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22 October 2015

By Email and Fax

Legislative Council Secretariat
Legislative Council Complex
1 Legislative Council Road
Central, Hong Kong
(Attn.: Mr Raymond Szeto)
(Fax no.: 2869 6794)

Dear Mr Szeto,

**703TH – Dualling of Hiram’s Highway between
Clear Water Bay Road and Marina Cove and
Improvement to Local Access to Ho Chung
Supplementary Information**

At the meeting of the Legislative Council (LegCo) Finance Committee (FC) held on 15 July 2015 for considering the funding application of the above project (PWSC paper no. PWSC(2015-16)22), members requested the Administration to provide the following supplementary information –

- (a) the availability of public car parking spaces near the reprovisioned public toilet within the project boundary;
- (b) report on Environmental Study / Engineering Review for the project; and

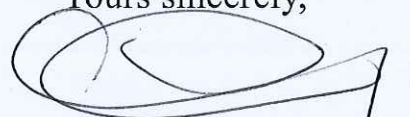
- (c) transparent design for the noise barrier on vehicular bridge-cum-walkway across Ho Chung Channel.

Regarding item (a), the Highways Department (HyD) and Transport Department (TD) have studied the feasibility of providing a suitable parking space in the vicinity of the reprovisioned public toilet at the junction of Hiram's Highway and Ho Chung Road. While a proposed lay-by on Hiram's Highway will be constructed under the project, it was planned for serving buses, mini-buses and other vehicles for boarding and alighting of passengers. There will not be sufficient space to provide on-street parking space that could accommodate vehicles of different sizes. After carrying out further desktop review and paying site visit, HyD could not identify suitable space for providing parking space without resuming more private land or introducing further slope cutting works involving slope with maximum height of 15 meters (m). On the other hand, at about 680 m away (with less than 1 minute driving time), there is an existing public toilet at the entrance to Pak Wai Village with public car parking spaces in the vicinity (See attached plan no. HMW6703TH-SK0055). Drivers may consider using that toilet where necessary.

Regarding item (b), the relevant reports of the Environmental Study / Engineering Review are enclosed.

Regarding item (c), for the proposed noise barrier on the vehicular bridge-cum-walkway across Ho Chung Channel, the part measuring 0.8m from ground level is opaque concrete base, and the part above 0.8m from ground level is made of translucent material.

Yours sincerely,



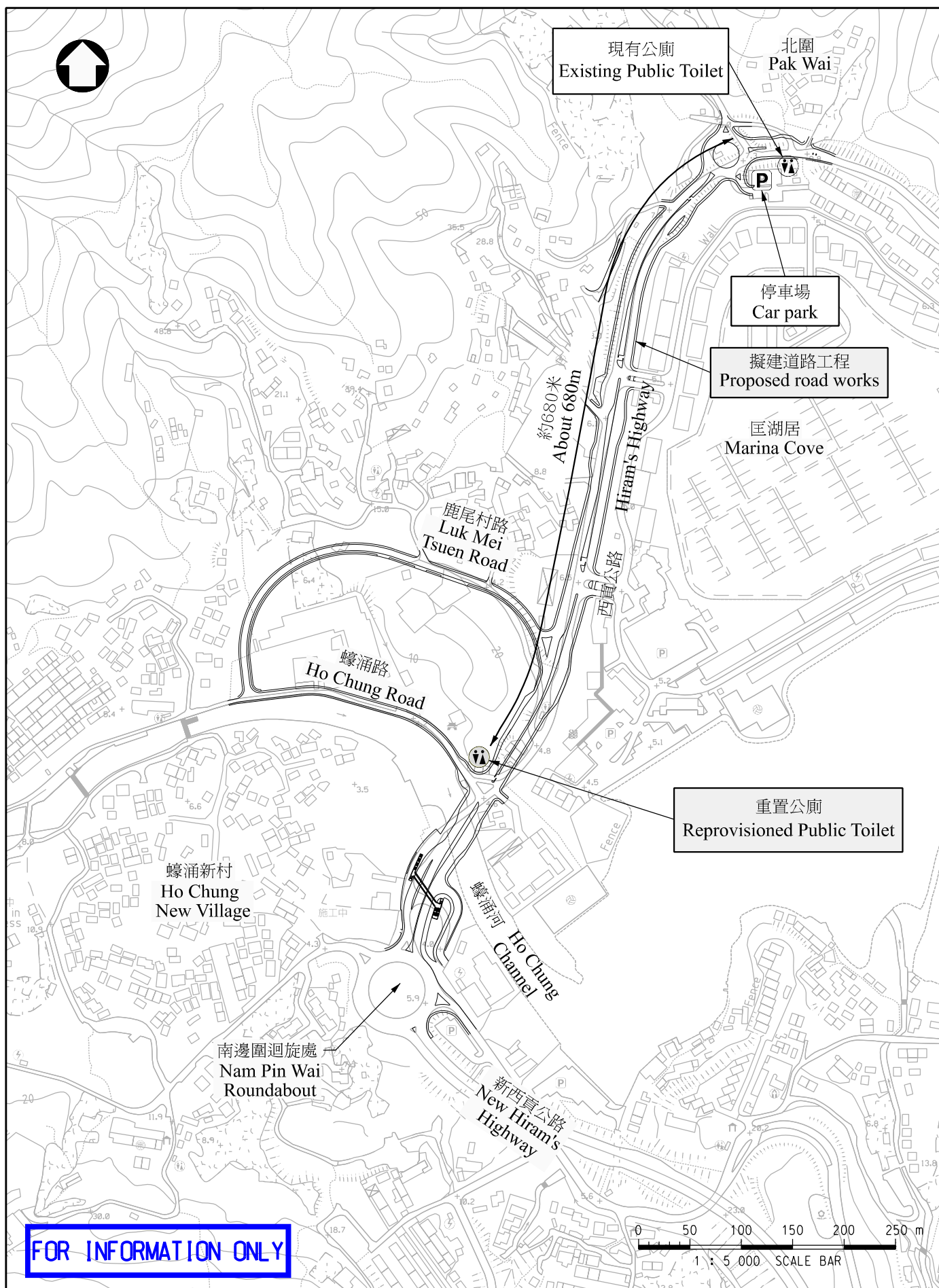
(Cedric CHENG)

for Secretary for Transport and Housing

cc:

CE3/MW, MWPMO, HyD

(Fax no: 2714 5289)



工務計劃項目第6703TH號
清水灣道與匡湖居之間的一段西貢公路分隔車道工程及
蠔涌區內通路改善工程 - 公廁及停車場位置圖

PWP Item No. 6703TH

Dualling of Hiram's Highway between Clear Water Bay Road and Marina Cove
and Improvement to Local Access to Ho Chung
- Location Plan of Public Toilets and Car Park

圖則編號 plan no.
HMW6703TH-SK0055

比例 scale
1:5000 或圖示
Or As Shown

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HIGHWAYS
DEPARTMENT
HONG KONG

路政署
香港



HIGHWAYS DEPARTMENT
Works Division
路政署
工程部

Agreement No. WD 1/2005

**Further Study on Dualling of Hiram's Highway
between Clear Water Bay Road and Marina Cove
and Improvement to Local Access to Ho Chung**



**Review of Environmental Study
Executive Summary
(Final)**

May 2011

MEINHARDT

**Highways Department
Works Division
The Government of the Hong Kong Special Administrative Region**

Agreement No. WD 1/2005

**Further Study on Dualling of Hiram's Highway
between Clear Water Bay Road and Marina Cove
and Improvement to Local Access to Ho Chung**

**Review of Environmental Study
Executive Summary
(Final)**

Meinhardt Infrastructure and Environment Ltd

Sub-Consultants:
MVA Hong Kong Ltd.
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Initiatives Landscape Architects
Archaeological Assessments Ltd

Document Rev: 0
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Document Ref.: 91022/044

Prepared By:  Date: 27 May 2011

(Billy Fan)

Checked By:  Date: 30 May 2011

(Helen Cochrane)

Approved By:  Date: 31 May 2011

(K W Lee)

3 APPROACH TO ASSESSMENT

- 3.1 The future improved Hiram's Highway will be classified as a "Rural Road" and while there will be a bridge crossing the Ho Chung River, the length of crossing between abutments is only about 43m.
- 3.2 As part of the Project, the foundation of the existing bridge crossing the Ho Chung River will be removed to restore the riverbed to its natural condition. The removal works do not require any dredging, and it is considered that the Project should not be a Designated Project under the EIAO. However, the Technical Memorandum on the Environmental Impact Assessment Process (EIA-TM) issued under the EIAO has been referenced in the preparation of this report.
- 3.3 The purpose of this report is to review and update the findings of the Environmental Study Report (ESR) (Babtie BMT Harris & Sutherland - 1999) prepared under the Agreement No. CE 25/97, which assessed the potential environmental impacts of the proposed project and recommended mitigation measures to minimise the anticipated impacts. Under this report, the status of existing environmentally sensitive receivers has been reviewed with respect

to the latest proposed alignment and new environmentally sensitive receivers have been considered as appropriate. The proposed mitigation measures have also been reviewed with respect to the latest standard, guidelines and industrial practice.

4 ENVIRONMENTAL REVIEW FINDINGS

Air Quality

- 4.1 A review of the previous study has been undertaken and after comparison with the current proposals, it has been concluded that there have been no significant changes to the factors affecting construction phase air quality (dust) impacts. The additional section of road to Pak Wai with provision of roundabout at the northern end was not assessed in the ESR and the construction programme is changed also, as such, reassessment of the construction phase air quality impacts for the Project have been undertaken. However, with the implementation of suitable mitigation measures, the conclusion that no significant residual impacts would occur remains valid.
- 4.2 In terms of operational phase impacts, computer modelling was undertaken and the results showed that concentrations of Respirable Suspended Particulates (RSP) and Nitrogen Dioxide (NO₂) are both predicted to be well within the Air Quality Objectives and therefore, no mitigation measures are required and no adverse residual impacts are predicted.

Noise

- 4.3 Since there have been changes to the construction programme, the usage of the powered mechanical equipment and an extension to the road layout, the

construction noise impacts have been reassessed. Recommended noise mitigation measures include reduction of quantity of PME, usage of quiet equipment and application of mobile noise barriers where applicable. Impacts can be reduced to acceptable levels at all representative NSRs, except for the Che Kung Temple in Ho Chung, a residential development in Luk Mei Tsuen and a residential development in Hiram's Villa which, due to the constraints on the use of a temporary barrier, will be subject to residual impacts ranging from 2-4 dB(A) for a period of approximately 5-6 months, 2-4dB(A) for a period of a month and 2 dB(A) for a period of 2 months respectively.

- 4.4 The main noise source during the operational phase will be the road traffic. The results of the operational noise modelling for the revised road layout indicate that some of the existing and future noise sensitive receivers (NSRs) will be affected by operational noise to levels above the noise criteria.
- 4.5 While noise source mitigation is preferred, given that the Project involves improving an existing road it is not possible to move the road alignment further away from the affected NSRs. Also due to the low predicted free flow traffic speed, the road gradients and the presence of a number of ingress and egress points, applying noise reducing surface materials would not be effective.
- 4.6 A noise protection scheme featuring a series of 18 noise barriers, both plain and cantilevered, of between 2.5m to 5m high has been proposed. The locations of these barriers are shown on **Figure 3** and **Figure 4**. The recommendation of these barriers is consistent with the findings of the previous assessment with the exception of previously recommended

noise barriers at Ta Ku Ling San Tsuen and adjacent to the previous alignment of the proposed access road linking Hiram's Highway to Ho Chung Road which are now not required.

- 4.7 Installation of noise barriers will significantly reduce the predicted noise levels at many of the NSRs. However, there are still some NSRs which are predicted to be exposed to noise levels that exceed the allowable criteria even after installation of barriers. In most of these cases the noise levels in excess of the criteria are caused by traffic on existing roads, which will not be modified as part of this project and these properties are not eligible for indirect technical remedies.

Ecology

- 4.8 The primary direct ecological impact of the Project would be the loss of a small section of relatively low value roadside woodlands. The only protected species affected by the Project is *Michelia alba*, with two of the affected individuals allocated for transplantation and two individuals needing to be felled. Under the revised design, the two old roadside trees *Ficus microcarpa* near to Marina Cove would be preserved, as would one old roadside tree *Ficus elastica* near Pak Wai. All other affected species are common and widespread species and compensatory planting will be implemented to mitigate the unavoidable tree loss.
- 4.9 The coastal mudflat and mangroves and associated species (especially seagrass and birds) downstream of Ho Chung River are the most important ecological sensitive receivers in the area. They are, however, located outside of the Project area and direct impacts to them are not anticipated. Significant indirect impacts via water quality deterioration are also not expected

with good construction site management and control of surface run-off.

- 4.10 Overall, impacts arising during the construction phase will be short-term in nature and would not affect important ecological sensitive receivers. The operation of the Project is of similar nature to the existing road network and will not introduce new types of impacts to existing ecological sensitive receivers. Thus, unacceptable adverse ecological impacts are not anticipated.

Landscape and Visual

- 4.11 The Project has changed the scale of the roads, with traffic speeds and volumes increased, and settlements in the area. The existing section of Hiram's Highway is characterised by small scale strip development and acting as a focus for the adjacent areas, with shopping, community meeting points and property access directly on the road.
- 4.12 The only area likely to carry long term 'significant residual impacts' are the road users and pedestrians on Hiram's Highway inside the road corridor isolated by noise barriers, central reserve and wide carriageway suffering loss of the sense of surrounding landscape character.
- 4.13 Moderate/significant residual visual impacts are expected for the users and residents of the area, which have a direct eastern aspect and will look directly towards the noise barrier on the new carriageway. Land constraints restrict mitigation measures and there is no room for screen planting either side of the barrier.
- 4.14 Opportunity for beneficial landscape impact may be available by improving the outlook of the area with significant off-roadside tree planting at the new access

road to Luk Mei Tsuen. Residents of Ho Chung and Luk Mei Tsuen, road users on Ho Chung Road and workers at ATV Studios may be benefited in long term should the mitigation be implemented.

- 4.15 Recognising both significant and beneficial impacts are envisaged in the landscape & visual assessment and the uncertainty of the extent of mitigation measures and the beneficial impacts, the conclusions of the landscape & visual assessment for the Project is currently undetermined. It is recommended for further study. The detailed design of the noise barriers including the colour scheme should be given due consideration to soften the hard features.

