower material:	15cm (6 inch) diameter steel tube.
Coating:	Epoxy painted for corrosion resistance.
Height:	30 metres (100 feet).
Guy wires:	Four aircraft cables (4.8mm diam), from each anchor corner to the 7.5, 15, 22.5 and 30 m tower levels.
Guy wire radius:	18.3 metres (60 feet) from tower base.
Tower system weight:	491 kg (1081 pounds)
Warning lamp system:	180 kg (396 pounds)
TOTAL WEIGHT	671 kg (1,477 pounds)

Sensors for wind speed and direction are mounted at 10 metre intervals up the tower. A copper lightening rod is attached to the top of the tower and then grounded through an earth connection at the tower base. Cables from the sensors run down the tower to the data logger which is housed in a locking box attached to the tower about 1.5m above ground level for easy access to download data (figure 8). According to Civil Aviation Department regulations, a warning lamp needs to be installed on top of the tower. This warning system will be powered by batteries recharged by photovoltaic panels attached near the bottom of the tower.

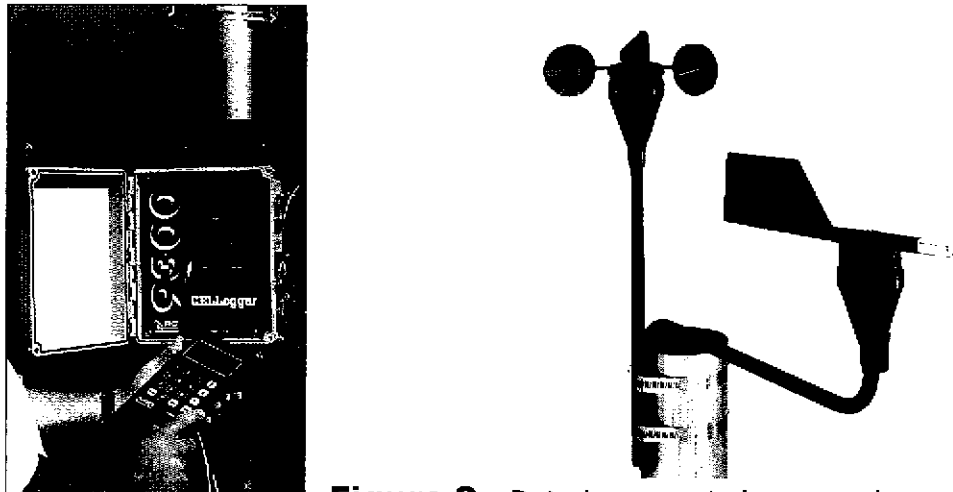


Figure 8. Data logger, wind vane and anemometer.

Chemical emissions from station

None of the station components listed above is expected to create any environmental impact. The lead acid batteries for the warning lamp system contain corrosive liquid but emission would not occur unless they are purposely damaged. No corrosion is expected from metal components because metal parts are either epoxy coated, stainless or galvanised steel, or housed in the weather-proof data logger box. The copper lightening rod and ground rod may corrode slightly, however the impact of this over the monitoring period would be insignificant. The sensors mounted on the tower are made of inert polycarbonate plastic and stainless steel.

Noise emissions from station

Noise emissions during operation are not expected from any of the wind monitoring station components. The sensors and data recording system are silent during operation. The only possible noise during operation would be from high wind speeds interacting with the tower structure.

B. Set-up components.

Chemical emissions from set-up and take-down

Short-term use equipment which contains potentially contaminating chemicals includes the hand held rock drill used to set the anchor points (figure 9). The self-contained rock drill holds about 1.5 litres of gasoline as fuel. There is no reason to suspect that the rock drill would leak under normal use if it is well maintained and operated according to set standards.

Figure 9. A typical hand held rock drill. Weight 30 kg (65 pounds), internal gasoline engine and air compressor, drilling rate 230 - 400 mm/min.

Noise emissions from set-up and take-down

Noise emission during set-up would occur from the use of a hand held rock drill for the setting of anchor holes (hole size: 45 mm (1.75 inch) diameter and approximately 40 cm (1.3 feet) deep). Depending on the rock type, drilling rates vary between 230 to 400 mm per minute, so that each hole would take about 1 to 2 minutes to complete. With a total of 5 anchor holes required at the site, this implies a total drilling time of about 15 minutes. **This work would be done only during daytime between 0800 and 1700 hrs.**

Predicted Noise Levels at Set-up

This section will estimate the Predicted Noise Level of the rock drill for sensitive receivers near the proposed site of Ngai Tau. The Sound Power Level of the drill is taken to be 116 dBA as referenced in the *Noise Control Ordinance, Technical Memorandum on Noise from Construction Work Other than Percussive Piling*, Table 3, Identification Code CNP 183. The nearest sensitive receivers to the proposed site are shown in figure 10.

