

Halcrow China Limited

AGREEMENT NO. CE 40/2000
10 YEAR EXTENDED LPM PROJECT
PHASE 2, PACKAGE G-OUTLYING ISLANDS
FEATURES NEAR SHEK PIK RESERVOIR,
LANTAU ISLAND
PROJECT PROFILE
August 2002

合樂中國有限公司

合約編號 **CE 40/2000**

延續十年之防止山泥傾瀉計劃第二期第 G 組

大嶼山石壁水塘

工程項目簡介

二零零二年八月

**The Government of The Hong Kong
Special Administrative Region
Civil Engineering Department
Geotechnical Engineering Office**

香港特別行政區政府

土木工程署

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**Civil Engineering Department
Geotechnical Engineering Office
The Government of the Hong Kong Special Administration Region**

**香港特別行政區政府
土木工程署
土力工程處設計部**

**Agreement No. CE 40/2000
合約編號 CE 40/2000**

**10-Year Extended Landslip Preventive Measures,
Phase 2, Package G – Outlying Islands, Investigation
Design and Supervision of Landslip Preventive Works
on Government Slopes and Related Studies**

Features near Shek Pik Reservoir, Lantau Island

**延續十年的防止山泥傾瀉計劃第二期第 G 組 – 離島
勘測、設計及監督政府斜坡之防止山泥傾瀉工程及有關研究
大嶼山石壁水塘**

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1 BASIC INFORMATION

1.1 *Project Title*

Agreement No. CE 40/2000

10-Year Extended Landslip Preventive Measures Project, Phase 2, Package G - Outlying Islands Investigation, Design and Supervision of Landslip Preventive Works on Government Slopes and Related Studies.

Location: Features near Shek Pik Reservoir, Lantau Island.

1.2 *Purpose and Nature of the Project*

The acceleration of the LPM Programme was originally arranged as a 5-year Project to end in March 2000. As part of Government's long-term strategy for upgrading slopes and retaining walls (hereafter referred to as 'features') in the New Catalogue of Slopes, the GEO has extended the Project for another 10 years beyond the year 2000. The 10-Year Extended LPM Project aims to complete the upgrading works for another 2,500 substandard government features and safety screening for another 3,000 private features by the year 2010.

The objective of this Agreement is to upgrade 60 substandard features, including cut slopes, fill slopes and retaining walls, located in the Outlying Islands, namely Cheung Chau, Hei Ling Chau, Lamma, Lantau and Peng Chau. These slopes are currently maintained by Architectural Services Department, Correctional Services Department, Highways Department and Lands Department. The scope of works comprises minor earthworks to facilitate landscaping, soil nailing, rock slope stabilisation measures (RSSM), drainage improvements and landscaping works.

1.3 *Name of Project Proponent*

Geotechnical Engineering Office (GEO)/Works Division

Civil Engineering Department (CED)

The Government of the Hong Kong Special Administrative Region

1.4 *Location and Scale of Project*

The Agreement involves investigation, design and upgrading works for the 60 substandard features distributed in Cheung Chau, Hei Ling Chau, Lamma, Lantau and Peng Chau. Among them, 9 features fall within Lantau South Country Park and 2 features fall wholly, or partially, within a Conservation Area on Lamma Island.

This project profile includes the 9 features in Lantau only (Attachment A). A separate project profile has been prepared for the 2 features on Lamma Island. A general location plan (Drawing No. A1 in Attachment A) shows the location of all study slopes, with the designated features, including the 9 features in Lantau included in this project profile, highlighted.

1.5 Number and Types of Designated Projects to be Covered by the Project Profile

In accordance with category Q.1 (a) of Part 1, Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO), 9 features in Lantau are regarded as a Designated Project, they fall within Lantau South Country Park. Therefore, under the EIAO an Environmental Permit must be obtained prior to the commencement of the construction of these designated features. The features included in this Designated Project are shown on Drawing Nos. A2 to A3 in Attachment A, and listed below:

Slopes lie within Lantau South Country Park

Shek Pik Reservoir:	Keung Shan Road:
13NE-A/C98	13NW-B/C80
13NE-A/C99	13NW-B/C82
13NE-A/C100	
13NE-A/C101	
13NE-A/C102	
13NE-A/C108	
13NE-A/C133	

1.6 Name and Telephone Number of Contact Person(s)

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2 OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

2.1 *Implementation and Planning of the Proposed Project*

The Agreement was awarded to Halcrow China Ltd. (HCL) as the engineering consultant in October 2000. HCL is responsible for investigation, detailed design and supervision of the construction works for the designated features. The proposed upgrading works are to be undertaken in Works Contract GE/2002/17.

The sequence of the proposed slope works, generally comprising 5 activities, is as below:

<u>Activities</u>	<u>Details</u>
(1) Minor earthworks including slope trimming and/or shotcrete removal	<ul style="list-style-type: none"> - trimming back of slope to improve gradient for landscaping works and disposal of excavated material - removal of existing shotcrete
(2) Installing soil nails and raking drains	<ul style="list-style-type: none"> - formation of holes into the slope by drilling the installation of steel bars and grouting up the holes for soil nails or installation of perforated PVC pipes for drainage for raking drains
(3) Rock Slope Stabilisation Measures (RSSM)	<ul style="list-style-type: none"> - typically comprising some, or all of the following measures; rock scaling, removal of unstable boulders, drilling for installation of rock dowels and/or rock bolts, and provision of rock mesh
(4) Drainage improvement works	<ul style="list-style-type: none"> - construction of concrete drainage channels to control surface runoff at the features
(5) Landscaping Works	<ul style="list-style-type: none"> - grassing, shrubs and tree planting

Details of the 9 designated features in this project profile and a summary of which of the above activities are relevant to each particular slope are presented in Tables 1 and 2, respectively.

Table 1 – Details of each Designated Feature

Feature No.	Height	Length along slope toe (m)		Slope angle		Existing cover	
	(m)	In Soil	In Rock	In Soil	In Rock	In Soil	In Rock
13NE-A/C98	24	104	--	40?	--	Vegetation	--
13NE-A/C99	14	104	--	50?	--	Vegetation	--
13NE-A/C100	7	50	60	48?	70?	Shotcrete	Shotcrete
13NE-A/C101	23	114	--	35?	--	Vegetation	--
13NE-A/C102	13	135	45	40?	40?	Vegetation /Shotcrete	Shotcrete
13NE-A/C108	17	196	55	55?	70?	Shotcrete	Shotcrete
13NE-A/C133	25	80	120	50?	50?	Vegetation	Bare
13NW-B/C80	18	65*	65*	40?	80?	Shotcrete	Shotcrete
13NW-B/C82	33	16	14	60?	80?	Shotcrete	Shotcrete / mesh

Note: *Total length of slope 13NW-B/C80 is 65m, rock slope is overlain by soil.

Table 2 – Proposed Works for Designated Features

Feature No.	Proposed Works
13NE-A/C98	<input type="checkbox"/> Install soil nails and prescriptive raking drains in the existing slope. <input type="checkbox"/> Drainage improvement works. <input type="checkbox"/> Landscape works, including shrub planting and hydroseeding with erosion control mat.
13NE-A/C99, 13NE-A/C101	<input type="checkbox"/> Fence off and protect existing vegetation in areas with no works. <input type="checkbox"/> Install soil nails and prescriptive raking drains in the existing slope. <input type="checkbox"/> Drainage improvement works. <input type="checkbox"/> Landscape works, including shrub and tree planting and hydroseeding.
13NE-A/C100	<input type="checkbox"/> Install soil nails and prescriptive raking drains in the existing slope. <input type="checkbox"/> Remove the existing shotcrete and undertake rock scaling. <input type="checkbox"/> Install rock dowels and any other RSSM required. <input type="checkbox"/> Drainage improvement works. <input type="checkbox"/> Landscaping works including shrub planting and hydroseeding with erosion control mat and wire mesh.
13NE-A/C102	<input type="checkbox"/> Minor trimming of the upper slope batter. <input type="checkbox"/> Install soil nails and prescriptive raking drains. <input type="checkbox"/> Drainage improvement works. <input type="checkbox"/> Landscape works, including shrub and tree planting and hydroseeding with erosion control mat.

Feature No.	Proposed Works
13NE-A/C108	<input type="checkbox"/> Trim back the western portion to 45°, removing the existing shotcrete. <input type="checkbox"/> Install soil nails rock dowels and prescriptive raking drains. <input type="checkbox"/> Strip the remaining shotcrete from the eastern portion. <input type="checkbox"/> Drainage improvement works. <input type="checkbox"/> Construct toe wall planter. <input type="checkbox"/> Landscaping works, including shrub planting and hydroseeding with erosion control mat and wire mesh.
13NE-A/C133	<input type="checkbox"/> Undertake rock scaling, rock doweling and other RSSM as required. <input type="checkbox"/> Drainage improvement works. <input type="checkbox"/> Construct toe wall planter. <input type="checkbox"/> Landscaping works including shrub planting and hydroseeding.
13NW-B/C80	<input type="checkbox"/> Remove the existing shotcrete and undertake rock scaling. <input type="checkbox"/> Install soil nails, rock bolts, rock dowels and prescriptive raking drains. <input type="checkbox"/> Replace the damaged rock fall fence at the base of the streamcourse. <input type="checkbox"/> Drainage improvement works. <input type="checkbox"/> Landscaping works, including shrub planting and hydroseeding with erosion control mat and wire mesh.
13NW-B/C82	<input type="checkbox"/> Remove the existing shotcrete and undertake rock scaling. <input type="checkbox"/> Install soil nails, rock bolts, rock dowels and prescriptive raking drains. <input type="checkbox"/> Drainage improvement works. <input type="checkbox"/> Landscaping works, including shrub planting and hydroseeding with erosion control mat and wire mesh.

Details of the proposed geotechnical and landscaping works at the 9 designated features are presented in Attachments B and C, respectively.

2.2 *Project Time Table*

Construction works for the designated features are to be carried out under Works Contract No. GE/2002/17. The Contract is scheduled for tendering in September 2002 and is likely commenced in December 2002 with a duration of 24 months. The main programme constraint to the overall completion of the project is the group of 7 features at Shek Pik Reservoir, which are roadside slopes within the Lantau South Country Park and the works at these features run throughout the duration of the Contract. These 7 designated features have been divided into 5 sections. The anticipated duration of each feature at Shek Pik Reservoir is about 6 months.

The remainder of the programme has been built around these 7 features, taking into other constraints such as traffic management for other projects, undertaking works at fill slopes during the dry season and other project or site specific constraints. It should be noted that the 2 remaining designated features, at Keung Shan Road, have been programmed to follow on from each other, to minimise the number of lane closures at any one time on this road, and to

minimise the quantity of such items as safety fence, which have to be imported onto Lantau, by moving these from one feature to the next.