Cultural Heritage and Archaeology

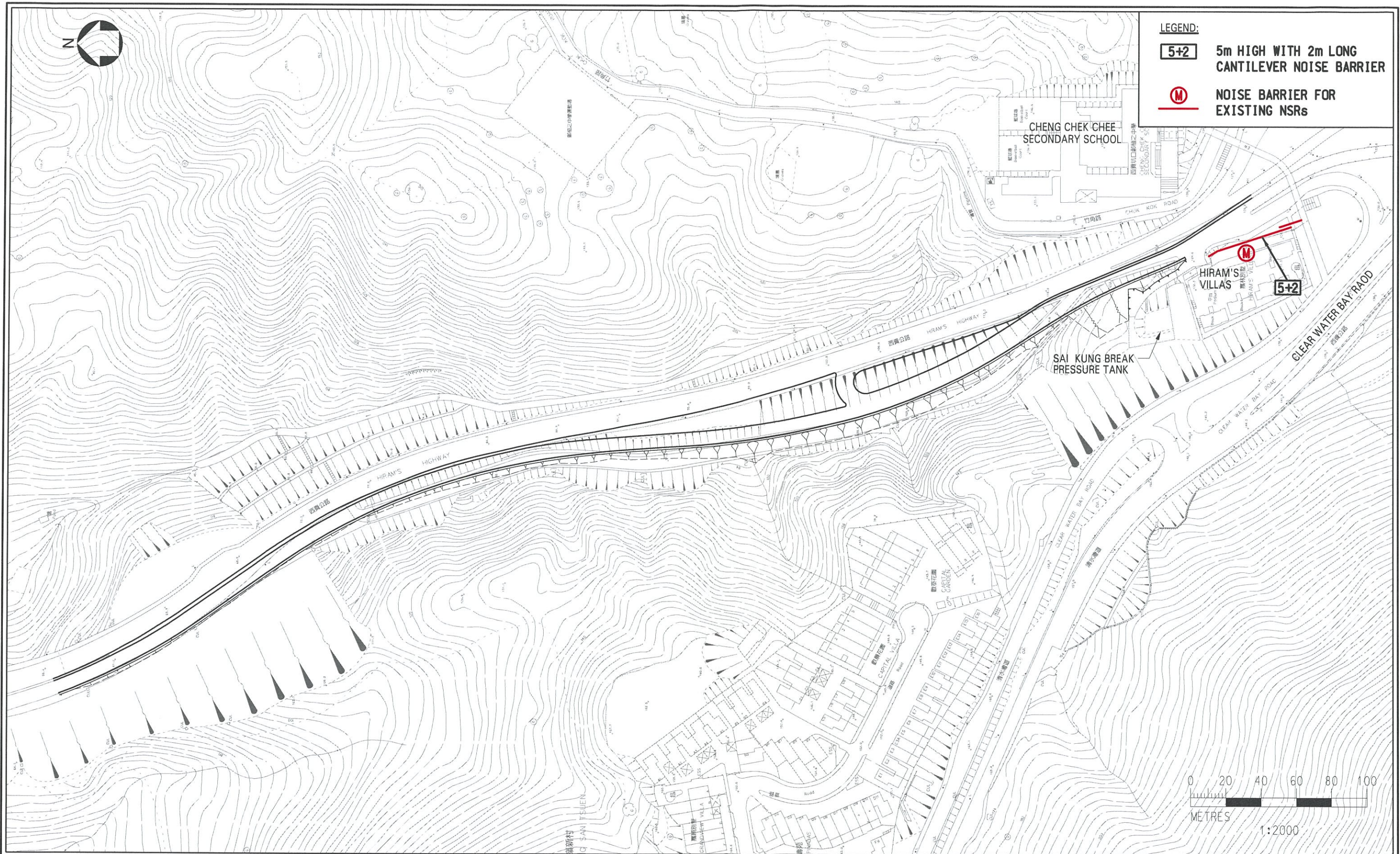
- 4.16 For the Marina Cove section of the Project, three built heritage resources and one grave were identified during the survey. The built heritage resources comprise a small roadside shrine, an associated Second Earth God Shrine and the stone marker near Nam Pin Wai Roundabout. The grave was found to belong to a member of the Lok clan, originally dating to the Late Qing Dynasty. A commemorative stone tablet was also identified near the Second Earth God Shrine.
- 4.17 At Ho Chung Road, the majority of the recorded resources were located in the village of Ho Chung outside the 50m zone of the study area. The recorded structures in Ho Chung village consisted of an abandoned school building, five residential structures, one storage shed and the Ancestral Hall of the Chan Family.
- 4.18 Four other resources were recorded as part of the survey, the Higher Earth God Shrine on Ho Chung Road, a Saints

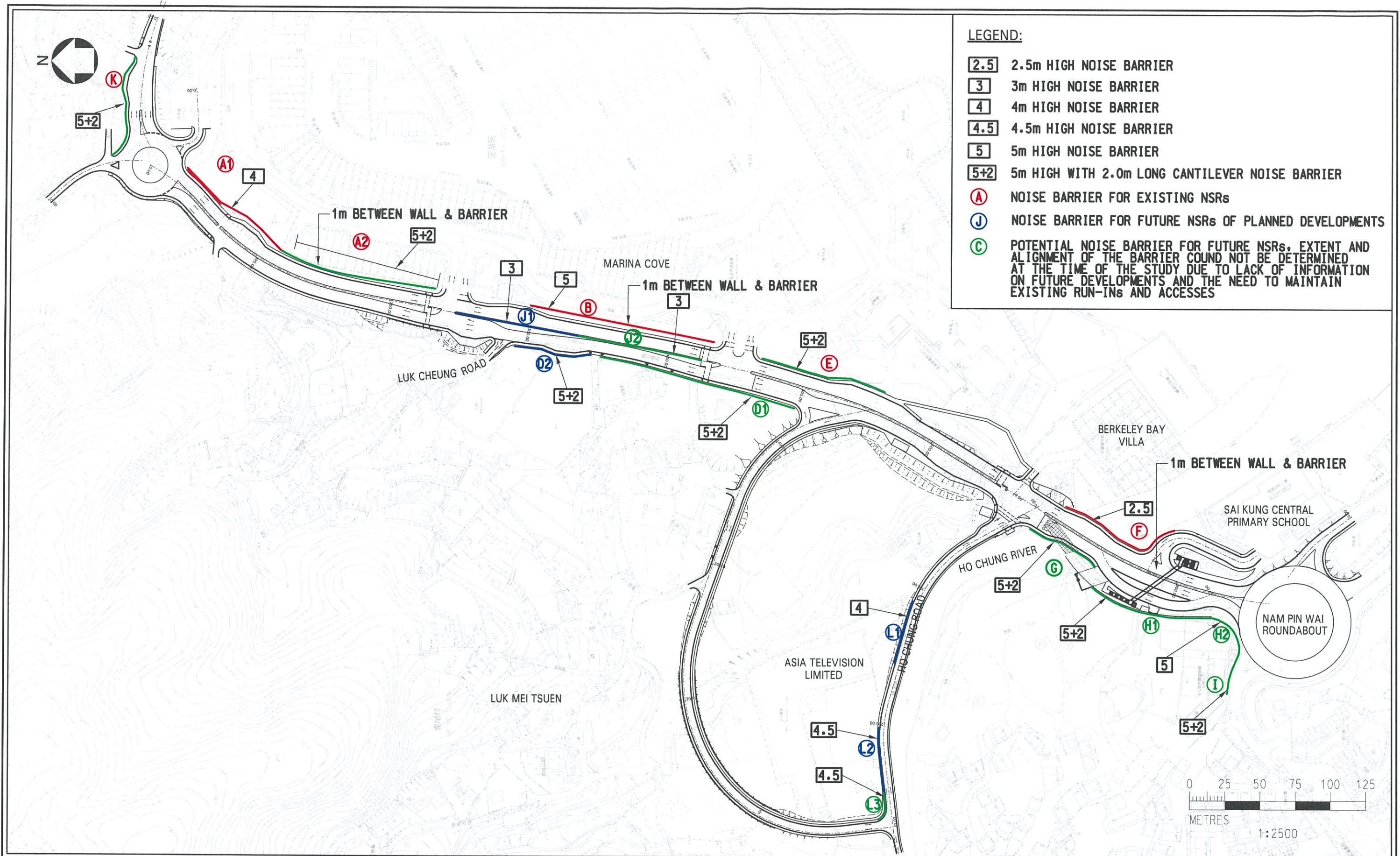
- Shrine, the Tai Yuen Shui Temple and shrine in Luk Mei Tsuen. The extended section of the alignment to Pak Wai did not encroach within the village of Pak Wai and the only recorded resource in this area was a stone marker at the roadside. One further grave was also identified but found to be in poor condition dating from the Late Ming Period.
- 4.19 No insurmountable direct or adverse impacts are predicted during either the construction or operational phases of the Project on the majority of these resources. However, there will be direct impacts on five identified resources, Earth God Shrine, Higher Earth God Shrine, the two stone markers and the commemorative stone table. Some construction phase mitigation measures are recommended for the affected resources.
- 4.20 For the Earth God Shrine on Hiram's Highway, the Higher Earth God Shrine along Ho Chung Road, it is recommended that the shrines be relocated, as the shrines are a privately owned structures, the method of relocation and new locations must be agreed by the owners. It is also recommended that the shrines be preserved by record (through full cartographic and photographic survey) which should be undertaken prior to the removal of the shrine from its existing location.
- 4.21 For the two stone markers and the commemorative stone tablet, it is recommended that these are to be removed prior to the commencement of the construction works and reinstated in locations as close to their location as far as possible at the end of the construction phase.
- 5 ENVIRONMENTAL MONITORING AND AUDIT (EM&A)**
- 5.1 The EM&A on landscape & visual aspect has been recommended to be conducted during design phase.
- 5.2 EM&A for dust, noise, cultural heritage and landscape & visual aspects have been recommended during the construction phase in order to ensure that all proposed mitigation measures are implemented and effective. The previously recommended implementation audits of the mitigation measures and compliance audits against legislative requirements and standards are again recommended.
- 5.3 EM&A for noise in terms of the operational performance of the noise barriers and landscape & visual in terms of the compensatory planting establishment has also been recommended.
- 6 OVERALL CONCLUSIONS**
- 6.1 The road alignment has been optimised to minimise environmental impacts where possible. Also, a comprehensive list of mitigation measures has been recommended to reduce the residual impacts.
- 6.2 With adoption of these mitigation measures, although there will be some residual construction noise impacts to Che Kung Temple in Ho Chung and a residential development in Luk Mei Tsuen and the Landscape & Visual impact is currently undetermined, overall, the Project will not result in any unacceptable residual environmental impacts.

FIGURES

Agreement No. WD 1/2005

**Further Study on Dualling of Hiram's
Highway between Clear Water Bay Road and
Marina Cove and Improvement to Local
Access to Ho Chung**







路政署
Highways Department

MEINHARDT
Meinhardt Infrastructure and Environment Ltd
邁進基建環保工程顧問有限公司



Agreement No. CE 49/2011 (HY)
Dualling of Hiram's Highway between Clear Water Bay Road
and Marina Cove and Improvement to Local Access to Ho
Chung – Design and Construction

Engineering Review Report (Final)

June 2015



3 PRELIMINARY ENVIRONMENTAL REVIEW

3.1 Background

- 3.1.1.1 This section reviews the available existing information including the findings, conclusions and recommendations from the Further Study on Dualling of Hiram's Highway between Clear Water Bay Road and Marina Cove and Improvement to Local Access to Ho Chung (Further Study), with particular focus on the report "Review of the Environmental Study" (FS-RES).
- 3.1.1.2 After completion of the FS-RES during the Further Study, the proposed road alignment for the road section between the northern entrance of Marina Cove and Pak Wai has been slightly shifted westward (by up to 4m) to allow a wider separation between the carriageway and existing houses in Marina Cove. As a result, the FS-RES did not include this shift of the road alignment.
- 3.1.1.3 In addition, requests from the Incorporated Owners of Hiram's Villas were received and in response, Noise Barrier M has been moved to the central reserve outside Hiram's Villas and additional noise mitigation measures at Hiram's Villas including an earth bund on the western side of the left fork of the south bound carriageway of Hiram's Highway and low noise road surfacing outside Cheng Chek Chee Secondary School (CCCCSS) has been included.
- 3.1.1.4 A Speed Arrester Bed was proposed by Transport Department (TD) in 2008 subsequent to a fatal accident at Nam Pin Wai Roundabout on 1 May 2008. Also, the Ho Chung Bridge could possibly be designed an arch bridge with shallower bridge deck as an alternative option. These changes were, also, not included in the FS-RES.
- 3.1.1.5 The main purpose of this section of this Review Report is to undertake an environmental assessment of the potential environmental impacts of the proposed changes detailed above , which involve the following:
- (a) Base Scheme – Revision of the noise mitigation measures near Hiram's Villas and revision of Alignment near Marina Cove, which is introduced in **Section 2.2** and shown in **Figure 2.1** to **Figure 2.10**;
 - (b) Works Item A) – the installation of a speed arrester bed (SAB), which is introduced in Section 2.3 above, shown in plan in **Figure 2.11**, and described below along with the main aspects of its construction methodology; and
 - (c) Works Item B) – the change in structural form to the Ho Chung Bridge, which is introduced in Section 2.4 above, shown in **Figure 2.12** and described below along with the main aspects of its construction methodology.

3.2 Base Scheme

3.2.1 Background

- 3.2.1.1 The noise protection measures for the Base Scheme alignment in the form of noise barriers are shown in **Figures 3.1.1** and **3.1.2**. The noise barriers are labelled alphabetically as shown in these figures.
- 3.2.1.2 In April 2009, Incorporated Owners of Hiram's Villa expressed their concern of the increased traffic noise impact due to the project and requested to have a noise barrier at a meeting with HyD. Although the traffic noise impact assessment has concluded that the project has no significant contribution to the traffic noise impact at Hiram's Villa, HyD decided to provide an extra noise barrier at Hiram's Villa. The original Noise Barrier M was therefore proposed to be located on the western side of Hiram's Highway adjacent to Hiram's Villas and gazetted in March 2010. The barrier in this location has been assessed in the FS-RES. However, while the barrier was able to effectively mitigate the traffic noise impact from Hiram's Villa, the noise barrier also cause inconvenience to the access of the residents and therefore subsequent request from the Incorporated Owners of Hiram's Villas has been received. After discussion, the Noise Barrier M has been reduced in height and relocated to the central reserve. The proposed new Noise Barrier M is now 134m long and 3m high, compared to the previously proposed 63m long and 5m high with 2m cantilever and the revised location is shown in **Figure 3.1.1**.
- 3.2.1.3 In addition, an earth bund is proposed to be situated on the western side of the left fork of the south bound carriageway of Hiram's Highway and its location is also shown in **Figure 3.1.1**. The proposed earth bund is 56.8m long and 3m high. Both mitigation measures have been included in the noise remodelling exercise in this Review Report.
- 3.2.1.4 At Marina Cove, with respect to comments from the residents, the alignment has been shifted up to 4m westwards and away from the development. The respective central dividers and noise barriers are, also, shifted to cater for the revision. The revised road alignment and, hence, the traffic noise sources in the operational phase, along with revised mitigation measures, have been included in the operational noise remodelling exercise in this Review Report.
- 3.2.1.5 Assessments for other environmental aspects are discussed qualitatively in this Review Report due to the relative minor impact induced by the revision.

3.2.2 Works Item A) Addition of Speed Arrester Bed

- 3.2.2.1 The proposed SAB runs in a north-west to south-east direction adjacent to the main road in the Hiram's Villas section of Hiram's Highway. It is 270m in length and 12m wide for most of its length but with a small 4m wide access ramp at the northern end. The SAB therefore has a plan area / footprint of approximately 3,260m². Its main features are an entrance road (about 130m long), a service road (3m wide), the gravel bed (about 110m long and 5m wide) a footpath (4m wide)

and the access ramp (4m wide). The service road and the footpath run the full length of the arrester bed part of the facility.

3.2.2.2 The proposed works area for construction of the SAB extends beyond the proposed permanent footprint boundary of the SAB. At the western edge of the footprint the works area run along the boundary of the nearby Conservation Area (CA).