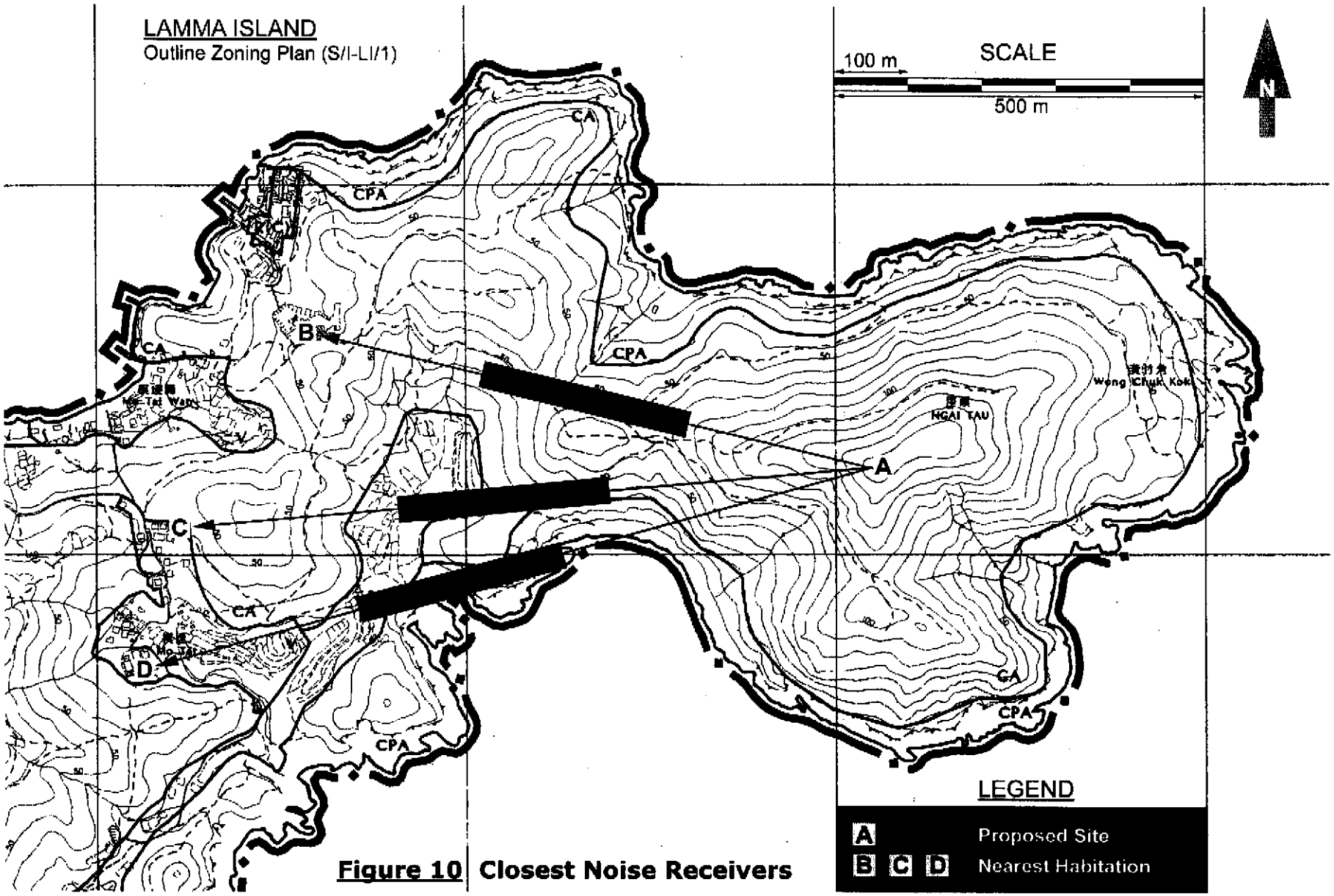


Figure 10 **Closest Noise Receivers**

Predicted Noise Levels at Set-up (continued)

Sensitive Receivers

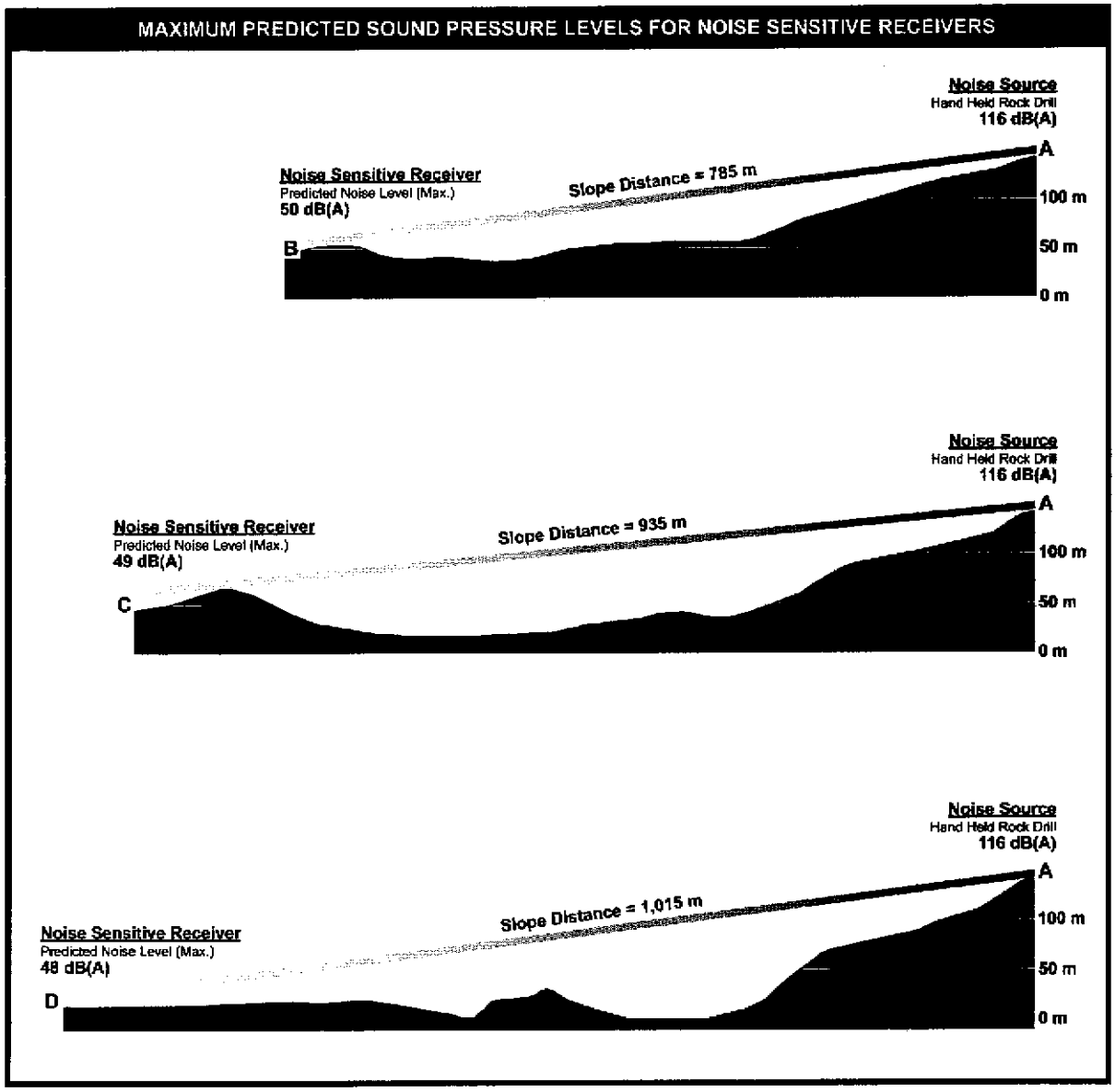
The three closest sensitive receivers impacted by the noise from drilling are indicated by sections AB, AC, and AD (figure 10). These sections represent slope distances of 785, 935 and 1,015 m respectively (figure 11).