The overall programme for Contract GE2002/17 is included in Attachment D. The approximate construction periods for the activities for an individual feature are typically as follows:

<u>Activities</u>	<u>Anticipated Duration</u>
(1) Minor earthworks including slope trimming and shotcrete removal	1 – 2 months
(2) Installing soil nails and raking drains	1 – 2 months
(3) Rock Slope Stabilisation Measures	1 – 2 months
(4) Drainage improvement works	0.5 – 1 month
(5) Landscaping Works	0.5 – 1 month

2.3 Interactions with Broader Programme Requirements or Other Projects that shall be Considered

As shown in Attachment D, the 9 designated features on Lantau are integrated into the construction programme for the upgrading works as a whole. It can be seen from the programme that works will be undertaken at a number of features at any one time. However, the works at the designated features on Keung Shan Road will not be concurrent and the works at the Shek Pik features are immediately adjacent to each other and have been broken down into five separate sections of works as follows:

<u>Section No. (as per the Contract Document)</u>	<u>Feature No(s).</u>
1	13NE-A/C108
2	13NE-A/C133
10	13NE-A/C99 and 13NE-A/C100
16	13NE-A/C98
19	13NE-A/C101 and 13NE-A/C102

Thus, with the exception of 13NE-A/C108 and 13NE-A/C133, which start at the commencement of the Contract there is effectively only one works site in operation at any time at the Shek Pik features. Features 13NE-A/C108 and 13NE-A/C133 are nearly 500m apart and are effectively “screened” from one another by a bend in the road. Thus there will be no cumulative affect during works at these concurrent features.

Interactions with other projects have been the subject of a series of Traffic Management Liaison Group (TMLG) meetings promulgated by China Light and Power (CLP) who have been undertaking cable laying in a trench excavation from Shek Pik Reservoir to Pui O. The TMLG

meetings were instigated to control the number of allowed closures in South Lantau and minimise disruption. The Drainage Services Department (DSD) Outlying Islands Sewerage Stage 1 Phase 1 Ngong Ping Sewage Treatment Works and Sewerage (Agreement No. CE 29/2001) was discussed in the TMLG meetings. The sewage treatment works aim to construct a sewage treatment plant at Ngong Ping and a 6.5km effluent export pipeline along Ngong Ping Road and Tai Road. These works are scheduled to be commenced in March 2003 and completed in mid 2005. The nearest DSD work site to the LPM work site for the 9 designated features in Lantau is about 200m north of the LPM site. Therefore, it is considered that this designated project would not affect or be affected by the DSD sewage treatment works, even though both works will be carried out at the same time.

The CLP cable laying works are complete in the vicinity of the Shek Pik features and the remainder of this project, towards Pui O, will be substantially complete by the end of 2002, when LPM works start under Contract GE/2002/17. Otherwise, there are no interactions with ongoing projects during the same period that need be considered.

3 MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

3.1 Outline Existing and Planned Sensitive Receivers and Sensitive Parts of the Natural Environment which might be Affected by the Proposed Project

3.1.1 Noise

Feature nos. 13NW-B/C80 and 13NW-B/C82 are located along Keung Shan Road near Kwun Yam Shan. Keung Shan Road is a major road in southwest of Lantau, running north-south above the western edge of Shek Pik Reservoir. The southern end of Keung Shan Road joins the western end of South Lantau Road at the Shek Pik Reservoir dam, and the northern end of Keung Shan Road branches into Ngong Ping Road to the east and Tai O Road to the west (Attachment A). No sensitive receivers are identified within 500m of the site.

Feature nos. 13NE-A/C98, 13NE-A/C99, 13NE-A/C100, 13NE-A/C101, 13NE-A/C102, 13NE-A/C108 and 13NE-A/C133 are located along South Lantau Road near Shek Pik Reservoir. South Lantau Road is a major road in South Lantau connecting Mui Wo and Shek Pik Reservoir (Attachment A).

Existing sensitive receiver and sensitive parts of the natural environment which might be affected by the Designated Features near Shek Pik Reservoir are indicated in Attachment A and are tabulated below:

Table 3 – Identified Sensitive Receivers

Sensitive Receiver Reference	Closest Slope Reference	Distance from the Closest Slope (m)
SR1	13NE-A/C98	430m
	13NE-A/C99	400m
	13NE-A/C100	400m
	13NE-A/C101	300m
	13NE-A/C102	270m
	13NE-A/C108	210m
	13NE-A/C133	490m

For all 9 slopes in Lantau, the major source of existing noise is road traffic on South Lantau Road and Keung Shan Road. Traffic flow is relatively low on both roads, however the noise level is expected to be higher during the weekends and on holidays due to the influx of visitors. Less than 80 vehicles were recorded within a half hour period on both South Lantau Road and Keung Shan Road at the location of subject feature on a weekday afternoon and a Saturday afternoon respectively.

3.1.2 Air Quality

Air quality sensitive receivers are the same as those noted for noise in section 3.1.1. Vehicle emissions at South Lantau Road and Keung Shan Road are the major source of existing air pollution. The level of pollution is expected to be relatively low due to the controlled traffic flow resulting from the existing road permit system operating in South Lantau. However, the level of pollution is expected to increase on weekends and public holidays due to the influx of visitors to South Lantau and increased public transport services. No other source of air pollution has been identified.

The closest Environmental Protection Department's Air Quality Monitoring Station to the sites is in Tung Chung. According to the Air Quality in Hong Kong 2000 (EPD, 2000), a mean concentration of 100µg/m³ for nitrogen dioxide (NO₂), total suspended particulates (TSP) and respirable suspended particulates (RSP) is recorded (Table 2 in Air Quality in Hong Kong 2000 (EPD, 2000)). The results are within the 24-hour Air Quality Objectives (AQOs) for NO₂ (150µg/m³), TSP (260µg/m³) and RSP (180µg/m³) under the Air Pollution Control Ordinance. Since the road permit system operates in South Lantau, traffic flow at the sites is lower than those at Tung Chung. It is, therefore, expected that levels of NO₂, TSP and RSP at the sites are lower than the readings obtained from the Tung Chung Air Monitoring Station. The overall background air quality at the site is considered fair.

3.1.3 Ecology

Refer to Attachment E for methodology.

Habitat

Feature nos. 13NW-B/C80 and 13NW-B/C82 are cut slopes along Keung Shan Road. 13NW-B/C80 and the northern portion of 13NW-B/C82 are covered by shotcrete, whilst the remainder of 13NW-B/C82 comprises bare rock and soil covered by wire mesh.

The area behind the northern portion of 13NW-B/C80 is a tree plantation comprised mainly of 5m – 7m tall *Lophostemon confertus* with some native trees and shrubs occurring. Above the central portion of 13NW-B/C80 is a natural slope covered by shrubs. The dominant species are *Baeckea frutescens*, *Embelia* sp., *Rhaphiolepis indica*, *Rhodomyrtus tomentosa* and *Melastoma* sp. At the southern end of slope 13NW-B/C80 is a small valley with a slow flowing stream covered by mature trees on both sides forming a small woodland area. The trees are over 10m in height and the presence of forest species such as *Lithocarpus corneus*, suggests that this small woodland area may be a remnant of good secondary forest.

For 13NW-B/C82, the natural hillside behind and adjoining the northern and southern ends of the slope are typical shrubland habitats dominated by *Baeckea frutescens*, *Embelia* sp., *Rhaphiolepis indica*, *Rhodomyrtus tomentosa*, *Litsea rotundifolia* and *Melastoma* sp. Further up the slope (>50 m) is a forest plantation that is mainly comprised of *Pinus ellottii*.

Feature nos. 13NE-A/C98, 13NE-A/C99, 13NE-A/C100, 13NE-A/C101, 13NE-A/C102, 13NE-A/C108 and 13NE-A/C133 are cut slopes along South Lantau Road near Shek Pik Reservoir. Feature nos. 13NE-A/C100, 13NE-A/C102, 13NE-A/C108 and 13NE-A/C133 are wholly or partially covered by shotcrete with sparse vegetation. Feature nos. 13NE-A/C98, 13NE-A/C99 and 13NE-A/C101 are covered by existing vegetation.

The natural hillside behind these 7 features is typical hillside shrubland dominated by *Rhodomyrtus tomentosa*, *Litsea rotundifolia* and *Rhaphiolepis indica* etc. Young forest plantations of exotic tree species, mainly *Pinus ellottii* are found at a distance (>50m) behind these slopes. A thin strip of young secondary woodland is found behind slope 13NE-A/C102 and 13NE-A/C108, between the crest of these features and the access track above. The dominant species in this area are *Itea chinensis*, *Cratogeomys cochinchinense*, *Schefflera heptaphylla* etc.

Flora

Within and in the vicinity of features 13NW-B/C80 and 13NW-B/C82, a total of 63 plant species were recorded including 33 trees, 14 shrubs, 6 climbers, 7 ferns, 2 bamboos and 1 grass species. Only one species, *Enkianthus quinqueflorus* (Plates E1 and E2 in Attachment E), recorded is protected in Hong Kong. A total of nine *Enkianthus quinqueflorus* trees were recorded in this shrubland. Of these 5 are located within 5m of the slope crest while the other 4 are over 10m up the natural slope. *E. quinqueflorus* was once threatened by over-collection in Hong Kong and has been listed as a protected species since the 1970's. However, since then, the wild populations have recovered and are now widespread and common in the countryside (Corlett *et al.* 2000). The fern *Cibotium barometz* is listed as a protected species in China due to over collection but it is widespread and very common in Hong Kong (Wu and Lee 2000).

Within and in the vicinity of the 7 features along South Lantau Road near Shek Pik Reservoir, a total of 74 plant species were recorded including 33 trees, 17 shrubs, 14 climbers, 9 ferns and 1 grass species. No rare or endangered plant species are found in this site.

Results of the findings are presented in Tables E1 and E2 in Attachment E.

Fauna

Within and in the vicinity of features 13NW-B/C80 and 13NW-B/C82, 15 bird and 15 butterfly species were recorded at this site. Furthermore 1 reptile species, the Changeable Lizard (*Calotes versicolor*) was also recorded, which is common in Hong Kong (Karsen *et al.* 1998). No amphibians were seen even with thorough searching in the stream adjacent to 13NW-B/C80. None of the animal species recorded is of high conservation value.

Within and in the vicinity of the 7 features along South Lantau Road near Shek Pik Reservoir, 18 bird and 14 butterfly species were recorded at this site. Furthermore 3 reptile species were recorded including Changeable Lizard, Brown Forest Skink (*Sphenomorphus indicus*) and Chinese Skink (*Eumeces chinensis chinensis*). All 3 species are common and widespread in Hong Kong (Karsen *et al.* 1998). No amphibians were seen probably, in part, due to the dry weather. Three of the bird species recorded are of some conservation concern. Black Kite and White-bellied Sea Eagle are considered to be species with “Regional Concern” and the Crested Serpent Eagle is considered to be a species with “Local Concern” (Fellowes *et al.* in press). However, all 3 species were seen soaring high up in the sky above the site, and were not found to be nesting or foraging in the vicinity of the features.

The results of the findings are presented in Tables E3 to E6 in Attachment E.

3.1.4 *Water*

West-east trending drainage concentrations are present at the northern and southern ends of features 13NW-B/C80 and 13NW-B/C82. Below these 2 slopes are Keung Shan Road and further fill and cut slopes. The drainage concentrations at these features are diverted into culverts running below Keung Shan Road and continue as ephemeral streamcourses running down the natural slope below, and ultimately feeding into Shek Pik Reservoir.

For the 7 features along South Lantau Road, Shek Pik Reservoir is located directly below the road opposite 13NE-A/C108 and the western end of 13NE-A/C102. A catchwater, leading to the reservoir, is located 40-100m beyond South Lantau Road opposite 13NE-A/C98 and 13NE-A/C100. All of the Shek Pik features, with the exception of the southern half of 13NE-A/C133, lie within a WSD water gathering ground. An ephemeral streamcourse is present within this water gathering area leading past the western end of 13NE-A/C102 and feeding directly into Shek Pik Reservoir via a culvert beneath South Lantau Road.