3.2.2.3 The main items for the construction method and the associated construction plant / equipment in brackets for the SAB are as follows:

- Vegetation and all unsuitable foundation / fill material will be removed from the works area (Excavator, bulldozer, breaker, lorry, dumper, dump truck, drill, crane, cutter, jig-saw, rock drill and winch);
- Material from the slope cutting area will be temporarily piled within the works area until a permanent concrete retaining structure can be installed (Piling plant, breaker, excavator, dumper, dump truck and crane);
- Strip foundation for the reinforced earth wall will be constructed using in-situ concreting before pre-cast concrete facing panel units are placed in successive courses (Excavator, roller, compactor, bar bender and cutter, concrete mixer, concrete pump, poker, generator, grout mixer, grout pump, power ramper);
- Suitable fill material will be deposited, spread, levelled and compacted in layers in between steel / polymeric reinforcing elements which will be tied with facing panel units (Dumper, dump truck, drill, roller and bulldozer);
- Pre-cast concrete coping blocks with railings will be installed on top of facing panel units (Lorry, winch, concrete mixer and pump, grout mixer and pump);
- In-situ reinforced concrete will be used to form the service road, footpath and the base of the gravel bed (Lorry, concrete mixer and pump, bar bender and cutter, saw (concrete), drill, grout mixer and pump);
- Clean, rounded, uncrushed hard gravel or artificial lightweight aggregate of no less than 10mm BS Sieve size will be used to fill the gravel bed which varies in depth by between 100 - 450mm (Lorry, dumper and dump truck);
- Miscellaneous items include: landscaping, road marking, tie into existing carriageway (Lorry, road planer or miller, road roller and paint line marker); and
- A road sweeper, air compressor and generator to be used throughout duration of the construction works.

3.2.2.4 The addition of the SAB will potentially induce environmental impacts associated with dust and noise during construction phase, in addition to other aspects. These are discussed qualitatively in this Review Report due to the relative minor impacts induced by this works item.

3.2.3 Works Item B) Changes to Ho Chung Bridge

- 3.2.3.1 The previously proposed concrete road bridge would have involved an increase in height of the bridge deck by about 1.5m with associated rising of the approach roads. It is now proposed that the new Ho Chung Bridge could be designed as a steel arch bridge with a shallower bridge deck. This would enable the level of the bridge deck and connection approach roads to be maintained at a similar level (approximately 250mm higher) to the existing road / bridge deck.
- 3.2.3.2 It is anticipated that key aspects for the previous replacement bridge proposed during the Further Study will be the same for the proposed new bridge, including:
- The construction method and construction equipment will remain essentially unchanged;
 - Pre-made elements of the bridge would be transported to the site; and
 - There would be no pier supports / structures placed in the Ho Chung River.
- 3.2.3.3 The potential environmental implications of the proposed bridge are expected to be limited to changes in visual impacts and operational noise. Hence, the traffic noise sources in the operational phase, along with revised mitigation measures in the **Base Scheme**, are all included in the operational noise remodelling exercise in this Review Report.
- 3.2.3.4 The other environmental impacts induced by this works item are also discussed qualitatively in this Review Report due to the relative minor impacts induced by this works item.

3.2.4 Environmental Legislation, Standards and Guidelines

- 3.2.4.1 Designated Projects are projects or proposals that may have an adverse impact on the environment and are subjected to the control of an Environmental Permit in addition to other relevant regulations, such as the Air Pollution Control Ordinance. It is thus important to determine the nature of the project in order to determine the applicable legislative control.
- 3.2.4.2 The status of the Hiram's Highway Improvement Stage 1 Project was previously confirmed in the FS-RES as not being a Designated Project under the Environmental Impact Assessment Ordinance (EIAO). It was not therefore necessary for the project to follow the statutory EIA process, but to be assessed in accordance with ETWB TCW No. 13/2003.
- 3.2.4.3 The works for this project are outlined in Section 3.1 of this Review Report and by the nature of the proposed works, the changes included in the Base Scheme (alignment section of about 164m in length slightly shifted westward by up to 4m near Marina Cove) and addition of the SAB (with a total length of 270m) are not major extensions or improvements to the existing roads (Items A.1, Part 1 of Schedule 2 of the EIAO) and thus are, also, not considered to be a Designated

Project under the Environmental Impact Assessment Ordinance (EIAO). As confirmed with Transport Department, the future improved Hiram's Highway will be classified as "Rural Road".

- 3.2.4.4 The length of the Ho Chung River bridge crossing is only just over 50m. Thus, both Items A.1 and A.8, Part 1 of Schedule 2 of the EIAO are not applicable. As part of the project, the foundation / supports (pad footings standing on the river bed) of the existing bridge crossing of the Ho Chung River will be removed and this is not dredging by nature, Item C.12, Part 1 of Schedule 2 of the EIAO is also not considered to be applicable.
- 3.2.4.5 The project is therefore not considered to be a Designated Project and the EIAO is not applicable although the Technical Memorandum on the Environmental Impact Assessment Process (EIA-TM) issued under the EIAO has provided useful reference for this Review Report.
- 3.2.4.6 The following Sections review the air quality, noise, ecology, landscape and visual, cultural heritage and the environmental monitoring and audit (EM&A) requirements of the revised road alignment discussed in **Section 2**.

3.3 Air Quality

3.3.1 Base Scheme

Construction Phase

- 3.3.1.1 The existing air quality in the area is influenced by emissions from vehicles using the road network, particularly Hiram's Highway. In addition there are occasional additional emissions from construction activities, which are temporary in nature.
- 3.3.1.2 In the FS-RES, the air quality study predicted that the concentrations of TSP at all of the representative air sensitive receivers (ASRs) during the construction phase would be within the TSP criteria except for one residential ASR (Luk Mei Village) where the criteria would be exceeded. Watering twice per day in the vicinity of the ASR was recommended as a mitigation measure and this was predicted to reduce the TSP levels to within the appropriate criteria. In addition detailed dust suppression mitigation measures, under categories of good house-keeping, provision of covers for dust sources and watering of site areas and activities were recommended in the FS-RES and these are reproduced in **Appendix 3.2.1**.
- 3.3.1.3 The alignment shift of approximately up to 4m to the road section near Pak Wai would result in any dust emission sources moving slightly further away from the residential receivers near Marina Cove and slightly closer to receivers to the west, such as Luk Mei Village. However, considering the separation distance between Luk Mei Village and the alignment, this would not significantly affect the predicted air pollution levels in this area.
- 3.3.1.4 In order to monitor the TSP concentrations at selected ASRs and to verify the implementation and effectiveness of the mitigation measures during the

construction phase, an EM&A programme was recommended in the FS-RES. Based on the highest mitigated hourly TSP concentrations obtained in the FE-RES, the ASRs where monitoring was recommended (with their predicted hourly TSP levels in brackets) are:

- Marina Cove (277 $\mu\text{g}/\text{m}^3$);
- Luk Mei Village (472 $\mu\text{g}/\text{m}^3$);
- Hiram's Villas (201 $\mu\text{g}/\text{m}^3$); and
- CCCSS (195 $\mu\text{g}/\text{m}^3$).

3.3.1.5 As recommended in the FS-RES, watering at a frequency of twice per day would be sufficient to reduce the TSP levels to within the appropriate criteria. Should exceedances are observed during the construction phase, the watering frequency could be increased to further mitigate the dust emissions. Hence, it is considered that the conclusions drawn in the FS-RES, that no adverse impacts would occur at the nearby ASRs, would remain valid.

Operational Phase

3.3.1.6 The FS-RES predicted that the concentrations of RSP and NO_2 at the representative ASRs during the operation phase would all be well within the AQO Standards so no impacts were anticipated and no mitigation measures were proposed. Consequently no EM&A requirements for operational air quality were required.

3.3.1.7 The alignment shift of approximately up to 4m to the road section near Pak Wai would move the air pollution sources slightly further away from the residential receivers near Marina Cove and slightly closer to receivers to the west, such as Luk Mei Village. However, this would not significantly affect the predicted air pollution levels in this area.

3.3.1.8 No significant change in the predicted impacts is anticipated and any effect of the alignment shift for construction would be detected by the construction stage EM&A programme which is recommended and for the operational stage the predicted impacts were well within the criteria.

3.3.2 Work Item A) Addition of Speed Arrester Bed

3.3.2.1 A description of the dimensions, main features and elements of the Speed Arrester Bed (SAB) are given in Section 3.1.3 above

Air Sensitive Receivers

3.3.2.2 The ASRs within 500m of the SAB construction area are listed in **Table 3.2.1** and below and shown in **Figure 3.2.1**.

Table 3.3.1 ASRs near to the Speed Arrester Bed

ASR ID	Description	Type	Nearest Horizontal Distance from SAB (m)
Existing ASRs			
CCC3	Cheng Chek Chee Secondary School	School	500
F5	Factory	Factory	394
HEC2	Heung Chung Village	Residential	264
NW3	Nam Wai Village	Residential	144
TK1	Ta Ku Ling San Tsuen	Residential	273
TK2		Residential	346
TK3		Residential	374
TK4		Residential	404
TK5		Residential	402
TK6		Residential	314
WM3	Wo Mei Village	Residential	229
WM5		Residential	96
WM6		Residential	92
Future ASRs			
PE1	Wo Mei Village	Residential	396

Construction Stage

- 3.3.2.3 The construction of the SAB would involve a number of activities with the potential to create dust emissions. These include, clearance of vegetation and unsuitable surface materials, cutting of the slope in preparation for a retaining structure, in-situ concreting, placement and spreading of fill materials, import of concrete blocks, in-situ concreting of the base of the gravel bed, the footpath and the service road and import and placing of the gravel in the gravel bed.
- 3.3.2.4 The construction area for the SAB is small and the duration of construction is estimated to only be about 3 months. In addition, the above activities will all be undertaken sequentially, with only one activity type being undertaken at any one time.
- 3.3.2.5 As can be seen from **Table 3.2.1** the nearest ASRs are Wo Mei Village and Nam Wei Village for which the nearest parts of the villages are 92m and 144m respectively from the SAB construction boundary. All of the other ASRs are over 200m from the works.
- 3.3.2.6 The predicted dust impact levels from similar construction activities in the FS-RES for ASRs with much smaller separation distances from the dust sources were found to be acceptable with standard mitigation measures applied. Therefore, it is anticipated that the construction activities for the SAB, with the same mitigation measures applied with larger separation distances, would, therefore, also be acceptable.

3.3.2.7 The recommended mitigation measures for dust suppression for the SAB are good house-keeping measure, provision of covers for dust sources and watering of site areas and activities and these detailed in **Appendix 3.2.1**.

3.3.2.8 It is considered that the proposed mitigation measures will control potential dust impacts from the SAB. It is recommended that the EM&A programme should be extended to include dust monitoring stations at Wo Mei Village and Nam Wei Village – see **Table 3.2.1**) for the approximately 3 month duration of the SAB construction works.

Operational Stage

3.3.2.9 The SAB is a safety feature for the steep part of the road near Hiram's Villas and would normally only be utilised in emergency situations to stop vehicles with break failure or similar problems. As such it is expected to be only used occasionally and there would not be any significant operational air quality impacts anticipated.

3.3.3 Work Item B) Potential Change of Structural Form of Ho Chung Bridge

Construction and Operational Phases

3.3.3.1 It is understood that the construction method, equipment and process will not change from that detailed in the FS-RES. Also, the alignment and orientation of the Ho Chung Bridge will remain unchanged in this proposed scheme. Hence, no additional air quality impacts would be anticipated for the construction and operation of the new bridge structure.

3.3.4 Environmental Monitoring and Auditing

Construction Phase

3.3.4.1 An EM&A programme was recommended in the FS-RES during the construction phase in order to monitor the TSP concentrations at selected ASRs and to verify the implementation and effectiveness of the mitigation measures. Following locations were assigned in the FS-RES to be the dust monitoring locations:

- (a) MC2 (Marina Cove);
- (b) LA7 (Luk Mei Village)
- (c) HV (Hiram's Villa); and
- (d) CCC2 (Cheung Chek Chee Secondary School)

3.3.4.2 It is considered that the proposed mitigation measures will control potential dust impacts from the newly proposed SAB. However, in order to verify the predicted result, the EM&A programme is recommended to be expanded to include Wo Mei Village and Nam Wai Village as additional dust monitoring stations for the approximately 3 month duration of the SAB construction works.

3.3.4.3 Hence, the dust monitoring locations proposed after inclusion of the 3 revisions are listed as follows:

- (a) MC2 (Marina Cove);
- (b) LA7 (Luk Mei Village)
- (c) NW3 (Nam Wai Village);
- (d) WM5 (Wo Mei Village)
- (e) HV (Hiram's Villa); and
- (f) CCC2 (Cheng Chek Chee Secondary School).

3.3.4.4 As no adverse residual impacts are predicted during the operational phase no EM&A is considered to be required and none is proposed.

3.4 Noise

3.4.1 Base Scheme

Construction Phase

3.4.1.1 The prevailing noise environment in the vicinity of the proposed project is dominated by the noise from the road traffic on Hiram's Highway. The existing NSRs located close to and facing Hiram's Highway are being exposed to noise levels of up to 80 dB(A). In addition there are occasional additional noise emissions from various construction activities, which are temporary in nature.

3.4.1.2 The construction activities for the Base Scheme involve the road improvement scheme, the construction of a retaining wall to replace a cut slope on the Sai Kung bound carriageway near Ho Chung / opposite Marina Cove and the erection of permanent noise barriers to mitigate the operational traffic noise.

3.4.1.3 In the FS-RES, the predicted maximum unmitigated noise levels for most of the NSRs will exceed the day-time noise criteria of 75 dB(A) for the residential developments and 70 dB(A) for the schools and temple during the construction activities. Some examples of the NSRs which would be significantly affected without mitigation are at Pak Wai Village, Marina Cove in Ho Chung, Luk Mei Village, Ho Chung Village and Hiram's Villas. Based on these results noise mitigation measures were required in a number of locations to reduce the predicted noise impacts to acceptable levels.

3.4.1.4 The main concern during the construction phase will be the operation of Powered Mechanical Equipment (PME). Mitigation measures were identified to reduce the noise to acceptable levels, including:

- Adoption of quieter PME;

- A reduced number of construction Plant / quieter PME;
- Limited concurrent use of the quieter PME; and
- Use of temporary / portable noise barriers to screen the noise and view to the construction activities and equipment for the NSRs.

3.4.1.5 With the adoption of the above mitigation measures only a few of the representative NSRs were predicted to suffer from residual noise impacts due to the proximity of the works to the NSRs during the construction phase. These are:

- CCCSS due to its elevated position and the impracticality of erecting a screening barrier of over 5m in height. The noise exceedance (4 dB(A)) would only occur during examination periods and the Contractor was recommended to plan the construction programme to avoid carrying out all construction activities, except concreting, within a distance of 75m during the examination period. On this basis there would be no residual impacts;
- Part of Luk Mei Village (NSR LA7) due to its proximity to the works, such that it is not practical to screen works within 14m but can be screened for works at a greater distance. It was recommended that the Contractor should use the quiet PME within 14m of the NSR LA7 and this would reduce the residual impacts to between 2-6 dB(A) for a period of one month;
- Pak Wai Village, Ho Chung Village and Hiram's Villas due to their proximity to the works. It was recommended that the Contractor should use quiet PMEs as much as possible to reduce the residual impacts at the NSRs. Also, if the proposed permanent noise barrier M could be constructed at an early stage this could also screen the other construction noise;
- Che Kung Temple due to its proximity to the works, such that it was not practical to screen works within 20m but it can be screened for works at a greater distance and it would be subject to residual impacts of 2-4 dB(A) for a period of 5-6 months where the works were to be carried out within 30m from the Temple; and
- Marina Cove due to the proximity of the works and limited space between the proposed barriers and the boundary wall of Marina Cove.

3.4.1.6 In order to further control the noise level, a list of good site practices were, also, recommended for the construction phase.