Sound Pressure Calculation Assuming Free-Field Radiation into Hemisphere

Sound Pressure Level (Lp) = Sound Power Level (Lw) - 20 log(r) - 8dB

Where Lw = 116 dBA (hand held rock drill), and **r** = distance to receiver.

Figure 11.



Noise Summary

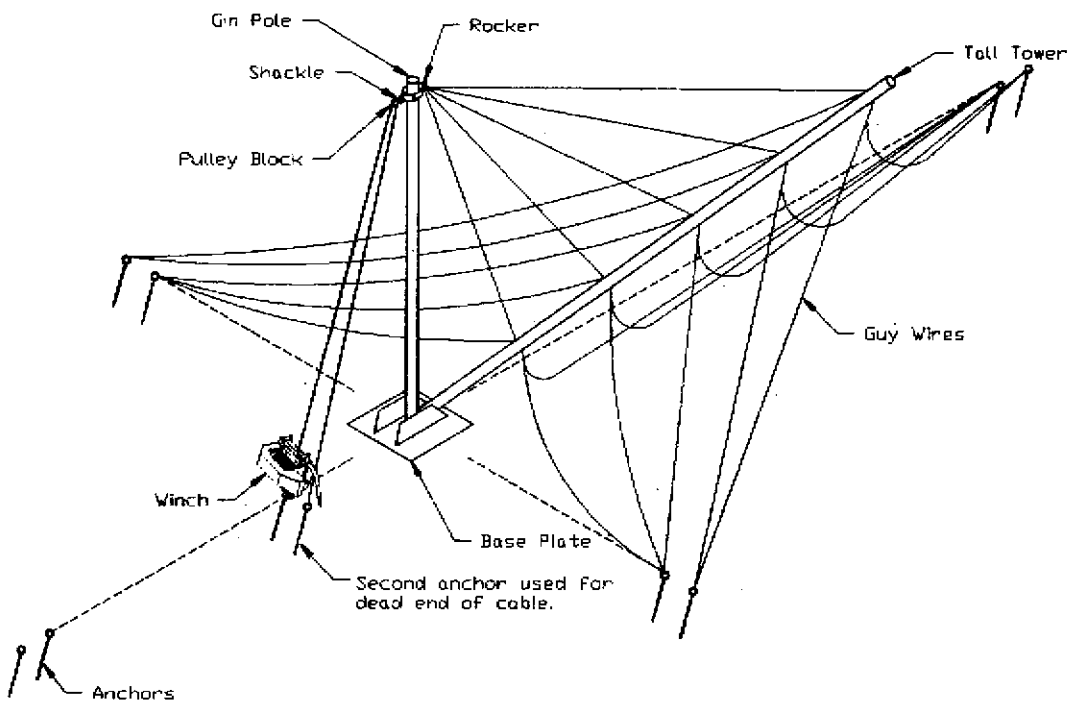
Figure 11 shows that the rock drill noise will not exceed 50 dBA at sensitive receivers. This meets the *Noise Standards for Daytime Construction Activities* for Domestic Premises on weekdays (75 dBA), and the *Basic Noise Level* for Rural Areas during general holidays and evenings (60 dBA).

C. Ground level impacts.

Anchor points and tower base

The site has a thin soil layer underlain by volcanic bedrock (rhyodacite), therefore rock anchors will be used. Since rock anchors are very strong, only one anchor is required at each of the four guy wire corners and for the winch, for a total of five rock anchors. Vegetation above each anchor point will be disturbed for drilling access, but is not expected to exceed 1 m^2 for each anchor. The anchor layout is shown in figure 12 except that each double anchor in the diagram will be a single rock anchor. Using a hand held rock drill, an anchor hole of size: 45 mm (1.75 inch) diameter and 40 cm (1.3 feet) deep will be made in the rock at each of the five anchor points. The anchor holes are angled at 45 degrees toward the tower (figure 13). The tower base is a hinged plate that does not require any foundation or drilling (figure 14).

Figure 12. Anchor hole lay-out



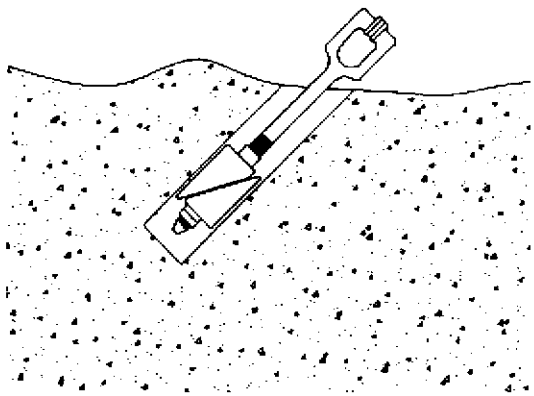


Figure 13 (left) Anchor hole cross section.

Figure 14 (right) Hinged tower base.

C. Ground level impacts (continued).

During set-up and take-down

During set-up and take-down 150 m^2 of the site vegetation (low shrub bamboo) will be disturbed in narrow cut-lines 0.5 to 2.0 m wide. The cut-line configuration is shown in figure 15. The orientation and size of these cut-lines is determined by these factors:

1. The tower must be raised into the prevailing wind direction (it must be pulled upright from the west toward the east by the winch).
2. When the tower is on the ground it must have 1 m on each side to attach sensors on their 1 m side supports. This is the widest cut line at the site, measuring 2.0m wide.
3. When the tower is raised from ground level to 45°, a minimum of two guy wires need to be under tension at each side (at the 15 and 30 m levels). These require narrow 0.5m cut-lines at ground level.
4. The total impact has been reduced by orienting the tower cut-line in the same direction as the footpath so that these two features overlap (see figure 19).