3.1.5 *Landscape and Visual*

All 9 features are visually sensitive as they are located along Keung Shan Road and South Lantau Road, the main arterial roads in South Lantau.

Features 13NW-B/C80 and 13NW-B/C82 located along Keung Shan Road and slopes 13NE-A/C100, 13NE-A/C102 and 13NE-A/C108 located along South Lantau Road are covered by shotcrete. Slopes 13NE-A/C98, 13NE-A/C99, 13NE-A/C101 and 13NE-A/C133 along South Lantau Road are covered by vegetation.

3.1.6 *Historical and Cultural*

The Antiquities and Monument Office of the Leisure and Cultural Services Department have confirmed that none of the 75 declared sites of cultural heritage lie in the vicinity of any features under this Agreement (CE 40/2000).

3.1.7 *Others*

None.

4 POSSIBLE IMPACTS ON ENVIRONMENT

4.1 *Processes Involved, Including Process Flow Diagrams, Site Plans, Storage Requirements and Information on Emission and Discharges*

The 7 features along South Lantau Road, and two slopes along Keung Shan Road near Shek Pik Reservoir fall within Lantau South Country Park. A general location plan of the 2 areas is presented in Attachment A.

As described in Section 2.1, the works at these designated features will comprise five key activities:

- 1) minor earthworks;
- 2) soil nailing;
- 3) rock slope stabilisation measures (RSSM);
- 4) drainage improvement works; and
- 5) landscaping works.

Details of the proposed works at the 9 features are presented in Attachment B.

All of the activities have some potential for environmental impact. All of the activities could lead to noise impacts and the generation of dust as mechanical equipment will be used in most cases, in particular during excavation and drilling for soil nails, raking drains and rock stabilisation measures, although drainage and landscaping works are unlikely to give rise to significant amounts of noise or dust. Ecologically, there could be disturbance to the existing wildlife during the works, and some trees and existing vegetation will be removed during trimming back and minor trimming of the slopes.

Waste will be generated largely during excavation works and during removal of existing shotcrete and this will need to be handled and removed from the site to controlled dumping points (i.e. the relevant outlying islands transfer facility and/or the public filling facilities) by implementing the trip ticket system as required in Contract GE/2002/17.

Impact on water quality would be low, however, there remains a small possibility that site runoff may enter the adjacent streamcourses and temporary measures will be required to ensure no contaminants or pollutants resulting from uncontrolled discharge from the sites entering these streamcourses.

4.2 Environmental Impact during Construction Phase

4.2.1 Noise

In the Particular Specification of Contract GE/2002/17, a maximum sound level of 75dB(A) is specified during the construction works as recommended in the “Recommended Pollution Control Clauses for Construction Contract” provided by EPD.

Noise during the construction phase will be generated from powered mechanical equipment (PME) being used during various construction activities. Operations that may generate adverse noise impacts can broadly be divided into the following 5 stages:

Activity 1 – Minor earthworks

- ? Trimming back of slope to improve the gradient to allow landscaping works and disposal of excavated material and/or removal of existing shotcreted areas.

Activity 2 – Soil nailing for soil slopes

- ? Formation of holes into the soil slope by drilling, installation of steel bars and grouting.

Activity 3 – RSSM for rock slope

- ? Rock scaling, removal of unstable blocks, installation of rock dowels and bolts, and rock mesh.

Activity 4 – Drainage improvement

- ? Construction of concrete drainage channels on the slopes and provision of subsoil drains.

Activity 5 – Landscaping works

- ? Grassing, shrubs and tree planting

The equipment which will be required for the construction operations during each of these stages is listed in Table 4 below:

Table 4 – Predicted Sound Power Levels for Each Construction Activities

Construction Activity	Equipment	CNP Equipment Code ⁽¹⁾	Number	Sound Power Level (SWL) in dB(A) ⁽¹⁾	Total SWL During Operation dB(A) ⁽²⁾
Activity 1	Excavator (Backhoe)	CNP081	1	112	115
	Lorry	CNP141	1	112	
Activities 2 and 3	Rock Drill, crawler mounted (pneumatic)	CNP181	1	128	128
	Air Compressor	CNP001	1	100	
	Hoist, petrol	CNP123	1	104	
	Concrete Pump	CNP047	1	109	
	Concrete Mixer	CNP046	1	96	
Activity 4	Concrete Pump	CNP047	1	109	109
	Concrete Mixer	CNP046	1	96	
Activity 5	Water Pump	CNP282	1	103	104
	Mixer	CNP046	1	96	

Notes:

- (1) Equipment codes and SWL are obtained from the Technical Memorandum on Noise from construction Work Other than Percussive Piling (EPD, 1998).
- (2) Total SWLs obtained are based on Table 4 in the Technical Memorandum as Note (1) above.
- (3) Refer to Tables F1 to F2 in Attachment F for Predicted Noise Levels.

The construction noise at the designated NSRs has been assessed in accordance with the methodology specified in the *Technical Memorandum on Noise from Construction Work Other than Percussive Piling* (EPD, 1998). The details of predicted unmitigated noise levels at the

representative NSRs during the slope maintenance works is shown in Attachment F. In addition, the worst case scenario of the closest feature to a sensitive receiver has been assumed.

The results (Tables F1 to F2 in Attachment F) indicate that noise levels at all noise sensitive receivers (NSR's) are generally within the contractual requirement of 75dB(A). However, the cumulative noise levels at NSR no. 1, in the vicinity of the Shek Pik Reservoir features (Figure A1 in Attachment A), will slightly exceed the contractual requirement of 75dB(A) during Activity 2. Based on the results noise mitigation measures will be necessary to reduce the noise to acceptable levels during these activities. Visitors to the Country Park may also be sensitive to the noise, however, based on their transient nature and the existing influence of South Lantau Road itself, such impacts are not considered to be significant.

4.2.2 *Air*

Earthworks and the drilling operations for soil nailing and particularly rock stabilisation could generate dust which may cause impacts, particularly during the dry season. Dust could also be generated from the stockpiling of construction materials and waste. The Contractor will be required to comply with the Air Pollution Control (Construction Dust) Regulation in order to ensure that no adverse dust impact on the air sensitive receivers will result.

4.2.3 *Ecology*

The proposed slope upgrading works that are likely to generate ecological impacts are largely associated with slope trimming, which will remove some vegetation including the loss of some shrubland and secondary woodland. However, shotcrete removal, soil nailing and RSSM could create dust that may affect local flora and fauna. Noise generated for the duration of the works could also cause disturbance to wildlife.

Trimming back at feature 13NE-A/C108 along South Lantau Road, and minor trimming at features 13NW-B/C80 and 13NW-B/C82 along Keung Shan Road are proposed. The trimming at feature 13NE-A/C108 results in the removal of some vegetation between the slope crest and the access track beyond. However, the area to be removed would not be extensive. The minor trimming at the 2 features on Keung Shan Road comprises localised rounding off at the crest of these features and would not involve any significant vegetation clearance. No trimming is required for the remaining 6 features along South Lantau Road Shek Pik Reservoir. Estimated areas of vegetation removal for the 9 features as a result of the geotechnical works are summarised in Table 5 as below.

Table 5 – Approximate Areas of Existing Vegetation Removal

Feature No.	Approximate Work Site Area (m ²)	Approximate Area of Vegetation to be Removed (m ²)
13NE-A/C98	3500	100
13NE-A/C99	1600	150
13NE-A/C100	1500	30
13NE-A/C101	3200	200
13NE-A/C102	3200	50
13NE-A/C108	3750	750
13NE-A/C133	5200	Nil
13NW-B/C80	1300	30
13NW-B/C82	3900	50

The minor trimming at feature 13NW-B/C80 will not affect the 5 protected *Enkianthus quinqueflorus* trees at the feature crest. However, the natural slope in this area above the feature crest is showing signs of instability, most notably a 100mm wide, 5m long tension crack located 10m behind the crest. Accordingly, works comprising soil nailing of the existing slope and sealing of the tension crack, are required to stabilise this area above the feature's crest, as shown on drawing no. LPM 0217/3212. The lowest two clumps of *Enkianthus quinqueflorus* are in the area of the proposed soil nails and will need to be transplanted. The other area of this plant species is further up the slope, outside the works site as shown on drawing no. LPM 0217/3211, and it is unlikely to be affected. The lower portion of the small woodland stream adjacent to 13NW-B/C80 may be affected by the works and protection measures will need to be implemented. Apart from these, no major ecological impacts are envisaged with the slope work in 13NW-B/C80 and 13NW-B/C82.

For the 7 features along South Lantau Road, near Shek Pik Reservoir, the proposed works may damage some of the existing vegetation at the features and on the semi-natural slope above 13NE-A/C108. However, no rare or endangered plant species were found at these features. The vegetation is either low-shrub, young secondary forest or exotic tree plantations, which are all very common habitat types in Hong Kong. Therefore, there will be no significant ecological impacts due to the proposed works. Although three raptors of conservation concern were recorded at this site, they were found to be flying above the site. There is no sign that they are dependent on this site for nesting and foraging. It is unlikely, therefore, that the slope works will affect these bird species.

4.2.4 Water Quality

Feature nos. 13NW-B/C80 and 13NW-B/C82 on Keung Shan Road lie well above Shek Pik Reservoir, however, the ephemeral streamcourses below these features ultimately feed into Shek Pik Reservoir. Therefore, any uncontrolled discharge from the sites could effect water quality in

the ephemeral streamcourses, which might indirectly affect Shek Pik Reservoir, although given the intervening distance such affect, if any, would be limited.

The Shek Pik features on South Lantau Road lie within the lower direct water gathering grounds for Shek Pik Reservoir. The ephemeral streamcourse at the western end of 13NE-A/C102 leads directly into Shek Pik Reservoir. Any uncontrolled discharge or spillage in this area could affect water quality feeding into Shek Pik Reservoir.

4.2.5 *Waste Management*

Waste will be generated largely during excavation works, trimming and from removing existing hard surfacing. For features 13NE-A/C108, 13NW-B/C80 and 13NW-B/C82, construction waste generated from the trimming back and minor trimming comprises of shotcrete, soil and rock. Construction waste generated from construction works at features 13NE-A/C100 and 13NE-A/C102 mainly comprises of shotcrete as the existing shotcrete surface will be removed as part of the construction works. The construction works for the remaining features will generate some trace amounts of construction waste.

Table 6 – Anticipated Waste Materials Arising

Feature No.	Removed Shotcrete (m³)	Soil (m³)	Rock (m³)	Refuse, Timber, etc (m³)	Total (m³)
13NE-A/C98	--	--	--	25	25
13NE-A/C99	--	--	--	25	25
13NE-A/C100	50	--	--	20	70
13NE-A/C101	--	50	--	20	70
13NE-A/C102	200	50	--	25	275
13NE-A/C108	150	3000	50	50	3250
13NE-A/C133	--	--	10	30	40
13NW-B/C80	50	25	20	25	120
13NW-B/C82	120	25	20	25	190

4.2.6 *Landscape and Visual Impact*

During the construction works, temporary scaffolding and working platforms will be erected on the slope face to install soil nails and carry out landscaping works. Some vegetation loss will be experienced during erection of this scaffolding. A number of trees are to be felled during excavation works for feature 13NE-A/C108.