3.4.1.7 The road alignment of the Base Scheme has been shifted westward by approximately up to 4m near Pak Wai compared to the scheme assessed in the FS-RES.

3.4.1.8 The noise sources from the construction works would, therefore, move further away from the nearest NSR, that is, Marina Cove (NSR - MC1). Thus, the predicted noise levels at this NSR would be slightly lower than previously

predicted in FS-RES and as this is the nearest NSR to the road works (both before and after the alignment shift), no additional adverse noise impacts to this area are anticipated. However, the shift of the alignment would result in the construction works being closer to Luk Mei Village, especially NSR LA7. However, the previous assessment has concluded that all works within 14m of the NSR would require further mitigation measures including quieter PME and thus, although there is a potential for an extension to the period of residual impacts, the conclusions would remain the same as in the FS-RES.

- 3.4.1.9 In addition to the alignment shift the noise barrier, Barrier M would be relocated from the western roadside of Hiram's Highway in front of Hiram's Villas to the central reserve of the road. It is estimated that the duration of the construction period for the barrier would be about one month.
- 3.4.1.10 The nearest NSRs to Noise Barrier M are CCCSS and Hiram's Villas, which would potentially be impacted by this change to the works location. As concluded in the FS-RES noise assessment, NSR CCCSS would be subject to noise exceedances of 4dB(A) during examination periods only, while the noise level at Hiram's Villas were predicted to comply with the day-time noise criteria after implementing the mitigation measures.
- 3.4.1.11 Due to the proposed relocation of Barrier M, the noise sources from construction works would be moved further away from the residential receivers at Hiram's Villas but closer to CCCSS. Thus, there would be no additional adverse noise impact to Hiram's Villas. However, it should be noted the revised location of Noise Barrier M to the central reserve, represents a construction work site already assessed in the FS-RES. Hence, the noise levels of the PMEs to be used in the construction of Noise Barrier M would not exceed those to be generated for the construction of the central reserve itself, and based upon the fact that these works cannot be conducted concurrently, the predicted construction noise levels at CCCSS are expected to be similar to the assessed scenario in the FS-RES. It should also be noted that all of the sensitive rooms in CCCSS have already been fitted with double-glazing and, as such, are expected to be protected from the construction noise. In addition, it was recommended in the FS-RES that the contractor should avoid carrying out noisy construction activities within 75m from the school during the school day (and especially during the examination periods), that is, undertake the construction works, including the central reserve and Noise Barrier M, in the school holiday periods. On this basis, there would be no additional adverse noise impact at this school.
- 3.4.1.12 The NSRs (Hiram's Villas, Luk Mei Village (NSR LA7), Ho Chung Village and Che Kung Temple, Marina Cove and Pak Wai Village) would remain in close proximity of the alignment construction works and would still be predicted to exceed respective noise criteria when construction works are close to the NSRs. Proposed noise mitigation measures will remain the same as in the conclusions of the FS-RES, including use of quiet PMEs within 14m and use of noise barriers when practicable.

3.4.1.13 Hence, it was concluded that there would be no significant increase in the level of residual impacts with revised scheme provided that the identified mitigation measures were implemented.

3.4.1.14 In addition, no significant increase in the level of residual impacts is anticipated with the implementation of the Base Scheme. Hence, the conclusion drawn in the FS-RES would remain valid.

Environmental Monitoring and Audit (EM&A)

3.4.1.15 In order to verify the implementation and effectiveness of the mitigation measures, it was recommended that the following NSRs are monitored for noise impacts during the construction stage:

- Pak Wai Village;
- Marina Cove;
- Luk Mei Village (LA7);
- Che Kung Temple near Ho Chung Road; and
- Cheng Chek Chee Secondary School.

3.4.1.16 As the Base Scheme would not affect additional NSRs, no changes to these monitoring stations are proposed for the EM&A Programme in this Review Report

Operational Phase

Previous Traffic Noise Impact Model Assumption and Revised Barrier Details

3.4.1.17 Traffic noise impacts during the operational phase have been modelled in the FS-RES. The main noise source during operational phase was identified as the traffic on Hiram's Highway. Operational traffic forecasts and data were provided by a comprehensive Traffic Impact Assessment Study as part of the Further Study and the predicted traffic flows had been accepted by Transport Department. The tentative works programme for the project, as presented in the FS-RES, has been extended from 2010-2012 and the Design Year of 2027 (2012 + 15, i.e. 15 years after the completion of the project) was adopted for the environmental assessments. The construction programme has been revised and the commissioning year would be anticipated to be by 2021. The 15 years after commissioning would therefore be Year of 2036.

3.4.1.18 The traffic data for 2036 has been predicted in the traffic impact assessment (TIA) conducted for Agreement No. CE 36/2011 (HY) *Further Study and Preliminary Design for Improvement of Hiram's Highway from Marina Cove to Sai Kung Town – Investigation*. The scope of the TIA covers the road section from New Hiram's Highway to Tai Mong Tsai Road and has taken the updated planning assumptions into account. The TIA report has been subsequently accepted by Transport

Department on 8 August 2013. The “Environmental Study Report” for Stage 2 for the above captioned project submitted in October 2014 has adopted the traffic data for traffic noise assessment.

- 3.4.1.19 By comparing the traffic flows for 2027 and 2036 for the same road section of Hiram’s Highway between Nam Pin Wai Roundabout and junction that unions with Hiram’s Highway, midway between Hiram’s Villa and Nam Pin Wai, it is observed that the traffic flows in the “Review of Environmental Study” for the design year 2027 are higher than the updated 2036 traffic flows presented in the “Environmental Study Report” due to the updated planning assumptions adopted in the latter 2014 submission. A comparison of the traffic data for the relevant section of road section for 2027 from the “Review of Environmental Study” and for 2036 from the "Environmental Study Report" is presented in the **Table 3.4.1**.

Table 3.4.1: Comparison of Traffic Flows for Road Section Between Nam Pin Wai Roundabout and the Junction that Unions with Hiram’s Highway

	Traffic Flow (vehicle/hr)	
	Year 2027 (Review of Environmental Study)	Year 2036 (Environmental Study Report)
Northbound	2050	1560
Southbound	1600	1200
Total	3650	2760

- 3.4.1.20 Making reference to **Table 3.4.1**, traffic noise assessment including the predicted traffic noise levels based on the traffic data contained in the "Review of Environmental Study" assessment would in fact represent a worse situation than the traffic noise assessment using the updated traffic data under the "Environmental Study Report". Hence, the traffic data in the "Review of Environmental Study" has been used for the worst-case scenario.
- 3.4.1.21 Traffic flows of local access roads are low and have limited potential for traffic impact assessment and, therefore, were not included in the traffic noise model.
- 3.4.1.22 Due to limited availability of information on future development layout plans for zoned residential sites, a 10m setback from the boundary and angles of view of typical village buildings was generally assumed and applied for the future NSRs. The road speed of 50 kph for Hiram’s Highway was confirmed by Transport Department and assumed in the noise modelling.
- 3.4.1.23 The results of the operational noise modelling for the proposed road layout in the FS-RES indicated that some of the representative NSRs would be adversely affected by operational noise. Some examples of these include: Hing Keng Shek Village, Pak Wai Village, Marina Cove, Berkley Bay Villa, Luk Mei Village, Che Kung Temple, Kong Fu Garden and Hiram’s Villas as well as proposed future developments at Luk Mei Village, Nam Pin Wai Village and Ho Chung.

3.4.1.24 Hence, it was considered that mitigation measures would be required and a range of noise barriers were considered to screen the NSRs. A noise protection scheme featuring noise barriers of varying types and heights and at varying locations was formulated based on the identified NSRs in the FS-RES.

3.4.1.25 In this Review Report, the proposed noise protection scheme and noise barriers has been revised to cater for the shift of the alignment at Pak Wai and the relocation of Noise Barrier M at Hiram's Villas. A request from the Incorporated Owners of Hiram's Villas was received after the release of the FS-RES and in order to address their request, Noise Barrier M has been relocated, as shown on **Figure 3.1.1**.

3.4.1.26 The revised noise protection scheme is shown in **Figures 3.1.1 and 3.1.2** and the details of the noise barriers are given in **Table 3.4.2** below.

Table 3.4.2: Proposed Noise Barriers in Base Scheme

Location	Barrier Type	ID in Fig. 3.1.1 & Fig. 3.1.2	Length (m)	Target of Protection (NSR)	Constraints
Proposed Noise Barriers for Protection of Existing NSRs					
East of Hiram's Highway (at grade)	4m high vertical noise barrier	A1	90	Marina Cove (MC)	The barrier has been extended to the North as far as possible and any further extension in length is not possible due to the presence of the junction of the Pak Wai Car Park Access and the roundabout at Pak Wai. As the proposed barrier is sufficient to protect all the existing NSRs to below 70dB(A), further increase to its height is not required.
East of Hiram's Highway (at grade)	5m high with 2.0m long cantilever noise barrier	A2	95	Marina Cove (MC)	The barrier is abutting barrier A1 at the North. The barrier cannot be further extended to the South because of the junction to Marina Cove. As the proposed barrier is sufficient to protect all the existing NSRs to below 70dB(A), further increase to its height is not required.
East of Hiram's Highway (at grade)	5m high vertical noise barrier	B	135	Marina Cove (MC)	The barrier cannot be extended to the South due to the presence of a junction to Marina Cove. In the North, as the currently proposed barrier is sufficient to protect all the existing NSRs to below 70dB(A), further increase to its length and height are not required.

Location	Barrier Type	ID in Fig. 3.1.1 & Fig. 3.1.2	Length (m)	Target of Protection (NSR)	Constraints
East of Hiram's Highway (at grade)	5m high with 2.0m long cantilever noise barrier	E	96	Marina Cove (MC)	As the currently proposed barrier is sufficient to protect all the existing NSRs to below 70dB(A), further increases to its length or height are not required.
East of Hiram's Highway (on vehicular bridge)	2.5m high vertical noise barrier	F	90	Berkeley Bay Villa (BB)	As the currently proposed barrier is sufficient to protect all the existing NSRs to below 70dB(A), further increases to its length or height are not required.
North of Hiram's Highway at Pak Wai (at grade)	5m high with 2.0m long cantilever noise barrier	K	75	Hing Keng Shek Village (HKS)	The barrier cannot be further extended at either end due to the road junctions.
East of Hiram's Villas (within central reserve)	3m high vertical noise barrier	M	134	Hiram's Villas (HV)	The original Barrier M location was objected to by the Corporate Owners of Hiram's Villa. The revised design of a 3m high noise barrier and the current footprint is accepted by the residents at Hiram's Villa.
Proposed Noise Barriers for Protection of Future NSRs in Planned Developments					
West of Hiram's Highway (at grade)	5m high with 2.0m long cantilever noise barrier	D2	62	Planned Area A (PA) (Planning Application Nos. A/SK-HC/119 and A/SK-HC/136)	The barrier cannot be further extended to the South due to the need to reserve space for the entrance to the village. Also the barrier cannot be further extended to the North due to the need to reserve space for the entrance to the village and Luk Cheung Road. Further increase in the height of the proposed noise barrier would not be effective and would not have significant effect on reducing the noise levels for the Planned NSRs which exceed the criteria.

Location	Barrier Type	ID in Fig. 3.1.1 & Fig. 3.1.2	Length (m)	Target of Protection (NSR)	Constraints
At the Central Profile Barrier of Hiram's Highway Between Southern and Northern Entrances of Marina Cove (at grade)	3m high vertical barrier	J1	95	Planned Area A (PA) (Planning Application Nos. A/SK-HC/119 and A/SK-HC/136)	As there are junctions of the North access to Marina Cove with Hiram's Highway, the barrier cannot be further extended. The barrier is abutting barrier J2 at the South. As the proposed barrier is sufficient to protect the existing NSRs, further increases to its height are not required.
North of Ho Chung Road (at grade)	4m high vertical barrier	L1	45	Planned Area AD (AD) (Planning Application No. A/SK-HC/131)	As the currently proposed barrier is sufficient to protect all the existing NSRs to below 70dB(A), further increases to its length or height are not required.
North of Ho Chung Road (at grade)	4.5m high vertical barrier	L2	45	Planned Area AD (AD) (Planning Application No. A/SK-HC/131)	As the currently proposed barrier is sufficient to protect all the existing NSRs to below 70dB(A), further increases to its length or height are not required.
Potential Noise Barriers for Future NSRs, Extent and Alignment of the Barriers Could Not Be Determined at the Time of the Study Due to Lack of Information on Future Developments and the Need to Maintain Existing Run-ins and Accesses					
West of Hiram's Highway (at grade)	5m high with 2.0m long cantilever noise barrier	D1	-	R(E) zone	The barrier cannot be extended to the North due to the need to maintain the existing access road. The barrier cannot be extended to the South due to the proposed access road.
Between South and North Entrances of Marina Cove (at the Central Profile)	3m high vertical barrier	J2	-	R(E) zone	The barrier will adjoin to barrier J1 at the North. The barrier cannot be extended to the South due to the pedestrian crossing and road junction.
West of Hiram's Highway (On embankment)	5m high with 2.0m long cantilever noise barrier	G	-	CDA zone	The barrier cannot be extended to the North due to the need to maintain the Ho Chung Road. The barrier cannot be extended to the South due to the need to maintain an existing run-in.

Location	Barrier Type	ID in Fig. 3.1.1 & Fig. 3.1.2	Length (m)	Target of Protection (NSR)	Constraints
West of Hiram's Highway (On embankment)	5m high with 2.0m long cantilever noise barrier	H1	-	Planned Area C (PC)	The barrier cannot be extended to the North due to the need to maintain an existing run-in. The barrier will adjoin barrier H2 at the South.
West of Hiram's Highway (On embankment)	5m high vertical noise barrier	H2	-	Planned Area C (PC)	The barrier will adjoin barrier H1 and I at the North and West respectively.
Nam Pin Wai Road	5m high with 2m long cantilever noise barrier	I	-	Planned Area C (PC)	The barrier will adjoin the barrier H2 at the East. The barrier cannot be extended to the West as limited by the Project Boundary.
North of Ho Chung Road (at grade)	4.5m high vertical barrier	L3	-	Planned Area AD (AD)	The barrier will adjoin barrier L2 at the East. The barrier cannot be extended to the West due to proposed access road.

3.4.1.27 It was noted that the proposed noise protection scheme comprised barriers of different types and heights and it was recommended that consideration of ensuring a smooth transition between vertical barriers of different heights should be undertaken during the detailed design stage.

3.4.1.28 In addition, an earth bund was requested by residents of Hiram's Villa. It will situate on the verge between two slip roads of Kowloon bound carriageway of Hiram's Highway and its location is shown in **Figure 3.1.1**. The proposed earth bund is 56.8m long and 3m high, and is proposed to mitigate the southbound traffic noise of Hiram's Highway from the residents in Hiram's Villas.

3.4.1.29 In addition to noise barriers, low noise road surfacing is suggested to be applied to the southbound road section fronting CCCSS. This is anticipated to provide a further 3dB(A) reduction to the operational traffic noise impact and the delineation is, also, shown in **Figure 3.1.1**.

3.4.1.30 It should, also, be noted that due to the elevated position of CCCSS, noise barriers on the roadside of Hiram's Highway would not be effective to protect the NSR from traffic noise and hence no noise barrier is suggested for the NSR specifically. However, the above revision proposed for the residents at Hiram's Villas, including the relocation of Barrier M to the central reserve, addition of an earth bund and low noise surfacing, would provide limited beneficial effect to the NSR. It should, also,

be noted that all of the sensitive rooms in CCCSS have already been fitted with double-glazing and, as such, are expected to be protected from the traffic noise. Thus, the CCCSS is not included in the traffic noise assessment.