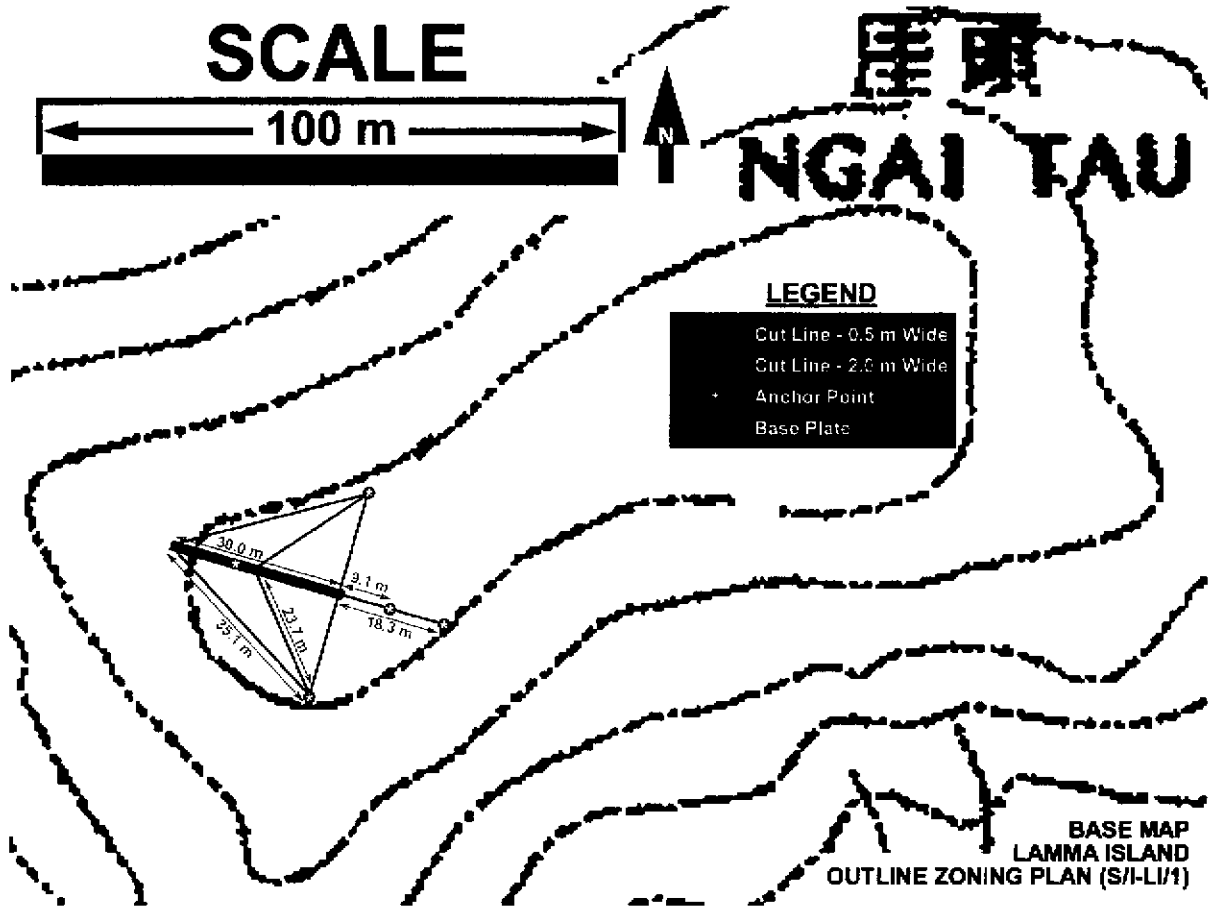


Figure 15.
Proposed cut-line alignment at site.

C. Ground level impacts (continued).

Footpath Access

A footpath is required to allow movement of people and equipment to the site during set-up and take-down as well as to allow staff access for data collection each month during the operation phase. As described in Table 1 (section 2B), the total number of person-visits to the site during the project period is estimated to be 150. There are several old paths in the area of the proposed site that can be re-used to reduce the impact of new paths. The alignment shown in figure 19 suggests that 340 m of temporary new footpath is needed to complete an access route to the site.

With the present vegetation conditions (see figures 17 and 18) and the proposed low frequency of access to the site, the temporary footpath will probably not be visible from any of the closest residential areas or from any of the closest hiking trails. The temporary footpath will not require any vegetation or slopes to be cut, except for within 20 m of the site. Most of the access footpath will only exist as a conceptual alignment followed by staff going to the site which will result in some short term disturbance to leaves and branches along the route during its use.

The footpath will require vegetation cutting only within a few metres (20 m) of the site where the shrubs are more dense. However, this part of the footpath will overlap with the tower cut-line described in figure 15. The general classification of vegetation around the proposed site is shown in figure 16.