Table 7 – Summary of Predicted Tree Felling

Feature No.	No. of Trees to be Retained	No. of Trees to be Felled	No. of Trees to be Transplanted
13NE-A/C98	111	Nil	Nil
13NE-A/C99	50	Nil	Nil
13NE-A/C100	11	Nil	Nil
13NE-A/C101	100	Nil	Nil
13NE-A/C102	94	Nil	Nil
13NE-A/C108	64	8	Nil
13NE-A/C133	111	Nil	Nil
13NW-B/C80	7	Nil	8*
13NW-B/C82	12	Nil	Nil
TOTAL	560	8	8

Note: * Should transplantation is not successful, native species will be planted to compensate for the loss.

In order to maintain the upgraded slopes, it is necessary to construct maintenance access staircases in order to clear drainage channels, maintain vegetation and the like. Traditionally these have comprised concrete stairs on slopes less than 45° and steel staircases on slopes steeper than 45°. Both can be visually intrusive if not correctly located. Further visual impact is caused by the handrailings associated with these maintenance stairs.

4.2.7 *Historical and Cultural*

No historical and cultural sites will be affected by the proposed works.

4.2.8 *Others*

None.

4.3 *Environmental Impact during Operation Phase*

There will be no adverse impacts of the sensitive receivers during the operational phase. It is expected, with the tree planting of native species and the other landscaping works proposed, that the slope works will result in positive impacts in terms of terrestrial ecology and landscape characters in the long term.

After the slope upgrading works, visual impact on features 13NE-A/C100, 13NE-A/C102, 13NE-A/C108, 13NW-B/C80 and 13NW-B/C82 will be improved by replacing existing shotcrete cover with hydroseeding.

5 ENVIRONMENTAL PROTECTION MEASURES TO BE INCORPORATED IN THE DESIGN AND ANY FURTHER ENVIRONMENTAL IMPLICATIONS

5.1 Measures to Minimise Environmental Impacts

5.1.1 Noise

Noise mitigation measures are required since the predicted cumulative noise levels at sensitive receiver 1 slightly exceed the contractual requirement of 75dB(A) mainly during soil nailing and rock stabilisation works (Table F2 in Attachment F). The major noise contributor in both soil nailing and rock stabilisation works is the noise generated by percussive drilling. The following mitigation measures are recommended to be used on the drilling equipment to attenuate the noise:

Table 8 – Recommended Mitigation Measures for the Noisy Equipment

Plant	Mitigation Measures	Maximum Reduction in dB(A)
Rock Drills and Tools	<ul style="list-style-type: none"> ? Fit suitably designed muffler or sound reduction equipment to reduce noise without impairing machine efficiency ? Ensure all leaks in air line are sealed ? Used dampened bit to eliminate ringing 	Up to 15

Source: Table B1 of Noise Control on Construction and Open Sites (BS5228:Part I, 1997)

For the purposes of this assessment the maximum possible reduction is not used, and a attenuation of 10dB(A) has been assumed when the above mitigation measures are employed, as shown in Attachment G. After the provision of the above mitigation measures, the noise level at all sensitive receivers will not exceed the contractual requirement of 75dB(A) during the construction works and no residual impacts will occur.

The mitigation measures are required to be employed at feature 13NE-A/C108. However, noise does have the potential to affect visitors to the Country Park, and whilst such visitors will not be significantly affected, due to their transient nature, it is recommended that such mitigation measures be employed for the drilling works at all features in Contract GE/2002/17 to minimise potential impacts.

5.1.2 *Air Quality*

With the adoption of the Recommended Pollution Control Clauses in the Particular Specification for Contract GE/2001/27, as detailed in Attachment H, environmental nuisance will be kept to a minimum. In addition it is also recommended that water spraying during drilling works, particularly during the dry season, be undertaken to minimise any adverse impact to the receivers. The Contractor shall ensure that there will be adequate water supply / storage for such dust suppression measures.

As noted in section 5.1.1, all plant and materials will be delivered to Lantau by sea, thus minimising air quality impacts caused by vehicle movements as there will be no need for these vehicles to use Tung Chung Road.

5.1.3 *Ecology*

Care should be taken to avoid damage to areas within a feature that do not require any works. To this end such areas will be fenced off, using chain link fencing, to prevent access during the course of the works and to preserve the existing vegetation in such areas (e.g. feature no. 13NE-A/C99, see drawing nos. LPM 0217/3422 and LPM 0217/L3421). Wherever possible trees should be preserved, and to this extent minimal tree felling will be undertaken for these features, notably only 13NE-A/C108 requires any tree felling. Where tree felling is unavoidable, compensatory planting will be undertaken to replace the felled trees with plant species recorded at the particular site in question, albeit any exotic trees that are felled will not be replaced by like specimens but will instead be replaced by native species.

For feature no. 13NW-B/C80, a more detailed survey will be carried out within the works site in order to tag all individual trees of the *Enkianthus quinqueflorus* species. The contractor and resident site staff will be briefed as to the exact locations of these trees. If possible, the trees will not be removed, and chain link fence shall be erected to protect the trees during the proposed works. However, given the scope of the proposed works in the affected area of 13NW-B/C80, it is more likely that the trees will require transplantation. Accordingly, the trees will be prepared for transplantation prior to works commencing in the affected area and the *Enkianthus quinqueflorus* trees will be transplanted to a location above the works site, as shown in drawing no. LPM 0217/L3211, prior to the works commencing. Existing location of the lower *Enkianthus quinqueflorus* will be soil nailed as described in section 4.2.3. Due to the lack of safe access to the entire feature crest, the new locations of the transplanted trees will be confirmed by the Engineer with expert's advice after a safe access is provided by the Contractor. In the Particular Specification of Contract GE/2002/17, transplanting works shall be undertaken by a specialist landscape contractor. The Contractor shall demonstrate that the proposed specialist landscape contractor has sufficient experienced and skilled labour to undertake the tree works specified. In addition to transplanting the existing trees, the landscaping works at this feature will include the planting of other native species. Should the existing *Enkianthus quinqueflorus* be failed to be transplanted, planting of other native species can compensate the loss of the existing *Enkianthus quinqueflorus*.

During the construction works at 13NW-B/C80, measures to prevent encroachment into the stream woodland will be put in place and enforced. The removal of any vegetation at the site shall be monitored to avoid unnecessary removal.

At the location of slope 13NW-B/C82 along Keung Shan Road and the 7 features along South Lantau Road near Shek Pik, since no rare or endangered plants or animals are recorded, no special recommendations are made. However, the removal of any vegetation at the site shall be monitored to avoid unnecessary removal.

5.1.4 *Water*

The Contractor shall comply with the Water Pollution Control Ordinance and its subsidiary regulations. In particular, conditions have been included in the Contract requiring the Contractor to comply with WSD's "Conditions of Working within Water Gathering Grounds", which he must comply with for the Shek Pik features on South Lantau Road.

During the proposed works, the contractor shall contain within any site all surface runoff generated from any works, dust control and vehicle washing etc. Any trade effluent or foul or contaminated or cooling or hot water shall not discharge into any public sewer, stormwater drain, channel, stream course or sea.

If site canteen or toilet facilities are erected, foul water effluent shall be directed to a foul sewer or to a sewage treatment and disposal facility.

5.1.5 *Waste Management*

The Contractor shall comply with the Waste Disposal (Chemical Waste) (General) Regulation, the Waste Disposal Ordinance and its subsidiary regulations and the Dumping at Sea Ordinance.

The Contractor shall not permit any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from Site onto any adjoining land, or allow any waste matter which is not part of the final product from waste processing plants to be deposited anywhere within any Site or onto any adjoining land.

The construction waste generated by the Contractor on site will be transported to the designated CED public filling facilities and the designated EPD outlying island transfer facilities in Mui Wo. Following recent problems on other Lantau Contracts, particular emphasis will be placed on the close supervision of the implementation of the trip ticket system and removal of C&D and other waste materials via the relevant Mui Wo waste transfer facility. Independent audits of the Contractor and resident site staff procedures will be undertaken from time to time by experienced head office staff from the consultant to ensure that the correct procedures are being followed at all times.

5.1.6 *Landscape and Visual*

Hoarding or safety fence shall be erected along toe of all works sites to screen the proposed works.

Current shotcrete cover of the features will be removed and replaced by hydroseeding surface with shrubs and, where possible, tree planting to improve the visual impact to the receivers.

Maintenance access staircases need to be provided, however, where possible the number of such staircases will be minimised as far as possible, in particular at the Shek Pik features, where use of the defunct access road above the crest of 13NE-A/C98, 13NE-A/C100 and 13NE-A/C102 can reduce the number of such staircases which would otherwise be required. Furthermore, steel access stairs will be avoided wherever possible, although it is inevitable that one will be required at feature no. 13NW-B/C80, which is too steep for the provision of an alternative.

Furthermore, it is proposed that the traditional concrete stairs be substituted by a masonry block equivalent similar to those used on Lantau Trail and elsewhere to provide a rustic feel that will more easily blend into the surrounding environment. Finally, although handrailings are inevitable to meet safety legislation requirements, it is proposed that the standard handrailing detail be substituted by a detail similar to that currently used by AFCD, i.e comprising concrete beams formed to look like wood. At the height and distance above the slope toe at which these handrailings will be constructed, it is envisaged that the visual affect of wood will be achieved.

Table 9 – Outline Landscape Mitigation Proposals

Feature No.	Landscape Mitigation Proposal
13NE-A/C98	Hydroseeding with shrubs and erosion control mat.
13NE-A/C99	Fence off and protect areas of no works to preserve existing vegetation. Hydroseeding with shrubs and erosion control mat.
13NE-A/C100	Hydroseeding with shrubs and erosion control mat.
13NE-A/C101	Fence off and protect areas of no works to preserve existing vegetation. Hydroseeding with shrubs and erosion control mat.
13NE-A/C102	Hydroseeding with shrubs and erosion control mat. Whip planting at feature crest.
13NE-A/C108	Hydroseeding with shrubs and erosion control mat. Compensatory tree planting comprising native shrubs and ground cover trees. Construction of toe planter for additional planting to screen the slope.
13NE-A/C133	Hydroseeding with erosion control mat for soil portions and maintain the bare rock appearance of rock portions. Construction of toe planter for additional planting to screen the slope.
13NW-A/C80	Hydroseeding with shrubs and erosion control mat. Planting pf additional native shrubs will be undertaken to compensate for the loss of <i>Enkianthus quinqueflorus</i> should the transplantation fails.

Feature No.	Landscape Mitigation Proposal
13NW-A/C82	Hydroseeding with shrubs and erosion control mat. Whip planting at the crest.

5.1.7 *Historical and Cultural*

Mitigation measures are not required as no cultural and historical site is affected by the works.

5.1.8 *Others*

No other mitigation measures are required.

5.2 *Comments on the Possible Severity Distribution and Duration of Environmental Effects*

No adverse residual noise, air, waste, water quality, ecology or landscape and visual impacts are predicted with the application of the mitigation measures as well as the pollution control clauses in Attachment H.