3.4.1.31 The proposed noise protection scheme incorporating a range of noise barriers and low noise surfacing were modelled and presented in the FS-RES to check the barrier performance. The modelling results showed that the proposed noise barriers would significantly reduce the predicted noise levels at many of the NSRs. However, there were still some representative NSRs which were predicted to be exposed to noise levels that exceed the allowable criteria for residential properties and educational establishments.

3.4.1.32 According to the FS-RES, there are 61 and 42 representative existing NSRs and future NSRs, respectively, selected for the operational noise impact assessment. As mentioned in **Section 3.4.1.24**, noise barriers were considered as mitigation measures for the existing and future NSRs. Noise barriers A1, A2, B, E, F, K and M were proposed to protect the existing NSRs, while the noise barriers D2, J1, L1 and L2 were proposed to protect the future NSRs at the currently planned future developments. In addition, noise barriers D1, G, H1, H2, I, J2 and L3 were potential noise barriers to the protect future NSRs, but the extent and alignment of the barriers could not be determined at that stage. The results showed that the further contribution to the noise reduction at the existing NSRs from barriers (D2, J1, L1, L2, D1, J2, G, H1, H2, I) proposed to protect future NSRs would be insignificant and therefore a phased implementation of noise barriers in accordance with Government Technical Circulars is proposed. Therefore, Barriers A1, A2, B, E, F, K and M which are proposed to protect the existing NSRs will need to be implemented first. The remaining barriers which will only protect future NSRs can be implemented in the next phase of works. At the time of development, the extent, alignment type and design of these barriers should be reviewed and defined strategically.

Remodelling of Noise Impacts to Incorporate the Changes to the Base Scheme

3.4.1.33 The Base Scheme includes some changes to the alignment previously proposed in the FS-RES. The changes are detailed below and shown in **Figures 3.1.1** and **3.1.2**. A review of the operational noise impacts of these changes has been undertaken including a remodelling of the relevant sections of the alignment where these changes are located.

3.4.1.34 The changes are:

- The alignment shift at Pak Wai;
- The relocation of Noise Barrier M;
- The installation of an earth bund adjacent to the CCCSS; and
- The incorporation of low noise surfacing at the road segments between CCCSS and Hiram's Villas.

- 3.4.1.35 It should be noted that **Works Item B) Change in Structural Form of Ho Chung Bridge** is also included in this re-modelling exercise. The results have been further discussed in the **Section 3.4.3.2** below.
- 3.4.1.36 As discussed in **Sections 3.4.1.18 to 3.4.1.20**, the traffic data in the "Review of Environmental Study" has been used in this assessment for the worst-case scenario.
- 3.4.1.37 The existing and future representative NSRs selected for the remodelling exercise, and their location, type, number of storeys / dwellings and their distance from the alignment are shown in **Table 3.4.3** and **Table 3.4.4** respectively. The selected NSRs have been taken from the NSR list in the FS-RES and are the closest NSRs to the locations of the proposed changes.

Table 3.4.3: Existing Representative NSRs for Operational Noise Impact Assessment

NSR ID	Location	Housing Type	No. of Storeys	No. of Dwellings	Buffer Distance from Nearest Alignment (m)
Near alignment shift for the road section between the northern entrance of Marina Cove and Pak Wai					
MC1	Marina Cove in Ho Chung	Medium Residential Building	Rise 3	6	22
MC2			Rise 3	12	23
MC3			Rise 3	12	55
MC4			Rise 3	12	25
MC9			Rise 3	8	43
MC10			Rise 3	8	55
LA1	Luk Mei Village (Part A)	Low Residential Building	Rise 2	6	39
LA2			Rise 1	11	67
LA3			Rise 1	6	50
LA4			Rise 1	4	24
LA10			3	3	57
LA11					60
Near Ho Chung Bridge					
BB1	Berkeley Bay	Low Residential Building	Rise 2	32	68
BB2	Villa near Ho Chung River		Rise 2		33
BB3			Rise 2		52
NP2	Nam Pin Wai Village	Low Residential Building	Rise 3	90	103
NP3			Rise 3	14	43
Near the proposed earth bund and relocation of Noise Barrier M					
HV	Hiram's Villas	Low Residential Building	Rise 3	10	10
HV2			Rise 3	10	15
HV3			Rise 3	10	15
PST1	Pik Shui Sun Tsuen	Low Residential Building	Rise 2	1	25
PST2			Rise 2	2	62

Table 3.4.4: Future Representative NSRs for Operational Noise Impact Assessment

NSR ID	Location	Planned Development	Local Ground Level (mPD)	Buffer Distance from Nearest Alignment (m)
Near alignment shift for the road section between the northern entrance of Marina Cove and Pak Wai				
PA-a	Luk Mei Village	Comprehensive Development Area - 2 storeys over one level of car park with maximum height of 9m	12.8	15
PA-b			11.8	5
PA-c			11.8	10
PA-d			10.9	14
PA-k			11.8	30
PA-l			11.8	20
PA-m			11.8	18
Near Ho Chung Bridge				
PC3	Nam Pin Wai Village	Comprehensive Development Area – 2 storeys over one level of car park with maximum height of 9m	8.0	42
PC4			8.0	32
PC5			8.0	26

3.4.1.38 The residential NSRs in the area are mainly low rise, scattered village houses of one to three storeys high, with some medium rise development at Marina Cove.

3.4.1.39 Results of the noise remodelling for the relevant Existing and Future representative NSRs are shown in **Table 3.4.5** and **Table 3.4.6** respectively. The traffic modelling results obtained in the FS-RES are, also, included for ease of comparison.

Table 3.4.5: Predicted Traffic Noise Levels, L10 (1hour) at Existing Representative NSRs for Mitigated Scenarios (With Mitigation by Barriers for Existing NSRs only) in 2027

NSR ID	Floor	Noise Criteria, dB(A)	Predicted Future L ₁₀ (1-hour), dB(A)		Difference Over FS-RES*
			FS-RES Mitigated Scenario	Base Scheme Mitigated Scenario	
Near alignment shift for the road section between the northern entrance of Marina Cove and Pak Wai					
MC1	1	70	64	61	-3
	2	70	67	63	-4
	3	70	68	66	-2
MC2	1	70	67	64	-3
	2	70	69	67	-2
	3	70	70	68	-2
MC3	1	70	67	62	-5
	2	70	67	64	-3
	3	70	67	65	-2

NSR ID	Floor	Noise Criteria, dB(A)	Predicted Future L ₁₀ (1-hour), dB(A)		Difference Over FS-RES*
			FS-RES Mitigated Scenario	Base Scheme Mitigated Scenario	
MC4	1	70	64	63	-1
	2	70	66	66	0
	3	70	68	68	0
MC9	1	70	61	59	-2
	2	70	66	65	-1
	3	70	66	68	2
MC10	1	70	61	59	-2
	2	70	67	68	1
	3	70	69	70	1
LA1	1	70	65	64	-1
	2	70	69	68	-1
LA2	1	70	64	63	-1
LA3	1	70	66	65	-1
LA4	1	70	69	70	1
LA10	1	70	59	57	-2
	2	70	60	59	-1
	3	70	62	63	1
LA11	1	70	58	57	-1
	2	70	61	60	-1
	3	70	64	63	-1
Near Ho Chung Bridge					
BB1	1	70	69	65	-4
	2	70	70	67	-3
BB2	1	70	67	65	-2
	2	70	69	67	-2
BB3	1	70	66	63	-3
	2	70	68	65	-3
NP2	1	70	66	62	-4
	2	70	67	64	-3
	3	70	68	65	-3
NP3	1	70	69	64	-5
	2	70	69	65	-4
	3	70	70	66	-4
Near the proposed earth bund and relocation of Noise Barrier M					
HV	1	70	68	77	9
	2	70	70	80	10
HV2	1	70	65	74	9
	2	70	68	77	9
HV3	1	70	77	75	-2
	2	70	80	80	0
PST1	1	70	63	62	-1
	2	70	64	64	0
PST2	1	70	67	65	-2
	2	70	68	66	-2

Note:



*

Shaded area represents exceedance of relevant noise criteria

Respective NSRs showing increment of predicted operational traffic noise in this Review Report over FS-RES is shown in “***Bold Italic***” (e.g. 2)

Table 3.4.6: Predicted Traffic Noise Levels, L₁₀ (1hour) in dB(A), at Future Representative NSRs for Mitigated Scenarios (With Mitigation by Barriers for Existing NSRs) in 2027

NSR ID	Floor	Noise Criteria, dB(A)	Predicted Future L ₁₀ (1-hour), dB(A)		Difference Over FS-RES*
			FS-RES Mitigated Scenario	Base Scheme Mitigated Scenario	
Near alignment shift for the road section between the northern entrance of Marina Cove and Pak Wai					
PA-a	1	70	70	67	-3
	2	70	70	70	0
PA-b	1	70	69	66	-3
	2	70	69	69	0
PA-c	1	70	74	72	-2
	2	70	74	74	0
PA-d	1	70	72	69	-3
	2	70	73	71	-2
PA-k	1	70	70	67	-3
	2	70	70	70	0
PA-l	1	70	69	66	-3
	2	70	69	68	-1
PA-m	1	70	71	67	-4
	2	70	71	70	-1
Near Ho Chung Bridge					
PC3	1	70	70	67	-3
	2	70	71	69	-2
PC4	1	70	69	67	-2
	2	70	70	69	-1
PC5	1	70	66	64	-2
	2	70	68	70	2

Note:



*

Shaded area represents exceedance of relevant noise criteria

Respective NSRs showing increment of predicted operational traffic noise in this Review Report over FS-RES is shown in “***Bold Italic***” (e.g. 2)

3.4.1.40 Results presented in **Table 3.4.5** show that, at Marina Cove, the shift of alignment together with mitigation measures would result in a general improvement of traffic noise impacts at the existing NSRs over FS-RES during the operational phase except at a few assessment points. There are 5 assessment points (3/F of MC9, 2/F and 3/F of MC10, LA4 and 3/F of LA10) out of 29 assessment points showing a minor increment of 1dB(A) to traffic noise level previously predicted in the FS-RES after implementation of Base Scheme. Although some increase is observed over the FS-RES, the increments do not contribute to exceedances of respective criteria and are, thus, considered acceptable.

- 3.4.1.41 Relocation of Noise Barrier M, even with the provision of the Earth Bund, would, however, results in a deterioration of traffic noise by up to 10dB(A) at the NSRs in Hiram's Villa during the operational phase. However, as discussed in **Section 2.2.1.2** and **Section 3.1.1.3**, Noise Barrier M has been shifted from its previous location directly outside the premises due to the request from residents of Hiram's Villa, and, hence, the deterioration is considered acceptable to the residents in Hiram's Villa.
- 3.4.1.42 Thus, in terms of existing NSRs as described above, it is concluded that the traffic noise levels during the operational phase would not be worsened with the proposed revised scheme.
- 3.4.1.43 In **Table 3.4.6**, it is demonstrated that a general improvement to traffic noise impacts at the future NSRs are predicted despite exceedances still being observed at PA-c and PA-d. The only increment in noise levels is predicted at PC5, although the traffic noise impacts would remain within the respective criteria. These overall noise level improvements result from the realignment of the future noise barriers in line with the revised alignment in this modelling exercise. Hence, in terms of future NSRs, it is, also, concluded that the traffic noise during the operational phase would not be worsened with the proposed revised road scheme.

Residual Impacts

- 3.4.1.44 The applicability for noise insulation at the existing NSRs was considered in the FS-RES but, due to contribution of noise from existing roads, none of the existing NSRs were considered eligible for Indirect Technical Remedies.
- 3.4.1.45 For the future NSRs, with the proposed barriers in place, there would still be some residual exceedances. However, further control could be achieved by planning and design measures when details are known.

Environmental Monitoring and Audit (EM&A)

- 3.4.1.46 In order to verify the effectiveness of the noise barriers, it was recommended in the FS-RES that the top floors of a Marina Cove NSR and a Luk Mei Village NSR be nominated as the monitoring locations for operational traffic noise monitoring as part of the EM&A programme. Considering the alignment has not been revised significantly, the proposed NSRs will still be valid for monitoring of the traffic noise monitoring after implementation of the **Base Scheme**.

3.4.2 Works Item A) Addition of Speed Arrester Bed

Construction Phase

- 3.4.2.1 The construction of the SAB would involve a number of activities with the potential to cause noise emissions. These include, clearance of vegetation and unsuitable surface materials, cutting of the slope in preparation for a retaining structure, in-situ concreting, placement and spreading of fill materials, import of

concrete blocks, in-situ concreting of the base of the gravel bed, the footpath and the service road and import and placing of the gravel in the gravel bed.

3.4.2.2 The construction area for the SAB is small and the duration of construction is estimated to only be about 3 months. The above construction activities will all be undertaken sequentially, with only one activity type being undertaken at any one time.

3.4.2.3 The NSRs within 300m of the SAB construction area are listed in **Table 3.4.7** with their type and horizontal distance from the works and shown in **Figure 3.2.1**. The selected representative NSRs (with their Slant Distance from the SAB construction area in brackets) are NSR TK1 at Ta Ku Ling San Tsuen (275m), NSR WM6 at Wo Mei Village (101m) and NSR 014d at Nam Wei Village (99m) and these are highlighted in bold in **Table 3.4.7** below.

Table 3.4.7: NSRs near to the Speed Arrester Bed

NSR ID	Description	Type	Nearest Horizontal Distance from SAB (m)
HEC2	Heung Chung Village	Residential	264
NW3	Nam Wai Village	Residential	144
TK1	Ta Ku Ling San Tsuen	Residential	273
TK2		Residential	346
TK6		Residential	314
WM5	Wo Mei Village	Residential	96
WM6		Residential	92
014a	Nam Wai	Residential	119
014b		Residential	113
014c		Residential	107
014d		Residential	99

3.4.2.4 The plant inventory of PMEs for the construction activities of the SAB is presented in **Appendix 3.3.1**. Since only one construction activity type would be undertaken at any one time, the activity with the highest SWL has been adopted in the noise assessment as the worst case scenario. The construction of the SAB may be undertaken during the construction of the Hiram's Villas road section and, therefore, cumulative construction noise levels for these two activities at the representative NSRs have been determined. The plant inventory and works programme for the construction of the Hiram's Villas section would be the same as in the previous the FS-RES.

3.4.2.5 A summary of the predicted unmitigated maximum noise levels is provided in **Table 3.4.8** below. The details of the predicted unmitigated noise levels at the representative NSRs are presented in **Appendix 3.3.2**. The results indicate that the noise levels at all sensitive receivers will exceed the day-time noise criteria of 75dB(A) for the residential developments. Therefore, noise mitigation measures will be necessary to reduce the noise to acceptable levels.

Table 3.4.8: Summary of Maximum Unmitigated Construction Noise Levels at Representative NSRs

NSR ID	Uses	Noise Criteria, dB(A)	Maximum Noise Level, dB(A)
			Un-mitigated Scenario
TK1	Residential	75	78
WM6	Residential	75	82
014d	Residential	75	83
Represents exceedance of relevant noise criteria			

3.4.2.6 Use of alternative quiet PME with lower SWLs has been recommended to reduce the noise impacts. The list of assumed quiet PME, and their respective SWLs, the mitigated plant inventory as well as references for the PMEs from approved Hong Kong EIAs, Hong Kong environmental studies, Hong Kong Control Of Noise Permits and British Standards are presented in **Appendices 3.3.3 and 3.3.4** respectively.