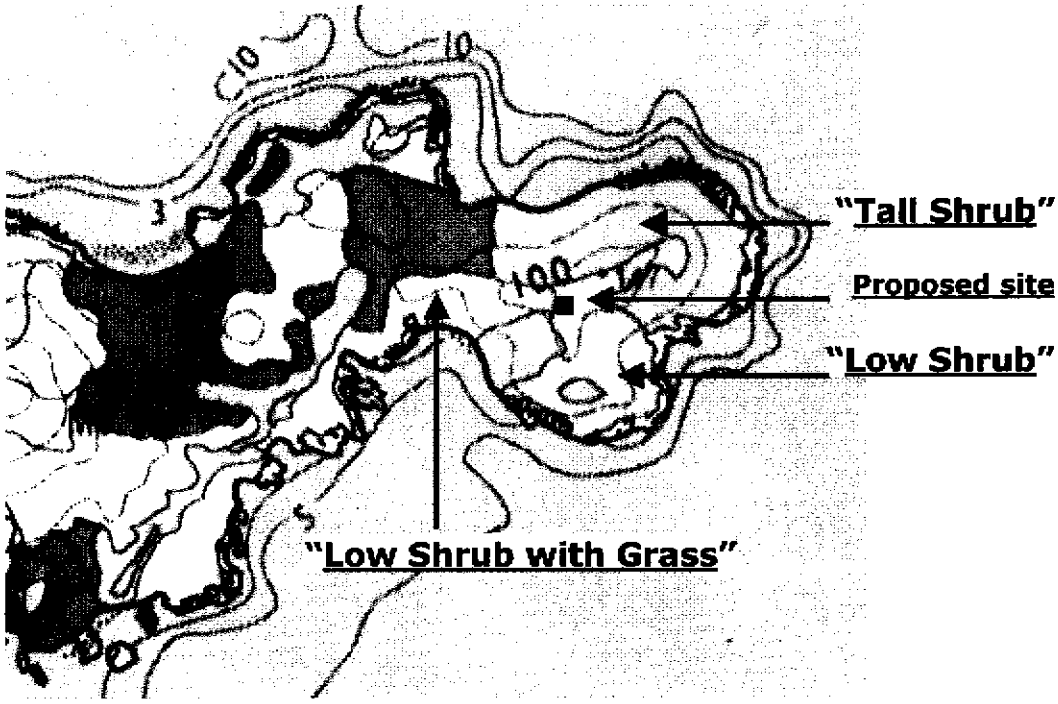


Figure 16.
General vegetation classification around the proposed site.
Hong Kong Vegetation Map, Series HM50V (1993), © World Wide Fund for Nature.

C. Ground level impacts (continued).

Footpath Access (Continued)

Typical ground cover of low shrub with grass and rock outcrops along the footpath is shown in figure 17, the more dense low shrub vegetation at the site is shown in figure 18.

Figure 17.
Low shrub with grass and rock outcrop covers most of the proposed access path. None of this vegetation would be cut. Approximately 150 person visits to the site are expected during the 13 month project.

Figure 18.
Vegetation cover at the proposed site.

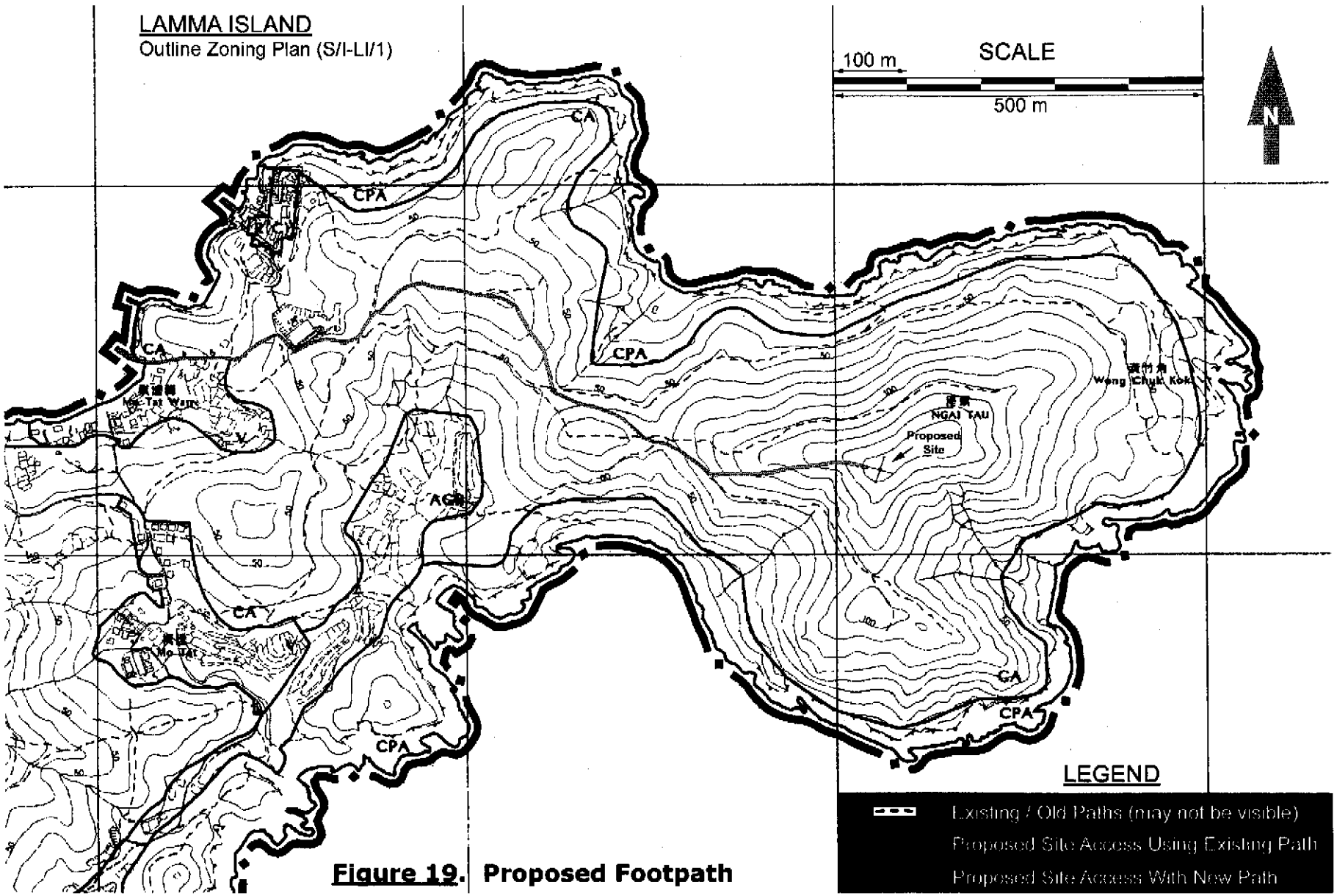


Figure 19. Proposed Footpath

D. Above ground impacts.

Birds

The monitoring station is a rigid structure that will be a new local feature for wildlife such as birds. Birds will react to this structure differently depending on the bird species, the season, the time of day, and the visibility. The main tower and the sensors attached to it are visually obvious because of their size and their non-reflective surfaces. These two structures can thus be considered a low collision risk for birds, particularly when birds are locally resident and become familiar with the tower location. It is not known if the guy wires may pose a risk to birds of prey like hawks, who may be injured if they hunt in proximity to the monitoring station and collide with a guy wire. The guy wires are 4.8 mm diameter (0.19 inch) and are slightly reflective because they are stainless steel which makes them less obvious under certain conditions. However, three factors would reduce this risk. 1. Birds of prey have exceptional eyesight (better than human) for hunting; 2. During times of poor visibility such as bad weather the hunting activity of birds decreases; 3. A red warning lamp at the top of the tower will make the station more visible at night time. Birds of prey have been observed soaring on air currents above the proposed site several times higher than the proposed tower (figure 20). The other uses of the site by birds throughout the year have not been documented.