In respect to the terrestrial ecology at crest of 13NW-B/C80, particular care shall be taken to provide in-situ protection for the *Enkianthus quinqueflorus*. If it is not possible to retain or transplant these specimens, native shrubs will be planted to compensate for the loss. During the proposed landscaping works upon completion of the slope upgrading works, native shrubs will be planted. While significant impacts are not predicted and the species is widespread and common in the countryside (Corlett *et al.* 2000), the proposed mitigation measures are considered sufficient to protect *Enkianthus quinqueflorus*.

5.3 *Comments on Any Further Implications*

None.

5.4 *Use of Previously Approved EIA Reports*

A similar recent project is in progress in the HKSAR, for which an environmental permit was granted as follows:

Agreement No. CE 74/99 and Supplementary Agreement No. 1.

This Agreement (CED, 2001), which also covers LPM Upgrading Works on Lantau Island. A project profile was submitted to EPD by CED on 27 April 2001 (Application No. DIR-055/2001) for permission to apply directly for an Environmental Permit (EP). The Project Profile concluded that there would be no adverse long-term or cumulative effects/impacts on the environment. CED was permitted to apply directly for an EP, and the EP was granted on 30 July 2001 (EP No. EP-102/2001).

6 REFERENCES

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附件

1 基本資料

1.1 工程標題

合約編號 CE 40/2000

土力工程處 - 延續十年的防止山泥傾瀉計劃第二期第 G 組 - 離島
勘察、設計與監督政府斜坡之防止山泥傾瀉工程及有關研究。

位置：大嶼山石壁水塘。

1.2 工程目的和性質

政府土力工程處的加速防止山泥傾瀉計劃原定於 2000 年 3 月完結為期 5 年。但此計劃已在 2000 年後伸延多 10 年，作為政府在鞏固及維修新紀錄冊的斜坡的部份長遠策略，目標是在 2010 年之時完成另外 2500 幅不合標準的政府斜坡鞏固工程及完成另外 3000 幅私人斜坡的詳細研究。

本顧問合約的目標是鞏固位於離島包括長洲、喜靈洲、南丫島、大嶼山及坪洲 60 幅不合標準的政府斜坡，該 60 幅斜坡的維修責任屬於建築署、懲教署、路政署及地政總署。鞏固工程包括小型土方工程、為土壤斜坡裝設泥釘、鞏固石坡措施、改善排水工程及景觀美化工程。

1.3 工程項目倡議人

香港特別行政區政府
土木工程署
土力工程處/工程處

1.4 工程位置及規模

整項顧問合約包括勘察、設計以及改善 60 幅低於現時安全標準的斜坡，分佈於長洲、喜靈洲、南丫島、大嶼山和坪洲。其中的 9 幅斜坡位於南大嶼郊野公園，兩幅斜坡全部或部份位於南丫島的自然保育區。

這工程項目簡介只會包括位於大嶼山南大嶼郊野公園內的 9 幅斜坡〔見附件 A〕，而另一獨立工程項目簡介則包括其餘兩幅位於南丫島自然保育區的斜坡的指定工程簡介。附件 A 內的繪圖 A1 為一般位置圖，顯示顧問合約 CE 40/2000 包括的所有斜坡的地點和編號，圖中灰格顯示被列為指定工程項目的斜坡〔包括本簡介的 9 幅斜坡〕。

1.5 工程項目簡介涵蓋的指定工程項目數目與類別

根據《環境影響評估條例》附表 2 第 I 部類別 Q1，本合約其中 9 幅建議斜坡鞏固工程位於大嶼山南大嶼郊野公園內，故須視為「指定工程項目」。因此，有關方面在施工前，必須根據《環境影響評估條例》申領環境許可證。附件 A 內的圖 A2 和 A3 顯示 9 個建議斜坡鞏固工程的位置，該斜坡編號及位置如下：

位於南大嶼山郊野公園內的斜坡：

<u>石壁水塘</u>	<u>? 路道</u>
13NE-A/C98	13NW-B/C80
13NE-A/C99	13NW-B/C82
13NE-A/C100	
13NE-A/C101	
13NE-A/C102	
13NE-A/C108	
13NE-A/C133	

1.6 聯絡人姓名及電話

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2 規劃大綱及工程項目的執行

2.1 規劃及實施工程

合樂中國有限公司〔合樂〕於2000年10月取得本工程顧問合約。合樂負責對每幅斜坡進行勘察及詳細的工程設計事宜，並須監督每項建築工程。承建商將根據工程合約〔編號GE/2002/17〕實施建議的鞏固斜坡工程。

建議鞏固斜坡工程共分為以下五個階段：

	建築活動	詳情
(1)	小型土方工程	- 切削斜坡、改善坡度，以便進行景觀美化工程、處置挖掘物料；及/或 - 移除現有的噴射混凝土範圍。
(2)	為土壤斜坡裝設泥釘	- 利用鑽探、安裝鐵枝及灌漿工程，在斜坡開鑿小孔。
(3)	鞏固石坡措施	- 石塊調整、移除不穩固的巨礫、用鑽探安裝石釘、石栓及石網。
(4)	改善排水工程	- 在斜坡上建設混凝土排水渠道，並安置地下排水道。
(5)	景觀美化工程	- 種植青草、喬木及灌木。

以下表一和二顯示本工程項目簡介包括的9幅指定斜坡的詳情和建議工程摘要：

表一：各個指定斜坡的詳情

斜坡編號	高度〔米〕	沿斜坡腳的長度〔米〕		斜度〔°〕		現有覆蓋面	
		土壤部份	石塊部份	土壤部份	石塊部份	土壤部份	石塊部份
13NE-A/C98	24	104	--	40°	--	植物	不適用
13NE-A/C99	14	104	--	50°	--	植物	不適用
13NE-A/C100	7	50	60	48°	70°	噴射混凝土	噴射混凝土
13NE-A/C101	23	114	--	35°	--	植物	不適用
13NE-A/C102	13	135	45	40°	40°	植物/噴射混凝土	噴射混凝土
13NE-A/C108	17	196	55	55°	70°	噴射混凝土	噴射混凝土

斜坡編號	高度〔米〕	沿斜坡腳的長度〔米〕		斜度〔°〕		現有覆蓋面	
		土壤部份	石塊部份	土壤部份	石塊部份	土壤部份	石塊部份
13NE-A/C133	25	80	120	50°	50°	植物	多露
13NW-B/C80	18	65*	65*	40°	80°	噴射混凝土	噴射混凝土
13NW-B/C82	33	16	14	60°	80°	噴射混凝土	噴射混凝土/ 石網

註：*斜坡編號 13NW-B/C80 的總長度是 65 米，斜坡的土壤部份位於石塊部份之上。

表二：各指定斜坡的建議工程

斜坡編號	建議工程
13NE-A/C98	<ul style="list-style-type: none"> ? 在斜坡裝設泥釘及地下排水道。 ? 改善排水系統。 ? 景觀美化工程包括在控制侵蝕網上種植青草及灌木。
13NE-A/C99， 13NE-A/C101	<ul style="list-style-type: none"> ? 隔離沒有工程進行的地方以保護現有的植物。 ? 在斜坡裝設泥釘及地下排水道。 ? 改善排水系統。 ? 景觀美化工程包括在控制侵蝕網上種植青草、灌木及喬木。
13NE-A/C100	<ul style="list-style-type: none"> ? 在斜坡裝設泥釘及地下排水道。 ? 移除噴射混凝土覆蓋面。 ? 鞏固石坡措施。 ? 改善排水系統。 ? 景觀美化工程包括在控制侵蝕網或石網上種植青草及灌木。
13NE-A/C102	<ul style="list-style-type: none"> ? 在斜坡上層作出切割。 ? 在斜坡裝設泥釘和地下排水道。 ? 改善排水系統。 ? 景觀美化工程包括在控制侵蝕網上種植青草及灌木。

斜坡編號	建議工程
13NE-A/C108	<ul style="list-style-type: none"> ? 把西面斜坡切削至 45 度及移除所有噴射混凝土覆蓋面。 ? 在斜坡土壤部份裝設泥釘，石塊部份安裝石栓，以及裝設地下排水道。 ? 改善排水系統。 ? 在坡腳建築綠化牆。 ? 景觀美化工程包括在控制侵蝕網或石網上種植青草及灌木。
13NE-A/C133	<ul style="list-style-type: none"> ? 鞏固石坡措施。 ? 改善排水系統。 ? 在坡腳建築綠化牆。 ? 景觀美化工程包括在控制侵蝕網上種植青草及灌木。
13NW-B/C80	<ul style="list-style-type: none"> ? 移除噴射混凝土覆蓋面。 ? 鞏固石坡措施，在土壤斜坡裝設泥釘及裝設地下排水道。 ? 更換破爛的擋石網。 ? 改善排水系統。 ? 景觀美化工程包括在控制侵蝕網或石網上種植青草及灌木。
13NW-B/C82	<ul style="list-style-type: none"> ? 移除噴射混凝土覆蓋面。 ? 鞏固石坡措施，在土壤斜坡裝設泥釘及裝設地下排水道。 ? 改善排水系統。 ? 景觀美化工程包括在控制侵蝕網或石網上種植青草及灌木。

附件 B 及 C 分別顯示各個指定斜坡的建議斜坡鞏固及景觀美化工程。

2.2 工程項目的時間表

建築工程合約 GE/2002/17 將包括本工程項目簡介的 9 幅斜坡鞏固工程。工程合約將於 2002 年 9 月進行承建商招標，並暫於 2002 年 12 月動工，為期 24 個月。這工程流程總體的最大限制是要在限期內為 7 幅位於南大嶼郊野公園嶼南道的指定斜坡進行鞏固工程，該 7 幅斜坡的鞏固工程將會分為 5 段進行。而每幅斜坡的建築工程大約為期 6 個月。

這建築工程合約包括的其他斜坡的鞏固工程均按各種限制，環繞以上提及的 7 幅斜坡工程而編定，這些限制包括其他工程的交通管制，在乾燥季節進行填土斜坡的鞏固工程、及受其他工程或地點的限制。而其餘兩幅位於南大嶼郊野公園? 山道的斜坡鞏固工程將分開進行以減少交通控制對遊人的不便，這安排亦可減少運送物料到地盤的數量，由於工程分開進行所需的欄網比同時進行多，當一個地盤完工，欄網可以直接運送至隔鄰的地盤再用。

附件 D 顯示建築工程合約 GE/2002/17 的流程圖，各斜坡建築活動的施工期大約如下：

<u>建築活動</u>	<u>預計施工期</u>
(1) 小型土方工程，包括一切削坡及移除噴射混凝土	1 - 2 個月
(2) 裝設泥釘	1 - 2 個月
(3) 鞏固石坡措施	1 - 2 個月
(4) 改善排水工程	0.5 - 1 個月
(5) 景觀美化工程	0.5 - 1 個月

2.3 與其他層面較闊的計劃的要求或須加以考慮的工程項目有沒有關連

根據附件 D 顯示，在南大嶼郊野公園內 9 幅指定斜坡的鞏固工程可納入為一個整體的斜坡改善工程，而若干數目的斜坡改善工程將會同一時間進行。山道的兩幅指定斜坡的改善工程將不會同時進行，而其餘的 7 幅指定斜坡是緊接在一起，故鞏固工程將分為 5 段如下：