3.4.2.7 The details of the predicted noise levels at the representative NSRs with the implementation of the practicable mitigation measures detailed above during the construction works are presented in **Appendix 3.3.5**, with a summary provided in **Table 3.4.9** below. After the implementation of the noise mitigation measures recommended, the noise levels at all the NSRs are predicted to comply with the day-time noise criteria of 75dB(A) for the residential developments.

Table 3.4.9: Summary of Maximum Mitigated Construction Noise Levels at Representative NSRs

NSR ID	Uses	Noise Standard, dB(A)	Maximum Noise Level, dB(A)
			Mitigated Scenario
TK1	Residential	75	64
WM6	Residential	75	72
014d	Residential	75	72
Represents exceedance of relevant noise criteria			

3.4.2.8 Adverse residual impacts during the construction phases of the SAB would not be anticipated, provided that the above mitigation measures are implemented. In addition the application of good site practices are recommended as listed below.

- Noisy equipment and activities should be located as far from NSRs as practical;
- Intermittent noisy activities should be scheduled to minimise exposure of nearby NSRs to high levels of construction noise;
- Idle equipment should be turned off or throttled down; and
- Noisy equipment should be properly maintained and used no more often than is necessary.

Environmental Monitoring and Audit (EM&A)

- 3.4.2.9 As the proposed addition would not cause adverse impact to the nearby NSRs, the EM&A programme proposed in the FS-RES would remain valid.

Operational Phase

- 3.4.2.10 As stated in the air quality section above, the SAB would normally only be utilised in emergency situations to stop vehicles with break failure or similar problems. As such, it is expected to be only used occasionally and there would not be any significant operational phase noise impacts anticipated.

3.4.3 Works Item B) Change in Structural Form of Ho Chung Bridge

Construction Phase

- 3.4.3.1 As explained in **Section 2.4.1.3** above, the bridge deck level of the revised Ho Chung Bridge would be installed at a lower level to the existing road and the same construction method, equipment and process would be used as in the FS-RES. Also, the alignment and orientation of the Ho Chung Bridge will remain unchanged in this proposed scheme. Therefore, no additional adverse noise impacts would be anticipated to the surrounding NSRs during the construction phase.

Operational Phase

- 3.4.3.2 The assessment of the noise implications to the change in structural form for the bridge has been included in the operational noise assessment exercise for the Base Scheme.
- 3.4.3.3 For existing NSRs near the Ho Chung Bridge, the operational traffic noise results detailed in **Table 3.4.5** show a general improvement in noise levels of up to 5dB(A). This improvement would be due to the combination of changes of structural form of Ho Chung Bridge and correspondence noise barriers designed to provide protection for the identified NSRs within the area, which included noise barriers and change of structural form of the Ho Chung Bridge. Hence, it was demonstrated that the **Works Item B) Change in Structural Form of Ho Chung Bridge**, in combination with other proposed revision and correspondence mitigation measures, would, also, improve the traffic noise impact during the operational phase in this area.
- 3.4.3.4 For future NSRs, the operational traffic noise results in **Table 3.4.6** demonstrate that a general improvement in traffic noise levels at the future NSRs would also be predicted, except at PC5. However, please note the traffic noise impacts would remain within the respective criteria. Hence, the revision to Ho Chung Bridge would, also improve the traffic noise impact during operational phase in this area.

Environmental Monitoring and Audit (EM&A)

- 3.4.3.5 Due to the improvement in noise levels observed in this modelling exercise over the previous levels in the FS-RES, the EM&A programme proposed in the FS-RES would remain valid for both the construction and operational phases.

3.5 Ecology

3.5.1 Base Scheme

- 3.5.1.1 The available ecological information including the EIA Study for DSD's drainage improvement works in Sai Kung⁽¹⁾ were reviewed in the FS-RES. A summary of the key issues, findings, conclusions and recommendations from the FS-RES is provided below. The potential ecological impacts as a result of the proposed changes to the Base Scheme are, also, assessed below.
- 3.5.1.2 As concluded in the FS-RES, the main habitats affected by the Project are developed areas which are already disturbed and are subject to constant disturbance due to human activities. The ecological value of this habitat type is low and the works of this Project are not expected to cause adverse ecological impacts. The other habitats affected include village areas, cultivation land (which appears to be abandoned), river, shrubland and the fringe of some Fung Shui woodland on the hill slopes between the Kwan Tai Tak Temple and Che Kung Temple. An ecological habitat map for the Project area and its surrounding area showing the Base Scheme alignment and the Project area boundary is provided in **Figure 3.4.1**.
- 3.5.1.3 Of the habitat types affected, the primary direct ecological impact of the Project would be the loss of a small section of roadside woodland. This Fung Shui woodland is dominated by exotic timber species rather than local species. No rare and uncommon species were recorded in this small patch of woodland. Thus, its ecological value is comparatively lower than in some other Fung Shui woodland in Hong Kong. The proposed alignment has, also, minimised the impacts to the woodland area as far as practicable while balancing the need to protect individual specimens of conservation value.
- 3.5.1.4 The only protected species affected by the Project is *Michelia alba*. Along the section between Ho Chung River and Marina Cove, three individual protected trees of *Michelia alba* were predicted to be affected, with two of these individuals proposed to be felled and the other to be transplanted. Along the section between Marina Cove and Pak Wai, an additional individual of *Michelia alba* has been identified to be suitable for transplantation during this Environmental Review.
- 3.5.1.5 Two Old and Valuable Trees (OVTs), both *Ficus microcarpa* (LCSD SK/3 and SK/4) near to Marina Cove would be retained. The OVT *Ficus elastica* (LCSD SK/2) at Pak Wai was lost after serious damage by a typhoon, thus tree preservation and protection measures for this individual are no longer needed. All

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¹ Agreement No. CE 11/2002 (DS) Drainage Improvement in Sai Kung – Design and Construction Final Environmental Impact Assessment Report, prepared for Drainage Services Department

other affected species are common and widespread species and therefore not of particular ecological significance.

- 3.5.1.6 The most important ecological concern associated with the loss of vegetated habitat is the potential loss of nesting areas for birds and general habitat for other wildlife. However, no ecologically important species are associated with the affected habitats. As noted in the FS-RES, the most important faunal species present are avifauna. The bird species of conservation interest were associated with the riparian and intertidal habitats, which would not be affected by this Project. In addition, any impacts on bird habitat would be temporary and reversible with extensive compensatory planting proposed.
- 3.5.1.7 The coastal mudflat and mangroves and associated species (especially sea grass and birds) downstream of Ho Chung River are the most important ecological sensitive receivers in the area. They are, however, located outside of the Project Area and direct impacts to them are not anticipated. Indirect impact to them via water quality deterioration could be a concern.
- 3.5.1.8 The proposed alignment does not require any structure to be placed in the river. The riverbed at the existing bridge area could, thus, be restored to its natural condition by removing the pad footing foundation of the existing crossing. The removal process might cause some temporary water quality deterioration of the Ho Chung River and downstream area. This potential impact would be minimised by scheduling the works to be undertaken during the dry season. Good construction site management and control of surface run-off will, also, minimise indirect impacts via water quality deterioration and other media.
- 3.5.1.9 The project boundary of the Base Scheme remains essentially the same as for the FS-RES, with the exception of the alignment shift near Marina Cove. At that section, potential impact in addition to the potential impacts predicted in the FS-RES is anticipated. The main areas affected by the road alignment shift are the villages and developed area, including an area of fringe plantation woodland of approximately 850m² between Marina Cove and Luk Mei Village. The area would be lost due to the associated slope improvement works at Pak Wai.
- 3.5.1.10 Although the local fauna may possibly utilise this habitat, the highly disturbed roadside section of vegetation (next to the existing road) would be unlikely to contain many species and fauna would generally be expected to preferentially use the less disturbed habitats further in-land. Given a small area of roadside habitat lost, no significant impacts would be anticipated.
- 3.5.1.11 It should be noted that a large area of primarily shrubland (approximately 20,700m²) adjacent to the roadside slopes at Ta Ku Ling in the middle of the Hiram's Villas Section is included in the Project Area so as to allow space for Natural Terrain Hazard Mitigation Works. The works would not require extensive vegetation removal and the shrubland is not considered to be of any particular ecological significance. Thus, unacceptable adverse ecological impacts are not expected.

3.5.1.12 Indirect impacts to habitats and associated fauna adjacent to works areas could result from increased human activities/disturbance, for example, noise-generating construction plant / equipment and dust creating construction activities. Potential impacts include the avoidance by wildlife of the areas adjacent to the works areas and a reduction in their density close to such disturbance. Disturbance to habitats adjacent to the works area could, also, result from improper storage and/or dumping of construction materials. With the implementation of good site management, no substantial disturbance impacts to these habitats were expected during the construction phase in the FS-RES. This conclusion would also be valid for the proposed Base Scheme, considering the Base Scheme would not generate any additional disturbance.

3.5.1.13 Overall, impacts arising during the construction phase will be short-term in nature and would not significantly affect important ecological sensitive receivers. The operation of the Project is of a similar nature to the existing road network and will not introduce new types of impacts to existing ecological sensitive receivers. Thus, it is concluded that unacceptable adverse ecological impacts are not anticipated from the implementation of the Base Scheme.

3.5.2 Works Item A) Addition of Speed Arrester Bed

3.5.2.1 The 500m Study Area for ecological impact assessment and the proposed location and works area for the SAB are shown in **Figure 3.2.1**. Areas of recognised conservation importance, such as a Coastal Protection Area (CPA) and a Conservation Area (CA) are found in the Study Area.

3.5.2.2 Although a CPA is found within the Study Area, construction of the SAB does not require any works to be placed in the coastal area and no direct impact to the CPA is expected. The proposed SAB works are located about 300m away from the CPA and, thus, indirect impacts via water quality deterioration are, also, not anticipated.

3.5.2.3 However, the proposed SAB is very close to a CA, with the boundary of the CA only separated by about 5m from the western edge of the SAB permanent footprint. The proposed works area notably extends beyond the western edge of the footprint perimeter to run along the boundary of the CA.

3.5.2.4 The construction methodology for the SAB includes removal of the vegetation and any unsuitable material for the foundation of the SAB using excavators and a bulldozer. This will involve permanent loss of habitat (approximately 515m²) due to the permanent presence of the SAB and an additional temporary loss resulting from the construction / clearance of the works area (approximately 385m²).

3.5.2.5 Thus, the direct ecological impact of the SAB would be the permanent loss of a section of relatively low value roadside shrubland and also the temporary loss of a larger area for the works area. As concluded from the previous studies, this highly disturbed roadside section of vegetation has not been noted to contain any floral or faunal species of ecological interest.

- 3.5.2.6 In order to minimise the potential impact associated with the loss of habitat, the SAB has been designed with the 3m wide service road being located along the eastern side of the SAB, adjacent to the existing road (rather than along the other, western side of the SAB). This will reduce the cutting into the habitat and maintain separation from the nearby CA for the permanent facility, thereby reducing habitat lost. Thus, the CA would remain intact and there would be no direct impacts on this resource. A reinforced earth wall would be provided to support the structure but would, also, avoid encroachment into the CA during the operational phase. The proposed works, therefore, avoid direct impacts to the CA and, thus, adverse ecological impact due to habitat lost is not anticipated.
- 3.5.2.7 It will be important to instigate measures to avoid intrusion into the CA by the Contractor and minimise human disturbance to it. For example, the works area boundary could be clearly marked on plans and also physically demarcated on the site before beginning the clearance and removal of vegetation to create the works area. The Contractor should be instructed to only clear vegetation up to the marked boundary and strictly ensure that no unnecessary clearance beyond this boundary occurs.
- 3.5.2.8 Once the clearing work is completed, and before the full commencement of works in the works area, the proposed boundary fencing should be erected along the boundary of the works area to prevent vehicle movements and encroachment of personnel into the CA. No openings in the fencing should be provided on the western side of the works area to avoid access to the CA. Any necessary gates in this fencing should be locked and the key kept by the site manager for official use only. Regular checking of the works site boundaries should be undertaken by resident site staff (RSS) to ensure that they are not breached and that damage does not occur to the surrounding areas. Any damage to the fencing should be repaired without delay. With implementation of precautionary measures, the impacts to the fauna would be minimised.
- 3.5.2.9 The estimated construction period for the SBA is 3 months and after this, the additional area occupied by the works area could start to regenerate. This process could be assisted by ensuring the area is clear of any contamination or construction waste, preparing the top layer to be receptive to the removed shrubland species as well as planting some areas with shrubs.
- 3.5.2.10 Indirect impacts associated with flora due to construction dust and with fauna due to noise and increased human activities may be potentially induced. However, faunal species in this habitat are believed to be habituated to disturbance and noise as the area is next to developed areas and highly disturbed by road traffic. No species of conservation interest were recorded in this habitat. In addition, the dust and noise impacts will be controlled to acceptable levels by the dust and noise mitigation measures recommended in the air quality and noise sections above and human disturbance will be minimised by erection of fencing along the facility boundary.

- 3.5.2.11 Hence, it is concluded that addition of the SAB would not cause additional adverse impacts to the habitat within the proximity.

3.5.3 Works Item B) Change in Structural Form of Ho Chung Bridge

- 3.5.3.1 The new proposed Ho Chung Bridge could possibly be designed as an arch bridge with a shallower bridge deck. It should be noted that the new bridge would not require any supporting structures to be erected in the river or on the riverbed and the area of the bridge deck would remain unchanged from the bridge proposed in the FS-RES.
- 3.5.3.2 Potential impacts to the aquatic environment could result from shading of the lower section of the Ho Chung River, which was, also, the case for the bridge proposed in the FS-RES. Shading a short section of a river channel is not known to negatively affect river fauna as the affected section is already shaded by the existing Hiram's Highway crossing. This Project would replace the existing crossing with a new one and will not introduce new impacts.
- 3.5.3.3 With the implementation of this Project, the old crossing will be demolished and the pad footings on the riverbed will be removed. Based on the as-built record of the existing bridge, the pad footings were placed on the existing riverbed without elements (such as piles) intruding into the sediment. As such, no treatment of the riverbed, such as backfilling, is anticipated upon removal of the bridge footings. It is proposed that the riverbed be left untouched for natural regeneration after removal of the bridge footings. Thus, overall impacts to Ho Chung River after the initial and temporary disturbance would be beneficial and this is consistent with the FS-RES findings.

3.5.4 Environmental Monitoring and Auditing

- 3.5.4.1 The project design has avoided affecting habitats of higher ecological values and no important ecological sensitive receivers will be affected by the project. As such, adverse ecological impacts are not anticipated, even without implementing the recommended precautionary measures, thus, specific EM&A requirements are not considered necessary. However, precautionary measures are provided below to ensure that all potential ecological impacts due to the project are kept to a practical minimum.
- 3.5.4.2 It was noted that the proposed noise protection scheme comprised barriers of different types and heights and it was recommended in FS-RES that consideration be given to ensuring a smooth transition between vertical barriers of different heights during the detailed design stage. This recommendation remains valid.
- 3.5.4.3 Good site management should be implemented to ensure the project works comply with general environmental protection requirements.
- 3.5.4.4 It is recommended that the works area boundary surrounding the SAB facility be clearly marked on a plan and physically demarcated on site before beginning the clearance and removal of vegetation to create the works area. The Contractor

should be instructed to only clear vegetation up to the marked boundary and strictly ensure that no unnecessary clearance beyond this boundary occurs. Regularly checking of the work site boundaries is recommended to ensure that they are not breached and that damage does not occur to surrounding areas.