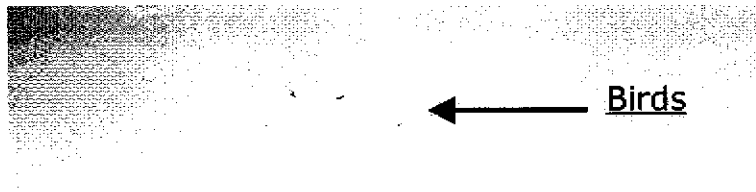
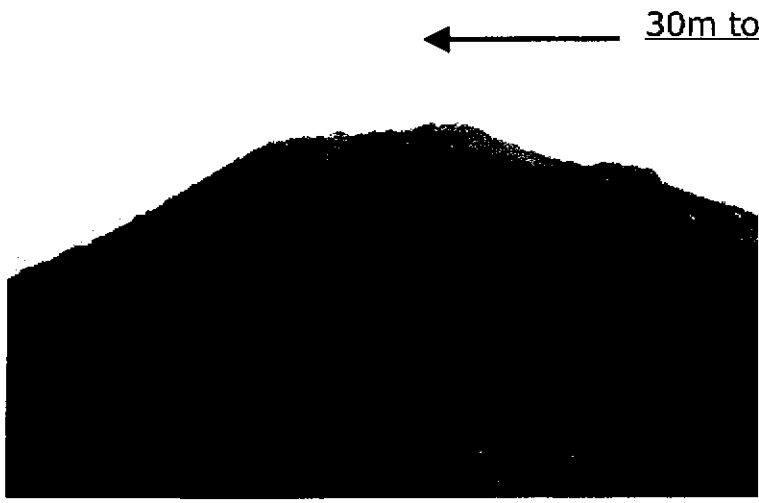


Figure 20. Birds soaring above the proposed Lamma Island site.

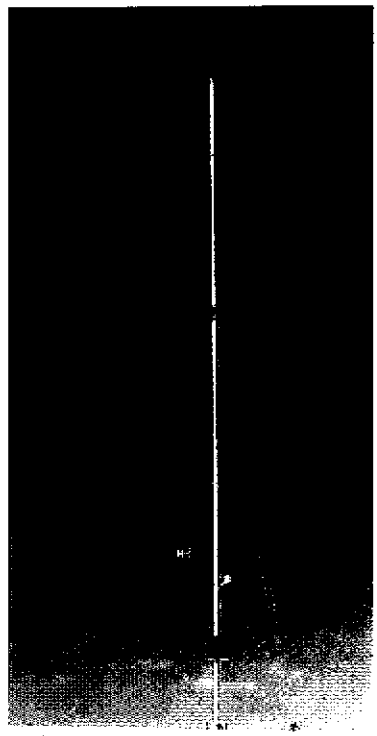


D. Above ground impacts (continued).

Visual disturbance

The visual intrusion on the landscape from the monitoring towers is a highly subjective impact and is difficult to measure in a quantitative way. For indication, the monitoring tower photographed in figure 21 is 20 metres tall, the proposed tower is 30 metres tall and is shown in figure 22. Simulated visual impacts are estimated for the Lamma Island site as seen from Mo Tat Old Village (figure 24) and looking over Mo Tat Wan (figure 23). Note that the simulated visual impact is exaggerated because the guy wires would not be visible at this distance unless highlighted by sunlight reflection.

Figure 21. 20m wind monitoring tower.



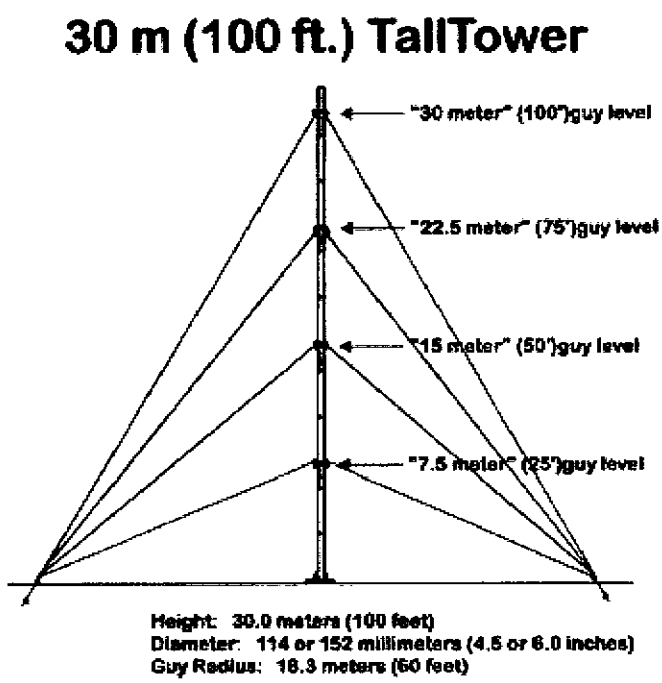


Figure 22.
30m wind monitoring tower.