<u>分段編號</u>	<u>斜坡編號</u>
1	13NE-A/C108
2	13NE-A/C133
10	13NE-A/C99 和 13NE-A/C100
16	13NE-A/C98
19	13NE-A/C101 和 13NE-A/C102

在以上 7 幅斜坡範圍內，除了斜坡 13NE-A/C108 和 13NE-A/C133 的兩個地盤會同時進行斜坡鞏固工程外，在同一時間只許有一個地盤工作由於斜坡 13NE-A/C108 和 13NE-A/C133 位於彎路旁而且相距 500 米以及被彎角相隔，故兩個地盤同時進行工程亦不會產生累積影響。

中華電力有限公司〔中電〕在石壁至貝澳一帶一直進行地下電線鋪置工程，中電召集一連串的交通管制聯絡小組會議，目標要控制南大嶼山主要道路的封路數目以及盡量減少有關工程對周遭的影響。

於交通管制聯絡小組會議中，也討論及渠務署的離島污水收集系統第一階段第一期的昂坪污水處理及排放系統〔合約編號 CE 29/2001〕。污水處理設施工程目的在於昂平興建一座污水處理廠和一條沿昂平路至大澳道長六點五公里的污水輸出管道。工程計劃於 2003 年 3 月展開並於 2005 年中完成。最接近的渠務署工程地盤位於大嶼山 9 幅指定斜坡鞏固工程地盤以北約二百米。因此，即使同時進行斜坡鞏固和渠務工程，斜坡鞏固工程也不會影響到渠務工程的進行，同時也不會受到渠務工程的影響。而本建議斜坡改善工程與其他工程的互相影響亦有在會議內討論，在本工程於嶼南道近石壁

水塘的 7 幅斜坡的位置，中電的電線鋪置工程已完成；而中電在其餘地點的電線鋪置工程將會在本建築工程合約 GE/2002/1 開始時，2002 年底，完成。所以本指定工程將不會被其他工程影響。

3 周圍環境的主要元素

3.1 可能受擬議工程項目影響的現存及計劃中的感應強的地方及自然環境中的敏感部分

3.1.1 噪音

斜坡 13NW-B/C80 和 13NW-B/C82 位於? 山道靠近觀音山的地方。? 山道是大嶼山西南部的一條主要公路，沿石壁水塘西岸，呈南北走向。? 山道南端在石壁水塘與嶼南道的西端相連，? 山道北端延伸到昂平路東邊和大澳道西邊（見附錄 A）。工程 500 米範圍沒有發現噪音感應強的地方。

內
斜坡 13NE-A/C98、13NE-A/C99、13NE-A/C100、13NE-A/C101、13NE-A/C102、13NE-A/C108 和 13NE-A/C133 位於嶼南道靠近石壁水塘的地方。嶼南道是大嶼山南部的一條重要公路，連接梅窩和石壁水塘（見附錄 A）。

附錄 A 顯示石壁水塘附近現有的噪音感應強的地方可能受工程影響的自然環境，列於下表：

表 3：已經確認的噪音感應強的地方

噪音感應強的地方編號	最近的斜坡編號	距離最近的斜坡〔米〕
SR1	13NE-A/C98	430
	13NE-A/C99	400
	13NE-A/C100	400
	13NE-A/C101	300
	13NE-A/C102	270
	13NE-A/C108	210
	13NE-A/C133	490

對於大嶼山的 9 幅斜坡，現有的主要噪音來源是嶼南道和? 山道的交通。兩條公路的交通流量都相對較少，但礙於周末和假期的觀光者增多，噪音水平都會較高。一個工作天的下午和星期六的下午，在嶼南道和? 山道的目標地點進行了半小時的交通紀錄，分別記錄了少於 80 輛的經過車輛。

3.1.2 空氣質素

空氣質素感應強的地方和 3.1.1 中指出的噪音感應強的地方一樣。嶼南道和? 山道的車輛尾氣排放是現有的主要空氣污染來源。由於現行的南大嶼山道路使用許可系統，該地區交通流量受到控制，所以污染水平較低。但是，由於周末和假期到南大嶼山的遊客增多，並且公共交通服務亦增多，污染程度也因此增加。並沒有發現其他的空氣污染源。

距離工程最近的環保署空氣質素監測站在東涌。根據“香港空氣質素年報”(EPD, 2000)，該站紀錄的二氧化氮(NO₂)、總懸浮顆粒(TSP)和可呼吸懸浮顆粒(RSP)的平均濃度為 100 μg/m³ (香港空氣質素二零零零年報, 表 2)。結果符合“空氣污染管制法例”中規定的 NO₂(150 μg/m³)、TSP(260 μg/m³)和 RSP(180 μg/m³)的 24 小時空氣質素目標。由於南大嶼山實行道路使用許可系統，工程地的交通流量低於東涌。因此，工程地的 NO₂、TSP 和 RSP 水平應該低於東涌空氣質素監測站獲取的讀數。工程地點的整體空氣質素被認為較好。

3.1.3 生態

研究方法見附錄 F。

生態環境

斜坡 13NW-B/C80 和 13NW-B/C82 是沿? 山道的兩個削土斜坡。斜坡 13NW-B/C80 和 13NW-B/C82 的北部均被噴漿混凝土覆蓋，後者的其他部分則為裸露的岩石和土壤，且被鐵網覆蓋。

斜坡 13NW-B/C80 北部的後方是由 5 米至 7 米高的紅膠木和一些本地樹種及灌木組成的植被。斜坡 13NW-B/C80 中部的上方是灌木覆蓋的自然斜坡。最主要的物種有崗松、酸籐果、車輛梅、車輪梅、桃金娘和野牡丹。斜坡 13NW-B/C80 的南端是一個有流水的小山谷，溪流兩岸被樹木覆蓋，形成小型的林地。樹木高度超過 10 米，有各種森林物種，例如石柯，顯示出這個小型林地可能是一個殘留的良好的次生林。

對於斜坡 13NW-B/C82，其後方的自然丘陵連接斜坡的北段和南端，是典型的灌木林，主要物種有崗松、酸籐果、車輛梅、香港山楂、桃金娘、豺皮樟和野牡丹。斜坡上方〔>50 m〕是一片主要為濕地松的種植林。

斜坡 13NE-A/C98、13NE-A/C99、13NE-A/C100、13NE-A/C101、13NE-A/C102、13NE-A/C108 和 13NE-A/C133 是沿嶼南道、靠近石壁水塘的七個削土斜坡。其中斜坡 13NE-A/C100、13NE-A/C102、13NE-A/C108 和 13NE-A/C133 均有被噴漿混凝土覆蓋全部或部分的斜坡面，植被稀疏。斜坡 13NE-A/C98、13NE-A/C99 和 13NE-A/C101 則被現有植被覆蓋。

這七個斜坡後面的自然山丘是典型的山丘灌木，主要有桃金娘、豺皮樟和車輛梅等。這些斜坡的後方較遠處〔>50m〕則發現外國樹種構成的年輕的種植林，主要是濕地

松。斜坡 13NE-A/C102 和 13NE-A/C108 的後方、兩個斜坡頂部之間和上方的引路亦發現一塊細帶狀的年輕的次生林。其一帶主要種有鼠刺、黃牛木和鵝掌柴等。

植物

斜坡 13NW-B/C80 和 13NW-B/C82 的區域，共記錄有 63 種植物種類，包括 33 種樹、14 種灌木、6 種攀援植物、7 種蕨類植物、2 種竹子和 1 種草。其中一種名叫吊鐘（見附錄 E 的圖 E1 和 E2）在香港是受保護的。這片灌木林中，共有 9 株吊鐘樹。其中 5 株位於斜坡頂部的 5 米範圍，其餘 4 株則種在自然斜坡上方超過 10 米處。吊鐘在香港曾因過量採集而遭到威脅，並於 70 年代被列為受保護品種。但從那時，其野生數量已經恢復，現在更已遍佈郊野（Corlett *et al.* 2000）。蕨類植物金毛狗在中國大陸遭到過量採集，同樣被列為保護品種，但在香港仍很常見（Wu & Lee 2000）。

在沿嶼南道、靠近石壁水塘的七個斜坡區域，共記錄有 74 種物種，包括 33 種樹、17 種灌木、14 種攀援植物、9 種蕨類植物和 1 種草。這工程區域沒有發現罕見或瀕危植物。

所有記錄列於附錄 E 的表 E1 和 E2。

動物

斜坡 13NW-B/C80 和 13NW-B/C82 的工程範圍共紀錄有 15 種鳥類和 15 種蝴蝶。此外還有一種爬行動物變色樹蜥，在香港很常見（Karsen *et al.* 1998）。經過在鄰近斜坡 13NW-B/C80 的溪流附近仔細的搜索，並沒有發現任何兩棲類動物。亦沒有發現有更高保護價值的動物。

在沿嶼南道、靠近石壁水塘的七個斜坡區域，共記錄有 18 種鳥類、14 種蝴蝶。此外還有 3 種爬行動物，包括變色樹蜥、蠍蜓和石龍子。這三種動物在香港十分常見（Karsen *et al.* 1998）。未有發現兩棲動物的部分原因可能是由於天氣太乾燥。鳥類當中有三種有一定的保護價值，黑鳶和白腹海鷹便是有區域保護價值的品種，蛇鵲是更有本地保護價值的品種（Fellowes *et al.* 正在出版）。但由於這三種鳥類都飛翔在工程地的上空，故不會在工程地範圍築巢或者覓食。

各種發現結果列於附錄 E 的表 E3 和 E6。

3.1.4 水

斜坡 13NW-B/C80 的北端和 13NW-B/C82 和南端有東西走向的集水道。這兩幅斜坡下方是？ 山道和填土斜坡及削土斜坡。這些斜坡處的集水道經過轉向，流到？ 山道下面的涵洞，作自然斜坡下面的臨時水道，最後流入石壁水塘。

沿嶼南道、靠近石壁水塘的七幅斜坡位於對著斜坡 13NE-A/C108 的公路和斜坡 13NE-A/C102 西端的正下方。一個流向水塘的引水道位於對著斜坡 13NE-A/C98 和 13NE-A/C100 的嶼南道的上方 40-100 米。除了斜坡 13NE-A/C133 的南半部分，所有的石壁斜

坡都位於水務署積水區域。一個臨時水道位於這個積水範圍內，流過斜坡 13NE-A/C102 西端，通過嶼南道下面的涵洞，直接流入石壁水塘。

3.1.5 景觀及視覺

在南大嶼郊野公園內的 9 幅斜坡分別位於? 山道及嶼南道邊，然而? 山道及嶼南道乃是南大嶼山的主要道路，所以視覺上該 9 幅斜坡均十分顯眼。

位於? 山道邊的斜坡 13NW-B/C80 和 13NW-B/C82，和位於嶼南道邊的斜坡 13NE-A/C100、13NE-A/C102 和 13NE-A/C108 均為噴射混凝土覆蓋。位於嶼南道邊的斜坡 13NE-A/C98、13NE-A/C99、13NE-A/C101 和 13NE-A/C133 均為植物覆蓋。