- 3.5.4.5 Once the clearing work is completed, and before the full commencement of works in the works area, the proposed boundary fencing should be erected along the boundary of the works area. No openings in the fencing should be provided on the western side of the works area. Any necessary gates in this fencing should be locked and the key kept by the site manager for official use only. Regular checking of the works site boundaries should be undertaken by resident site staff (RSS). Any damage to the fencing should be repaired without delay.
- 3.5.4.6 After completion of construction, the temporary areas of the works area surrounding the SAB facility should be checked for signs of contamination, debris, waste construction materials, such as concrete, containers etc., and cleared of any such material.

3.6 Landscape and Visual

3.6.1 Background to the Study

- 3.6.1.1 The potential landscape and visual impacts envisaged by the road improvements had been discussed in Section 8 of the FS-RES. The conclusion of the study stated the potential residual impacts as “*Undetermined*”. It is due to the potentially *Beneficial* landscape impacts may be recorded in LCU 3A and LCU 4. However, *Significant* residual impacts will remain in LCU 3B.
- 3.6.1.2 The visual impact analysis demonstrated that potentially *Beneficial* visual impacts may be recorded for VSR1 – Ex Sai Kung Primary School (currently disused), VSR42 – Ho Chung Road users, VSR43 – Ho Chung village and VSR44 – ATV Studios (currently disused). However *Moderate / Significant* residual impacts remain in both VSR45 – Mixed use area in Luk Mei Tsuen and VSR49 – residents at the junction of Hing Keng Shek Road whilst *Significant* impacts remains for VSR47 – Hiram’s Highway road users.
- 3.6.1.3 Whilst *Negligible* or even *Beneficial* Impacts were identified for much of the project area it was considered that *Significant Adverse* Landscape Impacts generated in Landscape Character Unit 3B could not be adequately mitigated. Furthermore the *Significant Adverse* and *Moderate Adverse* Visual Impacts generated to road users on Hiram’s Highway and to local residents were also excessive.
- 3.6.1.4 The primary source of landscape impact was generated by the loss of hillside and mature woodland next to Luk Mei Tsuen Road, coupled with the large change to the landscape character in the section from the Ho Chung River northwards. The FS-RES identified that the construction of the road with its inherent standardisation of the area, would be seriously detracting from the quality of the area and that the

divisive nature of the highway with its barriers and controlled crossings would segregate the communities either side of Hiram's Highway.

- 3.6.1.5 The profuse use of noise mitigation barriers was seen as a major contributor to the poor visual environment potentially created, both to road users and local residents. *Significant Adverse* Residual visual impacts resulted when installation of the barriers was coupled with the loss of visual amenity from removal of views.
- 3.6.1.6 Suggested landscape mitigation measures include compensatory tree planting but note that the maturity and scale of the lost woodland cannot be replaced in the short term. The project offered limited space for new tree planting and may not be able to adequately compensate for the resources lost within the project area. The quality of space provision for trees was identified as problematic, with ground conditions within the road and footpath zones rarely suitable.
- 3.6.1.7 Proposed visual mitigation measures were restricted to the planting at slopes and structures, planting to screen noise barriers and hard landscape treatments.
- 3.6.1.8 Potential *Beneficial* Residual Impacts were identified by the FS-RES, with the new section of road linking to Luk Mei Tsuen providing opportunities to improve the visual outlook of the area. With the proviso of undertaking significant off-roadside tree planting, residents of Ho Chung and Luk Mei Tsuen, road users on Ho Chung Road and workers at ATV Studios may benefit in the longer term if these mitigation measures were significant enough. However due to land ownership restrictions such planting cannot be undertaken and the beneficial impacts would not be realised.

3.6.2 Approach to Assessment

- 3.6.2.1 This study is carried out with reference to the EIAO Guidance Note No. 8/2002 for a systematic definition on significance of landscape and visual impacts, which identifies the 'significance' of landscape and visual impacts. As this Review Report is a preliminary assessment it does not provide all the details required by the TM-EIA and the Guidance Note. The project is not a designated project under the Environmental Impact Assessment Ordinance
- 3.6.2.2 Preliminary landscape and visual impacts are assessed against four criteria, namely:
- All direct and indirect impacts on existing/planned/approved land use and on future outlook;
 - Impacts on LANDSCAPE RESOURCES (the physical components of the landscape);
 - Impacts on LANDSCAPE CHARACTER (the aggregate impression created by a combination of resources); and
 - Impacts on VISUALLY SENSITIVE RECEIVERS or 'VSR's (the people who will see the Project).

3.6.2.3 The landscape and visual impact analysis contains the following:

- Baseline identification of sensitive receivers (resources, character and those in the zone of visual influence) and their sensitivity;
- Identification of the source of landscape and visual impact including the extent and types of impact;
- Identification of landscape and visual mitigation measures during both construction and operational phases; and
- Assessment of residual landscape and visual impacts during construction and at during operation.

3.6.2.4 The study area includes those resources within the project works area as well as those immediately surrounding the site boundary which might potentially be impacted. This is considered sufficient due to the small scale site area and nature of the works. The **assessment of landscape impacts** in this study involves the following procedures:

- (a) Identification of the baseline landscape resources and landscape character found within the study area. This is achieved by site visit and desktop study of topographical maps, information databases and photographs.
- (b) Consideration of the degree of sensitivity of the landscape resources / landscape character. This is influenced by a number of factors including:
 - quality and maturity of landscape resources/characters;
 - rarity of landscape resources/characters;
 - whether the landscape resources/ characters are considered to be of local, regional, national or global importance;
 - whether there are any statutory or regulatory limitations/requirements relating to the landscape resources/characters; and
 - ability of the landscape resources/characters to accommodate change.
- (c) Identification of potential sources of landscape impacts. These are the various elements of the construction works and operation procedures that would generate landscape impacts.
- (d) Identification of the magnitude of landscape impacts. The magnitude of the impact (or magnitude of change) depends on a number of factors including:
 - the physical extent of the impact,
 - compatibility of the project with the surrounding landscape,

- duration of impacts, i.e. whether it is temporary (short, medium or long term), under construction and operational phases, and
 - reversibility of change.
- (e) Identification of potential landscape mitigation measures. Mitigation measures may take the form of:
- adopting alternative design/alignment or revisions to the basic engineering or architectural design to prevent and/or minimize adverse impacts,
 - minimization of works areas, temporary construction,
 - remedial measures such as colour and textural treatment of physical, engineering and building features,
 - compensatory measures such as the implementation of landscape design measures (e.g. tree planting, creation of new open space etc) to compensate for unavoidable adverse impacts and to attempt to generate potentially beneficial long term impacts.
- (f) Assessment of landscape impacts after the implementation of the mitigation measures. By considering the magnitude of the various impacts and the sensitivity of the various landscape resources / character, coupled with the intended mitigation measures, it is possible to assess landscape impacts into four categories as follows:

Significant: Adverse / beneficial impact where the proposal would cause significant deterioration or improvement in existing landscape quality.

Moderate: Adverse / beneficial impact where the proposal would cause noticeable deterioration or improvement in existing landscape quality.

Slight: Adverse / beneficial impact where the proposal would cause barely perceptible deterioration or improvement in existing landscape quality.

Insignificant: No discernible change in the existing landscape quality.

3.6.2.5 The **assessment of visual impacts** has involved the following:

3.6.2.6 Identification of Zones of Visual Influence (ZVIs) during the construction and operational phase of the project. This is achieved by site visit and desktop study of topographic maps and photographs, and preparation of cross-section to determine the visibility of the project from various locations. The Zone of Visual Influence (Visual Envelope) is that area from which any part of the proposed Project can be seen. The extent of this zone is identified on **Figure 3.5.4**.

- (a) Identification of Visually Sensitive Receivers (VSRs) within the Zone of Visual Influence (ZVIs) at construction and operational phases. These are the people who would reside, work, recreate or travel through, the ZVIs.
- (b) Consideration of the degree of sensitivity to change of the VSRs. Factors considered include:
 - the type of VSRs, which is classified according to whether the person is at home, at work, at school, at leisure, or travelling. Those who view the impact from their homes are considered to be highly sensitive as the attractiveness or otherwise of the outlook from their home will have a substantial effect on their perception of the quality and acceptability of their home environment and their general quality of life. Those who view the impact from their workplace and at school are considered to be only moderately sensitive as the attractiveness or otherwise of the outlook will have a less important, although still material, effect on their perception of their quality of life. The degree to which this applies depends on whether the workplace is industrial, retail or commercial. Those who view the impact whilst taking part in an outdoor leisure activity may display varying sensitivity depending on the type of leisure activity. Those who view the impact whilst travelling on a public thoroughfare will also display varying sensitivity depending on the speed of travel.
 - other factors which are considered include the number of individuals, the value and quality of existing views, the availability and amenity of alternative views, number of VSRs, the minimum viewing distance of VSR, the duration or frequency of view, and the degree of visibility.
- (c) Identification of relative numbers of VSRs. This is expressed in term of whether there are few, medium or many VSRs in any one category of VSR.
- (d) Identification of potential sources of visual impact. These are the various elements of the construction works and operation procedures that would generate visual impacts.
- (e) Consideration of the potential magnitude of visual impact. Factors considered include:
 - the compatibility with the surrounding landscape,
 - the duration of the impact under the construction and operational phases,
 - the reversibility of the impact,
 - the scale of the impact and distance of the source of impact from the viewer, and
 - the degree of visibility of the impact, and the degree of which the impact dominates the field of vision of the viewer.

- (f) Identification of potential visual mitigation measures. These may take the form of adopting alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimise adverse impacts, remedial measures such as colour and textural treatment of building features, and tree planting to screen the roads and associated bridge structures.
- (g) Assessment of visual impacts before and after the implementation of the mitigation measures. By considering the magnitude of the various visual impacts and the sensitivity of the VSRs, and the numbers of VSRs that are affected, it is possible to assess visual impacts into four categories as follows:

Significant: Adverse / beneficial impact where the proposal would cause significant deterioration or improvement in existing visual quality.

Moderate: Adverse / beneficial impact where the proposal would cause noticeable deterioration or improvement in existing visual quality.

Slight: Adverse / beneficial impact where the proposal would cause barely perceptible deterioration or improvement in existing visual quality.

Insignificant: No discernible change in the existing visual quality.

3.6.3 Existing Landscape and Visual Characteristics

Base Scheme

- 3.6.3.1 The works are predominantly in an area zoned as Green Belt (GB) and include the steep, tree covered, artificial slopes 7SED/C13 and 7SE-D/C42 maintained by HyD as well as the adjacent private slope 7SE-D/C41 and the higher 7SE-D/C43 maintained by LandsD. Slope 7SE-D/R16, also maintained by LandsD to the east of Luk Cheung Road, is in land zoned Residential (Group D), under the Ho Chung OZP S/SK-HC/9.
- 3.6.3.2 The slopes are contained within landscape resource LDR-01 (Woodland surrounding Slopes 7SED/C13 and 7SE-D/R16) and LDR-02 (Village Margin surrounding Luk Cheung Road. These resource areas connect to the natural hillside woodland of the lower slopes of Buffalo Hill; LDR-03 (Natural Hillside below Buffalo Hill) zoned as Conservation Area (CA). The tree canopy here typically reaches about 8m height with species composed in the most part of mixed native woodland species including *Macaranga tanarius*, *Cinnamomum camphora* and *Ficus spp* whilst the understorey provides a full green cover.
- 3.6.3.3 This area sits within Landscape Character Unit LCU-3B (East Facing Hill Slope Settlements Surrounding Luk Mei Tsuen) as identified by the FS-RES and includes the mature woodland pockets and linear corridor containing Hiram's Highway. The area has been categorised as *High* in sensitivity to change.

- 3.6.3.4 Visual Receivers identified in the FS-RES are all *High* in sensitivity and include Residents of Marina Cove (VSR30), Occupants of Units in Mixed Use Area (VSR45) and Road Users on Hiram's Highway (VSR47b/c).

Works Item A) Addition of Speed Arrester Bed

- 3.6.3.5 The alignment of the SAB is within hillside zoned as Green Belt (GB) on the Ho Chung OZP S/SK-HC/9, west of New Hiram's Highway. The alignment borders on Conservation Zone (CA) to the west and crosses the tree covered registered slopes 11NE-B/C776, 11NE-B/C897 and 11NE-F/R305 maintained by HyD located in LDR-A1 (Vegetated Engineered Slopes).
- 3.6.3.6 The slope tree canopy here typically reaches about 10m height with plantation species composed in the most part of *Acacia auricauliformis*, *Acacia mangium* and *Eucalyptus citriodora*. The natural hillside slopes LDR-A2 (Natural Vegetated Hillside) are predominantly covered with *Mallotus paniculata*.
- 3.6.3.7 The SAB sits within Landscape Character Unit LCU-1 (Transport Corridor from the Hilltop at Clearwater Bay Road intersection to the River Crossing at Nam Pin Wai), an area identified in the FS-RES as being of *Low* sensitivity and within a landscape somewhat able to accommodate large scale changes.
- 3.6.3.8 Previously identified Visual Receivers were restricted to *Medium* sensitivity Road Users on New Hiram's Highway (VSR-47a) and the *Low* sensitivity, Occasional Users of Paths on Surrounding Hillside (VSRs 10 and 16). A further highly sensitive receiver is now identified due to the revised extent of the proposed works; Residents at Wo Mei Village (VSR-A1) where peripheral units have restricted easterly views up towards the hillside.

Works Item B) Change in Structural Form of Ho Chung Bridge

- 3.6.3.9 The Ho Chung Bridge sits within land designated both as Road and as Green Belt on the Ho Chung OZP SS/SK-HC/9. It is bordered by further Green Belt (GB) to the north and south with Coastal Protection Area (CPA) at the river area zoned under the Hebe Haven OZPS/SK-HH/6.
- 3.6.3.10 Grassed slopes 11NE-B/F328 and 11NE-B/F329 are maintained by HyD with the former bounded by a colourful noise barrier. The Bridge was identified in the FS-RES as sitting within Landscape Character Unit LCU-4 (Coastal Plain) and the sensitivity of the unit was assessed as *High*. Previously identified Visual Receivers included *Medium* sensitivity Sai Kung Primary School (VSR-1), *High* sensitivity Residents of Berkley Bay Villas (VSR-32), *Medium* sensitivity Ho Chung Road Users (VSR-42) and *High* sensitivity Road Users on Hiram's Highway (VSR-47b).
- 3.6.3.11 The planning designations for the areas are outlined on **Figure 3.5.1**. Landscape Resources are scheduled on **Table 3.6.1** and illustrated on **Figure 3.5.2**. Landscape Character Areas are scheduled on **Table 3.6.2** and illustrated on **Figure 3.5.3**. Visually Sensitive Receivers for the areas are scheduled on **Table 3.6.3** and illustrated on **Figure 3.5.4**.