Simulated visual impact: View over Mo Tat Wan

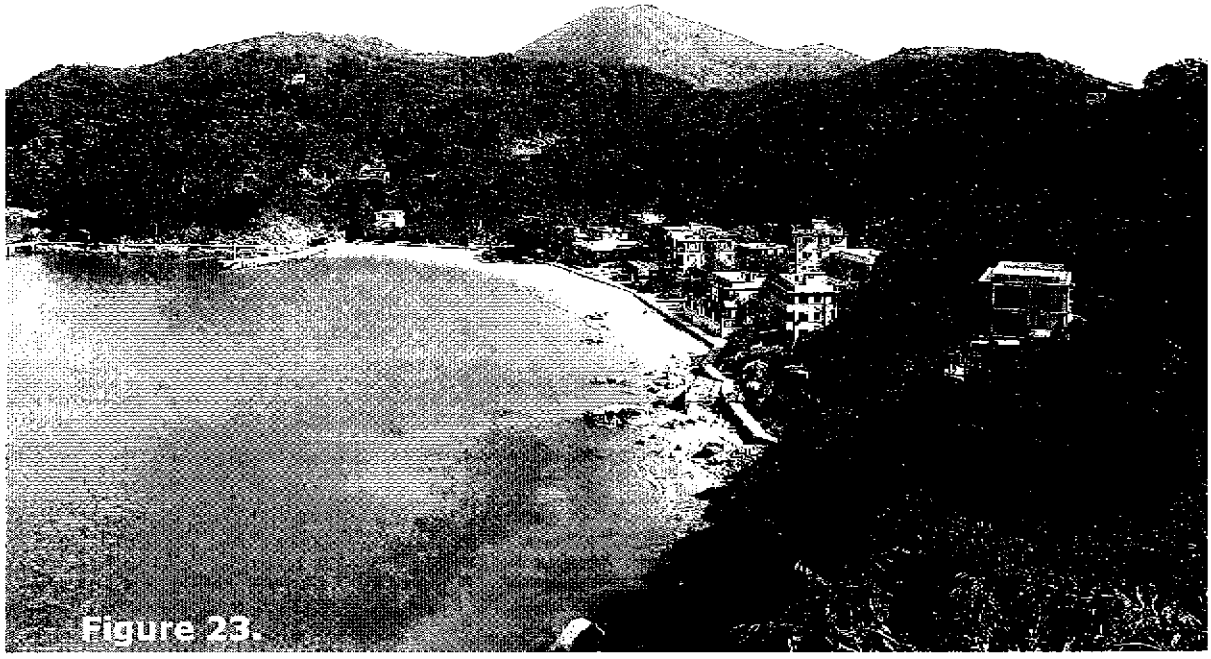


Figure 23.

Simulated visual impact: View from Mo Tat Old Village

Figure 24.

4. Major elements of the surrounding environment.

Lamma Island

Location

The proposed site is at 147m elevation on Ngai Tau (Cliff Head) which is on the eastern most point of Lamma Island, about 1 km from the nearest village of Mo Tat, which is presently a mixture of holiday houses and some original residents. Most of the surrounding agricultural land has been abandoned. The nearest major developments are the tourist town of Sok Kwu Wan and an active rock quarry, both about 3 km from the site.

Air

The nearest air quality monitoring station to Ngai Tau on Lamma Island is located Pak Kuk San Tsuen set up by Hong Kong Electric. The yearly and monthly averages in 1997 for sulphur dioxide were 7.6 and 3-12 micrograms per m^3 respectively; for nitrogen dioxide the yearly and monthly averages were 23.8 and 10-37 micrograms m^3 respectively, which complied with Air Quality Objectives. Data for other air pollutants are not available.

Ref: Air Quality in Hong Kong 1997, EPD

Water

From 1988 to 1997, EPD reports indicated that the marine water quality (Southern WCZ) of monitoring station SM 4 (in Sok Kwu Wan) complied 100% with the Water Quality Objectives from 1990 to 1997 for dissolved oxygen (bottom and depth averaged) and for unionized ammonia. However, for levels of total inorganic nitrogen, only the years 1989 and 1990 complied with the WQO.

Noise

The active quarry site at Sok Kwu Wan is a source of low frequency noise from rock removal, transport, and crushing.

Ecology

Sham Wan is the only known breeding site for endangered green turtles. Romer's Tree Frog (*Philautus romeri*) has been recorded at four sites on the island (*Porcupine! no.19 Apr 1999*). Finless porpoise occurs in the water around Lamma. Ha Mei Wan, south of Hong Kong Electric Company's power station, is an important habitat especially in Spring.

The South Lamma Island SSSI which surrounds Shan Tei Tong (Mount Stenhouse) was designated in 1980 and covers about 450 hectares. This SSSI is the habitat for locally rare bird species. Common birds on Lamma include the Greater coucal (*Centropus sinensis*), the Common kingfisher (*Alcedo atthis*), the White-breasted kingfisher (*Halcyon smyrnensis*), the rufous-backed shrike (*Lanius schach*), the crested bulbul (*Pycnonotus jocosus*), the Chinese bulbul (*Pycnonotus sinensis*), and the Red-vented bulbul (*Pycnonotus aurigaster*).

The Plumbeous Water Snake (*Enhydris plumbea*), the Taiwan Kukri Snake (*Oligodon formosanus*), the Hoopoe (*Upupa epops*), and Mongoose have been recorded at Yung Shue Wan (*Porcupine! no.15, Dec 1996*). The Checkered Keelback (*Xenochrophis piscator*) and the Bamboo Snake (*Trimeresurus albolabris*) were recorded near Hong Kong Electric Company's Power Station (*Porcupine! no.16, Jul 1997*).

Ground Cover

Most of Lamma Island is heavily eroded and ground cover consists of bare rock and soil, or vegetation dominated by grasses and low shrubs. Pockets of taller shrub and forest are scattered in valleys and some slopes. The proposed site is dominated by thin soils, bedrock outcrops and boulders and a mixed cover of low shrubs and grass.

Tourism

There are no hiking trails or footpaths presently in use near the proposed site at Ngai Tau, although these have existed in the past.