3.1.6 歷史及文化

經康樂及文化事務署古物古蹟辦事處的證實，在本顧問合約的 60 幅斜坡的範圍內沒有包括現時 75 個法定文化遺產地點。

3.1.7 其他

沒有影響。

4 對環境可能造成的影響

4.1 倡議工程涉及的工序、工序流程圖、場地平面圖貯存規定、散發物及排放物的資料可能導致的環境影響

南大嶼郊野公園內共有 11 幅斜坡，其中 9 幅位於嶼南道，兩幅位於? 山道近石壁水塘。附件 A 顯示各個斜坡的一般位置圖。

正如上文，第 2.1 節所述，這些指定斜坡工程將包括五項主要建築活動：

- 1) 小型土方工程；
- 2) 裝設泥釘；
- 3) 鞏固石坡措施；
- 4) 改善排水工程；及
- 5) 景觀美化工程。

附件 B 顯示各指定工程項目的建議工程詳情。

上述所有活動均可能構成環境影響，而且由於需要使用機動設備，故亦會造成噪音影響。此外，大部份建築活動如土方工程〔削土及移除噴射混凝土〕和裝設泥釘，特別是鑽探期間，均可能產生塵埃，但改善排水及景觀美化工程則不會引起大量塵埃。從生態角度而言，施工期間可能對野生生物構成滋擾，而斜坡切削或小型維修的工程亦將會移除部份現有的植物。

小型土方工程包括移除噴射混凝土會引致廢料的產生，這些建築廢料必需處理以及運送至有關的公眾填土設施及或公眾填土設施。根據合約 GE/2002/17 要求，運送廢料時必須執行有關的載運記錄制度。

建議的斜坡鞏固工程對於水質影響很少，但工程地盤的廢料亦有機會被帶到附近的溪流，所以有關的暫時性措施必需執行以防止污染物沒有控制地流入附近溪流。

4.2 施工期對環境的影響

4.2.1 噪音

根據環保處發出的建議納入建築合約的污染管制條款，此建築合約〔合約編號 GE/2002/17〕規定在工程進行期間，聲功率級不可超出 75 分貝。

在施工期間，由於需要使用機動設備進行各項建築活動，故噪音將會產生。總括而言，可產生負面噪音影響的工程大致可以分為以下五個階段：

- ? 活動一 - 小型土方工程：切削斜坡，改善坡度，以便進行景觀美化工程；處理挖掘物料及/或移除現有的噴射混凝土範圍。
- ? 活動二 - 為土壤斜坡裝設泥釘：利用鑽探、安裝鐵枝及灌漿工程，在斜坡開鑿小孔。
- ? 活動三 - 為石坡進行鞏固石坡措施：石塊調整、移除不穩固的巨礫、安裝石釘、石栓及石網。
- ? 活動四 - 改善排水工程：在斜坡上建設混凝土排水渠道，並裝置地下排水道。
- ? 活動五- 景觀美化工程：種植青草、喬木及灌木。

下表 4 顯示各個施工階段所須使用的設備：

表 4：各項建築活動的估計聲功率級

建築活動	機動設備	建築噪音 許可證 設備代號 ⁽¹⁾	設備數目	聲功率級 分貝(A) ⁽¹⁾	運作期的總 聲功率級 ⁽²⁾
活動 1	挖土機 〔反鏟挖土機〕	CNP081	1	112	115.0
	貨車	CNP141	1	112	
活動 2	鑽石機、裝設履帶 〔氣動〕	CNP181	1	128	128.1
	空氣壓縮機	CNP001	1	100	
	起重機、汽油	CNP123	1	104	
	混凝土泵	CNP047	1	109	
	混凝土攪拌機	CNP046	1	96	
活動 3	鑽石機、裝設履帶 〔氣動〕	CNP181	1	128	128.1
	空氣壓縮機	CNP001	1	100	
	起重機、汽油	CNP123	1	104	
	混凝土泵	CNP047	1	109	
	混凝土攪拌機	CNP046	1	96	
活動 4	混凝土泵	CNP047	1	109	109.2
	混凝土攪拌機	CNP046	1	96	
活動 5	混凝土泵	CNP282	1	103	103.8
	攪拌機	CNP046	1	96	

附註*：(1) 設備代號及聲功率乃根據《管制建築工程噪音〔撞擊式打樁除外〕技術備忘錄》釐定。

(2) 運作期的總聲功率級乃根據附註(1)之技術備忘錄內的表 4 釐定。

(3) 附件 F 顯示本工程對指定噪音感應強的地方建築噪音評估。

工程顧問已根據《管制建築工程噪音〔撞擊式打樁除外〕技術備忘錄》的特定方法，對指定噪音感應強的地方進行建築噪音評估。附件 F 詳列在斜坡進行修葺期間，在具代表性噪音感應強的地方，於採取緩解措施前的估計噪音水平。在計算噪音水平時，假設最接近噪音感應強的地方的斜坡所造成的最惡劣情況。

結果顯示，所有建築活動對噪音感應強的地方的最高噪音水平均低於工程合約規定的 75 分貝最高水平。而建築活動二〔裝置泥釘〕的累積影響對於噪音感應強的地方，略為超出合約所規定的 75 分貝。根據此評估結果，承建商必須採取噪音緩解措施以減低噪音至可接受水平。此外，郊野公園的遊客亦將受噪音滋擾，但由於他們逗留時間短暫，加上該處嶼南道路段的影響，故不會對他們造成明顯的影響。

4.2.2 空氣

土方工程與裝設泥釘及鞏固石塊而進行的鑽探工程，特別是在乾旱的季節，均可構成塵埃影響。此外，儲存挖土物料或物料本身亦可成為塵埃的來源。然而，承建商亦須遵守《空氣污染管制〔建築塵埃〕規例》，確保空氣污染感應強的地方不會受到塵埃導致的負面影響。

4.2.3 生態

可能帶來生態影響的斜坡改造工程大部分與斜坡整修有關，可能清除某部份的植被，包括失去一些灌木和次生林。同時，清除灌漿混凝土、打泥釘和 RSSM 帶來的塵土將會影響動植物。工程期間產生的噪音也可能對野生生物造成影響。

建議對沿嶼南道的斜坡 13NE-A/C108 和沿? 山道的斜坡 13NW-B/C80、13NW-B/C82 進行小型整修。斜坡 13NE-A/C108 斜坡的小型整修需要清除斜坡頂部之間和引路的一些植被。但是清除的區域並不很大。? 山道兩個斜坡的小型整修包括斜坡頂部的局部磨圓，但是不會帶來大幅度的植被清除。沿嶼南道和石壁水塘的 6 個斜坡不需要修葺。預計 9 個斜坡土力工程將導致的植被清除列於下表 5：

表 5：現有植被的清除面積

斜坡編號	大概工程地盤面積 (平方米)	大概植被清除面積 (平方米)
13NE-A/C98	3500	100
13NE-A/C99	1600	150
13NE-A/C100	1500	30
13NE-A/C101	3200	200
13NE-A/C102	3200	50
13NE-A/C108	3750	750
13NE-A/C133	5200	零
13NW-B/C80	1300	30
13NW-B/C82	3900	50

斜坡 13NW-B/C80 的小型整修不會影響斜坡頂部的五種受保護的吊鐘樹。但是，斜坡頂部以上的自然斜坡表現的不穩定，最明顯的是斜坡頂部後面 10 米處的 100 毫米寬、

5 米長的張力裂縫。因此，對現有斜坡進行打土釘和張力裂縫的密封時，需要穩定斜坡頂部以上的區域，如圖紙 LPM 0217/3212 所示。最低的兩遍吊鐘樹叢位於打泥釘範圍內，需要保護或移植。有這種植物的其他區域在斜坡上方更遠處，在圖紙 LPM 0217/3211 顯示的工程區域以外，不太可能受影響。臨近斜坡 13NW-B/C80 的林地溪流的下半部分可能受到工程影響，需要採取保護措施。此外，斜坡 13NW-B/C80 和 13NW-B/C82 的工程預計不會有很大的生態影響。

對於沿嶼南道、靠近石壁水塘的 7 個斜坡，計劃的工程可能破壞一些位於斜坡上、或斜坡 13NE-A/C108 上方的半自然斜坡上現有的植被。但是，這些地方沒有發現罕見或瀕危品種。植被都是低矮灌木、年輕的次生林或外國樹種植被，這些在香港都是很常見的種類。因此，這些計劃的工程不會帶來很大的生態影響。儘管該地記錄有三種有保護價值的鳥類，它們被發現高高飛翔在工地上空，沒有跡象顯示它們依賴於這塊地方來築巢或覓食。因此，斜坡工程不太可能影響這些鳥類物種。

4.2.4 水

位於嶼南道的斜坡 13NW-B/C80 和 13NW-B/C82 在石壁水塘的上方，可是斜坡下面的臨時水道最終流入石壁水塘。因此任何未經控制的工程地盤污水排放都可能影響臨時水道的水質，從而可能間接影響石壁水塘的水質。從間隔距離的考慮，若有這樣的影響，問題亦不大。

嶼南道的斜坡位於石壁水塘的直接集水區。斜坡 13NE-A/C102 西端的臨時水道直接流入石壁水塘。這一區域的任何未經控制的污水排放或溢漏都可能影響流入石壁水塘的水質。

4.2.5 廢料

斜坡整修和清除現有堅硬表面的挖掘工作將產生廢料。對於斜坡 13NE-A/C108、13NW-B/C80 和 13NW-B/C82，小型整修或切削產生的工程廢物包括噴漿混凝土、土壤和岩石。斜坡 13NE-A/C100 和 13NE-A/C102 工程產生的廢物主要包括噴漿混凝土，因現有的噴漿混凝土表面將在工程中被清除。其餘斜坡工程只會產生少量的廢物。

為

表 6：預計產生的廢物材料

斜坡編號	清除的噴漿 混凝土 (立方米)	土壤 (立方米)	岩石 (立方米)	廢物、木料 等(立方米)	總計 (立方米)
13NE-A/C98	--	--	--	25	25
13NE-A/C99	--	--	--	25	25
13NE-A/C100	50	--	--	20	70
13NE-A/C101	--	50	--	20	70
13NE-A/C102	200	50	--	25	275
13NE-A/C108	150	3000	50	50	3250
13NE-A/C133	--	--	10	30	40
13NW-A/C80	50	25	20	25	120
13NW-A/C82	120	25	20	25	190

4.2.6 景觀和視覺

在施工期間，在斜坡表面將會裝設臨時柵架和施工平臺，以方便進行裝設泥釘和進行景觀工程。在裝設柵架期間將要清除一些植物。斜坡 13NE-A/C108 挖掘施工期間將砍伐一些樹。

表 7：預計砍伐樹木總表

斜坡編號	保留樹木數量	砍伐樹木數量	移植樹木數量
13NE-A/C98	111	零	零
13NE-A/C99	50	零	零
13NE-A/C100	11	零	零
13NE-A/C101	100	零	零
13NE-A/C102	94	零	零
13NE-A/C108	64	8	零
13NE-A/C133	111	零	零
13NW-B/C80	7	零	*8
13NW-B/C82	12	零	零
總計	560	8	8

備註：* 工程將種植本地灌木以補償損失，若移植方法失敗。

爲了對 修葺後的斜坡進行維修工作，必須修建通道樓梯，用來清理排水渠、修葺植被等等。傳統的做法是在角度小於 45° 的斜坡上修建混凝土階梯，或者在角度大於 45° 的斜坡上修建鋼階梯。如果不妥善安排兩種階梯的位置，可能會影響視覺效果。樓梯的扶手欄杆亦會帶來視覺影響。