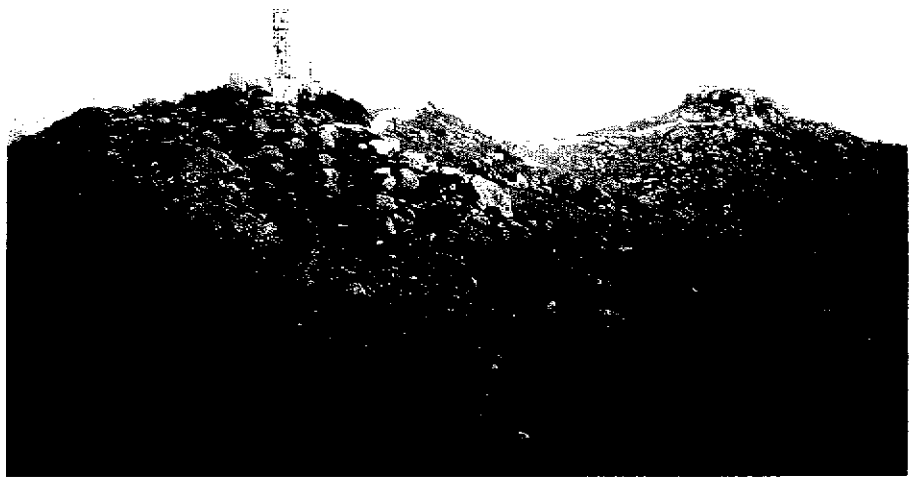
Antiques and monuments

Sham Wan Archaeological Site which is one of the five most important archaeological sites in Hong Kong is about 3 km southwest of Ngai Tau. Tin Hau Temple and the Kamikaze Caves in Sok Kwu Wan are about 3 km west from the proposed site. The temple is more than 150 years old and the Kamikaze Caves are a monument of the Second World War.

Similar Structures

Telecommunications towers can be seen on Ling Kok Shan at an elevation of approximately 245 metres (figure 25). These are short lattice towers with dish antennas attached to the structure. Because of their free-standing (no guy wire) design, lattice type towers have a large cross section for extra strength and they are highly visible from a distance. The proposed tower on Ngai Tau would be taller but considerably less visible than the one on Ling Kok Shan.

Figure 25.



5. Environmental protection measures to be incorporated in the design.

A. Siting.

Vegetation protection

The proposed site is located in an area with predominantly low shrub vegetation and thin soil cover. Impact is reduced in this environment by the use of a light tower and anchoring system which does not require any foundation and uses only 5 small (45 mm diameter) anchor holes. Most impact on the site vegetation occurs during 2-4 days of system set-up and take-down when cut-lines are needed to facilitate the raising and lowering of the tower structure. Impact on vegetation from the cut-lines is expected to be limited because shrubs on cut-lines only require trimming to a height of 1 metre, it is not necessary to remove any plants or disturb their root systems. Since the dominant shrub at the site is bamboo, which proliferates via its root system, the regeneration of the vegetation after disturbance is expected to be rapid. Photographs will be taken before and after the project to establish whether any remedial measures are needed to assist the regeneration of disturbed vegetation.

B. Set-up.

Vegetation protection

No heavy machinery will be used during the station set-up so that soil compaction and disturbance will be minimal. The complete tower package will be hand delivered to the site and set down at the base plate location and then assembled by hand and raised using an electric winch. Only the cut-lines (shown in figure 15) would be disturbed during this phase. Shrubs would be trimmed to a height of 1 metre on the cut-lines to facilitate the assembly of the tower, the connection of guy wires, and the protection of sensors during tower raising.

Movement of personnel will be controlled and co-ordinated to minimise vegetation damage due to walking. There will be a strict no-smoking policy for all personnel involved at the site, both at set-up, take-down, and during routine maintenance and data downloading visits to avoid any fire damage. Access to the site will follow the footpath alignment shown in figure 19, which uses old path alignments as much as possible and reduces new disturbance to approximately 340 metres. Since the existing and proposed path alignments are not likely to be visible because of the infrequent use during the project (about 150 person visits), tourists, hikers, and local residents would not be tempted to follow any paths up to the site.

Equipment

All tools and equipment will be checked to ensure good maintenance before being brought to site. Fueling of the hand held rock drill will be done off site so that fuel spills are avoided. Absorbent towels will be on hand to contain any fuel or oil drips and a portable fire extinguisher will be on hand when the rock drill is at the site. The battery for the electric winch will be a sealed type so that no battery acid can leak at the site.

C. Operation.

Bird safety
To make the guy wires more visible and reduce the possibility of collision with birds, short plastic markers may be attached at prominent points on the guy wires to make them more obvious to birds. The exact design of these is still under discussion with local bird experts. The red warning lamp to be installed at the top of the tower (for aircraft) may provide additional protection to birds by making the structure more obvious at night time.

Human safety
Markers will be placed at the anchor points and on the lower guy wires to prevent any accidents in poor visibility if people are walking on the site. The Civil Aviation Department has stipulated that a red warning lamp is required at the top of the tower for illumination at night and during times of poor visibility. This warning lamp system will be powered by a solar panel and sealed battery mounted on the tower.

Visual impact
The Civil Aviation Department does not require any coloured painting scheme for the tower. Therefore the tubing can be ordered from the supplier with a neutral grey epoxy coating that will reduce the overall visual impact of the station by blending with the landscape colours and reducing reflections from the metal tubing.

Vegetation protection
Visits to the site will be limited to about two people per month during the operation phase. During these visits the data will be collected and the station structure checked. At the monthly visit the staff will walk down each cut line once to verify the anchors and the guy wires. At this time the vegetation can also be monitored for regeneration and any remedial action can be taken on subsequent visits.

D. Take-down

Anchor holes
After removal of the anchor bolts from bare rock, the holes will be filled with a compound such as grout or cement mix to ensure that the rock surface is restored to its original shape. Since each anchor hole is about 45mm (1.75 inches) in diameter, the remaining traces of this project after take-down will be invisible except when standing immediately on top of the former anchor positions. For those anchor points that had a soil cover before drilling, the soil will be replaced immediately after setting the anchor, and also after removing the anchor at the end of the monitoring period, so that the original ground cover is maintained at all times.

6. Use of previously approved EIA reports

This project
No previously approved EIA has been conducted on the proposed project.

7. Compliance with zoning

A. Hong Kong Airport Control of Obstructions Ordinance.

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The proposed site has a restricted height of 188 metres above Principal Datum (Figure 26). The maximum elevation at the proposed site is 147.3 metres above Principal Datum. A 30 metre tower with a 1 metre lightning rod placed on this site would have a maximum elevation of 178.3 metres above Principal Datum, and therefore complies with the Ordinance.

Figure 26.