4.2.7 歷史及文化

建議的斜坡鞏固工程將不會影響現有或建議中的文化遺產地點。

4.2.8 其他

沒有其他影響。

4.3 運作期對環境的影響

工程的運作期將不會對感應強的地方造成負面影響，相反景觀緩解工程建議種植本地及其他植物預料會對環境造成長期的正面影響。

完成斜坡改善工程後，斜坡 13NE-A/C100、13NE-A/C102、13NE-A/C108、13NW-B/C80 和 13NW-B/C82 由噴草取代從前的。噴射混凝土後，視覺效果將會得到改善。

5 將採取的環保措施和其他影響

5.1 減低環境影響的措施

5.1.1 噪音

評估結果預計在噪音感應強的地方（編號 SR1），裝設泥釘及鞏固石坡措施的噪音水平略微超過合約要求的 75 分貝，所以需要採取噪音緩解措施（見附錄 F 的表 F2）。裝設泥釘及鞏固石坡措施中的主要噪音來源是撞擊式打樁。表 8 詳列在使用鑽探設備時可採取的緩解措施，以減低所發放的噪音：

表 8：爲造成噪音設備建議的緩解措施

設備	舒緩措施	最大減噪分貝
鑽石機及相關工具	<ul style="list-style-type: none"> ? 安裝適當設計的消聲器或減聲設備，在不降低機器效率的情況下減小噪音； ? 確保密封所有氣喉的漏隙； ? 使用減震鑽頭以防止高音噪聲。 	最大達到 15

來源：施工和露天地盤噪音管制，表 B1 (BS5228:Part I, 1997)

為方便進行評估，假設有關於設備的噪音水平可減低 10 分貝，見附錄 G。採取以上緩解措施後，所有噪音感應強的地方在施工期間的噪音水平都不會超過合約要求的 75 分貝，並且不會造成任何影響。

斜坡 13NE-A/C108 的鞏固工程須使用噪音緩解措施。此外，噪音可能影響到郊野公園的遊客，因遊客逗留時間短暫，故工程噪音不會對他們造成嚴重影響，但亦建議在鑽探期對所有斜坡採取緩解措施，藉此將對郊野公園遊客的影響減至最低。

5.1.2 空氣質素

通過採取至 GE/2001/27 合約的特殊規定中的建議污染管制條款（詳見附錄 H），環境損害將維持最低。此外，建議鑽探施工期間進行噴水，特別在乾燥季節，從而減小對污染感應強的地方造成任何不良影響。承建商應該確保此類塵土緩解措施中有足夠的水供應。

如 5.1.1 節中所指出，所有設備和材料都將經海運運送到大嶼山，不需要使用東涌道，從而將車輛帶來的空氣質素影響減到最小。

5.1.3 生態

施工期間要注意避免損害工程地上不需要施工的區域。因此這些區域應用相連的柵欄圍住，施工期減避免進入，從而保護區域現有的植被（例如 斜坡 13NE-A/C99，見圖紙 LPM 0217/3422 和 LPM 0217/L3421）。只要有可能，樹木必須被保存，因此斜坡工程中只會砍伐最少的樹木，只有斜坡 13NE-A/C108 被要求有樹木砍伐。在樹木砍伐無可避免的情況下，將採取補救措施，用該地有記錄的植物種類替換砍伐的樹木。對於任何被砍伐但無法用同類樹種替換的外國樹種，將用本地樹種替換。

對於 13NW-B/C80 斜坡，將在工程地盤進行更詳細的調查，為所有單棵吊鐘樹進行標記。承包商和駐地工作人員將被告知這些樹木的確切地點。如果可能，這些樹不會被清除，並在工程期間為它們設置柵欄進行保護。但是，有見及斜坡 13NW-B/C80 影響區域所計劃的工程範圍，這些樹很可能需要移植。因此，開工前應為這些受影響區域的樹做好移植準備，吊鐘樹將在開工前被移植到工程地上方的位置，如圖紙 LPM 0217/L3211 所示。而下部現存的吊鐘樹的位置進行泥釘，如第 4.2.3 段所說明。由於欠缺安全的路徑到達整個斜坡頂部，移植樹的位置會在承建商提供安全路徑之後，由工程師加上專業意見去確定。於合約 GE/2002/17 的特別規格中，移植工作需要由專門景觀承建商負責。除了合約的一般要求，承建商需要顯示出專門景觀承建商擁有足夠的經驗及工人去進行有關的樹木工作。除了移植現有的樹木，這些斜坡的景觀工程將包括種植天然物種。假若現有的吊鐘樹不能移植，那麼種植其他天然物種可以補償其損失。

斜坡 13NW-B/C80 施工期間，將採取避免侵犯林地溪流措施。該地盤的任何植被清除都將得到監控，以避免不必要的清除。

沿? 山道的斜坡 13NW-B/C82 和沿嶼南道、靠近石壁的 7 個斜坡，因沒有罕見或瀕危動植物的記錄，所以不會有任何特殊措施的建議。但是，地盤上任何植被的清除都應受到監控，以避免不必要的清除。

5.1.4 水

承建商應遵守水污染管制條例及其附屬規例。合約中特別要求承建商在石壁水塘附近斜坡施工時遵守水務署公佈的“集水區施工條款”。

施工期間，承建商應對任何工程、塵土控制和車輛清洗產生的地面逕流在地盤進行收集。承建商不允許在任何公眾污水管道、雨水渠、水溝、水道或海水排放任何工業廢水、髒水、污染水、冷卻水或熱水。

如果地盤設立公共食堂或衛生設施，髒水應直接排放至污水管道或污水處理設備。

5.1.5 廢料

承建商應遵守廢物處理〔化學廢物〕〔一般〕規例、廢物處置條例及其附屬規例、海上傾倒物料條例。

承建商不應允許任何含有沙、水泥、泥沙或任何懸浮或可溶解物質的髒水、污水或廢水從地盤流入任何相鄰區域，或任何未經處理的廢物堆積在地盤或相鄰區域的任何地方。

內

承建商在地盤產生的任何建築廢物將被運送到指定的土木工程署公眾填土設施和位於梅窩的環境保護署離島廢物轉運設施。考慮到最近在大嶼山其他工程中發生的問題，特別注意實行廢物運載記錄系統，通過相關的梅窩廢物轉運設施清除公眾及其他廢料。經驗豐富的顧問公司高級人員將不時進行承建商和駐地盤人員工作程序的獨立審查，確保遵守正確的程序。

5.1.6 景觀和視覺

所有工程地盤的腳下將設置臨時圍板或安全柵欄，以遮隔地盤內工程進行的視線。

斜坡現有的噴漿混凝土覆蓋層將被清除，用噴草和/或灌木、或喬木(如果可能)覆蓋表面，以改善現有景觀。

斜坡設計必須提供用於斜坡維修的階梯，設計應盡可能減階梯的數量，特別在靠近石壁水塘的斜坡。使用斜坡 13NE-A/C98、13NE-A/C100 和 13NE-A/C102 頂部現有荒廢的小路作為斜坡維修的通道可大為減少階梯的數量。此外，儘管斜坡 13NW-B/C80 由於太陡峭而無可避免要設置一條鋼階梯，仍應盡量避免使用鋼階梯。

此外，本工程建議用類似大嶼山道的石砌階梯代替傳統的混凝土階梯，從而造成一種更容易和周圍環境相融合的感覺。最後，儘管扶手必須滿足安全規範的要求，建議用

類似現在漁農自然護理署使用的細節設計代替標準的扶手細節設計，即看上去像木頭的混凝土棧。這種扶手修建在斜坡腳上方一定的遠度和高度，看上去有木質的效果。

表 9：景觀緩解措施建議

斜坡編號	景觀緩解措施建議
13NE-A/C98	控制侵蝕網、噴草及種植灌木。
13NE-A/C99	圍網保護無施工的區域，以保存現有的植物；控制侵蝕網、噴草及種植灌木。
13NE-A/C100	控制侵蝕網、噴草及種植灌木。
13NE-A/C101	圍網保護無施工的區域，以保存現有的植物；控制侵蝕網、噴草及種植灌木。
13NE-A/C102	控制侵蝕網、噴草及種植灌木；斜坡頂部種植樹苗。
13NE-A/C108	控制侵蝕網、噴草及種植灌木。種植本地灌木補償砍伐的樹木；在斜坡腳種植綠化牆以遮隔斜坡範圍的視線。
13NE-A/C133	在土壤部分使用控制侵蝕網和噴草，保持岩石部分的裸露岩石外貌；在斜坡腳種植綠化牆以遮隔斜坡範圍的視線。
13NW-A/C80	控制侵蝕網、噴草及種植灌木；種植本地灌木以補償失去吊鐘的損失〔若移植吊鐘失敗〕。
13NW-A/C82	控制侵蝕網、噴草及種植灌木；斜坡頂部種植樹苗。

5.1.7 歷史及文化

由於沒有文化遺產地點受影響，所以毋需作出緩解措施。

5.1.8 其他

沒有需要其他的環境緩解措施。

5.2 評論環境影響可能有的嚴重性、分佈及時間

施行減低環境影響的措施和遵守工程合約內的環保條文〔見附件 H〕，本工程預測將不會帶來負面的剩餘的噪音、空氣、廢料、水質、生態、景觀及視覺影響。

在陸地生態而言，建議工程對斜坡 13NW-B/C80 頂部的吊鐘必需小心保護。若保護或移植吊鐘是不可行，本工程將種植本地喬木以補償砍伐吊鐘的損失以外，種植木本地喬木已包括在景觀緩解工程。此外保護或預測建議工程不會對該斜坡造成主要影響由於吊鐘在港相當普遍以及分佈甚廣〔Corlett et al., 2000〕，故本工程項目簡介對吊鐘提出的緩解措施已很足夠。

5.3 評論其他影響

沒有其他評論。

5.4 使用以前通過的環評報告

以下是最近有關類似的工程項目，該項目正在本港展開並已取得環境許可證。

合約編號 CE 74/99 及附加合約編號 1

此合約〔CED，2001〕包括在大嶼山內的防止山泥傾瀉斜坡改善工程。土木工程署於2001年4月27日提交該工程項目簡介〔申請編號 DIR-055/2001〕向環保署申請准許直接申請環境許可證。該簡介評論其工程不會對環境造成長期或累積負面影響。土木工程署的申請獲得接納，環境許可證於2001年7月31日發出〔環境許可證編號 EP-102/2001〕。

6 參考資料

詳見本項目簡介英文版〔P. 24〕。

ATTACHMENTS

附件

- A. Location Plans and Locations of Sensitive Receivers
位置圖及噪音感應強的地方位置圖
- B. Construction Details for the Designated Features
建築工程詳情
- C. Landscaping Details for the Designated Features
景觀緩解工程詳情
- D. Indicative Works Programme
工程流程圖說明
- E. Results of the Ecological Survey
生態環境調查結果
- F. Predicted Noise Level without Mitigation Measures
噪音感應的地方噪音水平評估〔採取緩解措施前〕
- G. Predicted Noise Levels after Mitigation Measures
噪音感應的地方噪音水平評估〔採取緩解措施後〕
- H. Particular Specification Clauses included in Contract GE/2002/17
工程合約 GE/2002/17 內的環保條文
 - Pollution Control
污染控制
 - Waste Management
廢物處理
 - Conditions for working within Water Gathering Grounds
集水區施工條款