Table 3.6.1: Schedule of Landscape Resources and Sensitivity

LDR ID	Description	Size (m ²)	Sensitivity
Base Scheme			
LDR-01	Woodland surrounding Slopes 7SED/C13 and 7SE-D/R16	1,900	High
LDR-02	Village Margin surrounding Luk Cheung Road	23,000	Medium
LDR-03	Natural Hillside below Buffalo Hill	100,000+	High
LDR-04	Vacant Lots at Luk Chung Road	6400	Medium
LDR-05	Amenity Buffer along Hiram's Highway	4400	Medium
Work Item A – Addition of Speed Arrester Bed			
LDR-A1	Vegetated Engineered Slopes	26,775	Medium
LDR-A2	Natural Vegetated Hillside	100,000+	High
LDR-A3	Village Gardens at Wo Mei	100,000+	Medium
Work Item B – Change of Structural Form of Ho Chung Bridge			
LDR-B1	Ho Chung River	10,000+	High
LDR-B2	Flood Plain East of Hiram's Highway	12,800	High
LDR-B3	Flood Plain West of Hiram's Highway	7,900	Medium

Table 3.6.2: Schedule of Landscape Character Units

LCU ID	Description	Sensitivity
Base Scheme		
LCU-3b	Hillside Settled Valley around Luk Mei Tsuen	High
LCU-5	CDA at Marina Cove	Low
Work item A – Addition of Speed Arrester Bed		
LCU-1	Transport Corridor along Hiram's Highway	Low
LCU-1a	Settled Valley around Wo Mei Village	Medium
LCU-1b	Coastal Upland and Hillside above Nam Wai	High
Work item B – Change of Structural Form of Ho Chung Bridge		
LCU-3a	Low Lying Settled Valley at Ho Chung	Medium
LCU-3b	Hillside Settled Valley around Luk Mei Tsuen	High
LCU-4	Coastal Plain at Ho Chung River Mouth	Low

Table 3.6.3: Schedule of Visually Sensitive Receivers

VSR ID	Description	Sensitivity
Base Scheme		
VSR-30	Residents of Marina Cove	High
VSR-45	Occupants of Units in Mixed Use Area	High
VSR-47B	Road Users on Hiram's Highway (Section B)	High
VSR-47C	Road Users on Hiram's Highway (Section C)	High
VSR-B1	Pedestrians at Marina Cove Shopping Centre	High
Work item A – Addition of Speed Arrester Bed		
VSR-10	Walkers on Hillside Paths above Nam Wai	Low
VSR-16	Walkers on Ta Ku Ling Hill Paths	Low
VSR-47A	Road Users on Hiram's Highway (Section A)	Medium
VSR-A1	Residents at Wo Mei Village	High
Work item B – Change of Structural Form of Ho Chung Bridge		
VSR-1	Occupants of Sai Kung Central Primary School	Medium
VSR-25	Residents of Nam Pin Wai	High

VSR ID	Description	Sensitivity
VSR-32	Residents of Berkeley Bay Villas	High
VSR-42	Road Users on Ho Chung Road	Medium
VSR-44	Occupants of ATV Studios	Low
VSR-47B	Road Users on Hiram's Highway (Section B)	High
VSR-B1	Pedestrians at Marina Cove Shopping Centre	High

3.6.4 Sources and Magnitude of Landscape and Visual Impact

3.6.4.1 The proposed works will comprise highway diversion, slope clearance and cutting, demolition, excavation, retaining wall construction, highway construction, drainage works, noise barrier, roadbridge and footbridge construction. During the Construction Phase, working space for excavation and scaffold construction shall be required as well as working area for mixing and storage.

3.6.4.2 During the Construction Phase, potential Landscape and Visual Impacts would arise from:

- (a) Demolition, excavation and construction works for the new highway, speed arrester bed and bridges;
- (b) Stockpiling of excavated and building materials and storage of construction equipment and plant in Works Area / Site Office Area;
- (c) Off-site construction traffic involving haulage of excavated materials;
- (d) Temporary traffic / road diversions;
- (e) Night-time lighting;
- (f) Temporary works hoardings, noise barriers and enclosures; and
- (g) Contractor's temporary works areas, including parking areas.

3.6.4.3 During the Operational Phase, potential Residual Landscape and Visual Impacts would be related to the permanent loss of landscape resources, loss of visual amenity from such resources and construction of visible structures:

- (a) Noise barriers, profile barriers, road signage engineered walls and slopes, bridges;
- (b) Permanent net loss of landscape resources, including trees and vegetation;
- (c) Permanent change in local street character and atmosphere;
- (d) Loss of visual amenity from restriction of views; and
- (e) Loss of visual amenity generated by lost landscape resources.

3.6.5 Potential Landscape and Visual Impacts

Base Scheme

- 3.6.5.1 The adoption of the Base Scheme, with its introduction of a more westerly alignment for the road in the section opposite Marina Cove will require 1600m² of land currently zoned as Green Belt (GB) to be adopted as Road, outside of the land allocated on the OZP. This Green Belt land is connected green space linking to the Conservation Area at Buffalo Hill.
- 3.6.5.2 The alignment impacts 1500m² of steep, tree covered slope located in LDR-1 and 500m² located in LDR-2 which are required to be cut back to allow sufficient space for road widening resulting in the permanent loss of existing mature vegetation. Approximately 250 No. of trees on and around the hillside will require to be felled during construction phase in these landscape resources.
- 3.6.5.3 The resulting loss of further hillside woodland, in LDR-1 in particular, will have an adverse impact on the landscape character of the area (LCU-3b) during both construction and operational phases, over and above that previously identified in the FS-RES.
- 3.6.5.4 A loss of visual amenity to identified Visually Sensitive Receivers is anticipated during both construction and operational phases as a result of the loss of permanent landscape resources caused by the base scheme alignment. However, it may worth noting that the shift in alignment was in fact requested by Marina Cove, who is expected to suffer the visual impact, and agreed by the residents during the gazettal stage.

Works Item A) Addition of Speed Arrester Bed

- 3.6.5.5 The alignment of the SAB located at the west of New Hiram's Highway cuts into 3700m² of hillside zoned Green Belt (GB), completely severing it into separate sections. The alignment borders on land zoned as Conservation Area (CA) to the west and following construction there will no longer be Green Belt buffer between the highway and the Conservation Area.
- 3.6.5.6 LDR-A1 includes the steep, Simar slopes 11NE-B/C776 and 11NE-B/C897, where 2640m² will be required to be cut back, whilst the tree covered hillside area of LDR-A2 is also impacted and an area of 1100m² will require to be removed to allow space for the SAB resulting in the permanent loss of the vegetative cover. Approximately 200 No. of trees on the slope will require to be felled in this area.
- 3.6.5.7 A tall and continuous retaining structure of between 8 and 10m in height is required adjacent to the SAB. The works during both construction and operation will be prominent to Road Users on New Hiram's Highway (VSR-47a,) whilst selected Residents at Wo Mei Village (VSR-A1) may be able to have restricted views of some of the works during construction including that on the hilltops, whilst during operation they may note the loss of mature trees from a change to the skyline. Clear views to the works themselves are not anticipated. In fact, majority of the

village buildings of Wo Mei Villages are facing the north and have restricted view to the site.

Works Item B) Change in Structural Form of Ho Chung Bridge

- 3.6.5.8 A change in the structural form of Ho Chung Bridge will have no anticipated impact to the landscape planning framework or identified landscape resources during construction or operation.
- 3.6.5.9 The proposed structural form maintains a lower deck level; closer to the existing surrounding landscape and is therefore likely to be more easily absorbed into the existing landscape during operational phase, demonstrating reduced impacts on landscape character.
- 3.6.5.10 Due to its height and form the proposed structural arch may actually be more visually prominent to surrounding sensitive receivers. Noise mitigation barriers required on the bridge may be visually intrusive and the proposed structural form may actually be able to better integrate these effectively during operational phase than other structural forms. Other potential sources of visual impact include high bay lighting masts.

3.6.6 Proposed Mitigation Measures

Base Scheme

- 3.6.6.1 Greening of the newly formed cut slopes will potentially allow the development of small seedling trees and vegetative cover over the new formed cut slopes as was proposed by the FS-RES. This will help to mitigate adverse impacts to local visual receivers, maintain the landscape character and provide compensation of landscape resources. Design of the slopes shall be carried out in accordance with GEO Publication No. 1/2011 "Technical Guidelines on Landscape Treatment for Slopes". The opportunities for planting large trees are severely restricted however.

Works Item A) Addition of Speed Arrester Bed

- 3.6.6.2 Opportunities for greening in front of the hillside retaining wall are limited by the need to avoid works in the Conservation Area and to minimise impact to the existing hillside, however, new planting on the cut slopes to the east of the SAB may be undertaken. Introduced buffer planting should have the effect of screening the lower half of the SAB from Road Users on New Hiram's Highway (VSR-47a); the upper section will be visually prominent to road users. The lower retaining wall should be able to utilise vertical greening and tree screening to some beneficial effect, especially around the ramp section, which may be visible at early stages of operation to Residents at Wo Mei Village (VSR-A1) to the west. The proposed mitigation measures should enable the adverse impacts to landscape character to be minimised.

Works Item B) Change in Structural Form of Ho Chung Bridge

- 3.6.6.3 As potential impacts are essentially identified as visual, the aesthetic design of the proposed bridge is the key to successful integration. The bridge sits on the threshold of a number of character areas and may come to be considered rather as a visual gateway from one character area to another. A design form that makes the bridge both more responsive to the surrounding environment and yet distinctive as a local landmark is beneficial in both visual and landscape character terms. The careful application of lighting and noise barriers into the structural design of the bridge, rather than being applied separately, can act to create a rationalised visual impression and minimise clutter. The finish colour of the bridge is important, with dark, recessive colouring being better suited to the rural application. The bridge itself is closely linked to the adjacent footbridge, which is likely to be far more visually incongruous than its low lying neighbour. A responsive and bespoke design form for the footbridge, which is integrated to that of the Ho Chung River Bridge and responds to the same structural form and chromatic treatments, would be beneficial. The bridges together should be seen as an integrated design response and may form an iconic landscape feature for the area.
- 3.6.6.4 The mitigation measures proposed above which may be employed to lessen the impact of the various elements of the project specifically upon landscape and visual receivers, both during the construction and operational phases for the three study areas are considered separately to those proposed in the FS-RES and are described below and scheduled in **Table 3.6.4** and **Table 3.6.5**. The land areas identified for project planting are identified on **Figures 3.5.5a, 3.5.5b and 3.5.5c**.

Table 3.6.4: Recommended Construction Phase Landscape and Visual Mitigation Measures

ID No.*	Type	Landscape / Visual Mitigation Measure	Funding / Implementation	Management / Maintenance
CM1	Design / Planning – Landscape	Refinement of Works Alignment To minimize impact to valuable landscape resources, particularly mature trees, the alignment of the works will be reviewed and refined during detail design and construction	HyD / Consultant Team	Consultant Team / Contractor

ID No.*	Type	Landscape / Visual Mitigation Measure	Funding / Implementation	Management / Maintenance
CM2	Site Practice – Landscape	No-Intrusion Zone To maximize protection of existing resources including watercourses, existing trees, ground vegetation and the associated understory habitats a “No-intrusion Zone” will be designated to various areas within and along the site boundary with rigid and durable fencing for each individual no-intrusion zone. Regular checks will be carried out to ensure that the work site boundaries are not exceeded, hoarding is properly maintained and that no damage is being caused to these protected areas.	HyD	Contractor
CM3	Site Practice – Visual	Erection of Screen Hoardings Temporary screen hoardings shall be erected around the works areas to screen activities from local receivers. It shall be designed and to be compatible with the existing rural context, adopting ima.	HyD	Contractor
CM4	Site Practice – Visual	Control of night-time lighting No night time work shall be programmed, avoiding light pollution to visual receivers.	HyD	Contractor

Table 3.6.5: Recommended Operational Phase Landscape and Visual Mitigation Measures

ID No.	Type	Landscape / Visual Mitigation Measure	Funding / Implementation	Management / Maintenance
OM1	Design / Planning – Landscape / Visual	Compensatory Tree Planting Suitable land pockets within the project area will be used for the implementation of compensatory mitigation to offset the net loss of key landscape resources and improve visual amenity. A compensatory tree planting proposal including locations of tree compensation will be submitted separately to seek relevant government department's approval, in accordance with ETWB TCW No. 3/2006.	HyD	HyD / LCSD
OM2	Design / Planning – Landscape / Visual	Horizontal and Slope Greening Shotcreting of cut rock slopes shall be avoided and greening applications employed throughout the project. Both cut and backfill slopes shall be hydroseeded and native seedlings trees planted.	HyD	HyD
OM3	Design / Planning – Landscape / Visual	Vertical Greening Vertical greening / climbers shall be applied to all above ground structures against exposed walls as far as possible subject to technical operational and maintenance constraints. Such planting shall be employed at noise barriers, walls, columns and footbridges	HyD	HyD

ID No.	Type	Landscape / Visual Mitigation Measure	Funding / Implementation	Management / Maintenance
OM4	Design / Planning – Visual	Architectural Design Aesthetics for Bridges and Barriers The noise barriers, bridges and other above-ground structures shall be designed to meet high aesthetic requirements. The design of all structures shall be submitted to the ACABAS for approval. Specific attention shall be undertaken to ensure the form, material and surface detailing of the structures is considered to fit into the local context in terms of the landscape character of the site.	HyD	HyD

Residual Impacts

Base Scheme

- 3.6.6.5 It is considered that the proposed Base Scheme changes would be generally in accordance with the planning goals and objectives for the study area. However it does conflict with land zoned as Green Belt rather than adopt the Road alignment of the OZP and the extent and quality of landscape resources lost resulting from this alignment change would not be able to be fully replaced within the Project. The proposed shift will result in an increase in the Magnitude of Change to the documented landscape resources, landscape character and affected VSRs. Significant landscape and visual impacts identified in the FS-RES are thus intensified.

Works Item A) Addition of Speed Arrester Bed

- 3.6.6.6 It is considered that the proposed works would be generally in accordance with the planning goals and objectives for the study area. However they do conflict with land zoned as Green Belt and the extent of landscape resources lost within this area would not be able to be fully replaced within the Project. Due to the Low sensitivity of the character area and with no highly sensitive visual receivers close to the proposed works, significant residual impacts to Landscape Character or VSRs are not anticipated. Finding available space to address the further loss of vegetation caused by the SAB does not appear possible within the project area and a net loss of landscape resources will result.

Works Item B) Change in Structural Form of Ho Chung Bridge

3.6.6.7 It is considered that the proposed changes to the bridge structural form would be in accordance with the planning goals and objectives for the study area. Due to the High sensitivity of the character area and with surrounding highly sensitive visual receivers close to the proposed works, the aesthetic design of the Ho Chung River Bridge together with the proposed Ho Chung Footbridge must be of outstanding quality in order to ensure that unnecessary residual impacts to Landscape Character and VSRs are not generated.

3.6.6.8 The significance of residual impacts for the project areas are scheduled on **Table 3.6.6** and **Table 3.6.7** and **Table 3.6.8** below. Impacts are *Adverse* unless specified.

Table 3.6.6: Significance of Residual Impacts to Landscape Resources

ID No.	Description	Receiver Sensitivity	Magnitude of Change		Significance	
			Con	Op	Con	Op
Base Scheme						
LDR-01	Woodland surrounding Slopes 7SED/C13 and 7SE-D/R16	High	Large	Inter	Sig	Mod
LDR-02	Village Margin surrounding Luk Cheung Road	Medium	Small	Neg	Slight	Insig
LDR-03	Natural Hillside below Buffalo Hill	High	Neg	Neg	Insig	Insig
LDR-04	Vacant Lots at Luk Chung Road	Medium	Neg	Neg	Insig	Insig
LDR-05	Amenity Buffer along Hiram's Highway	Medium	Large	Inter	Mod	Slight
Work Item A) – Addition of Speed Arrester Bed						
LDR-A1	Vegetated Engineered Slopes	Medium	Large	Inter	Mod	Slight
LDR-A2	Natural Vegetated Hillside	High	Small	Neg	Mod	Insig
LDR-A3	Village Gardens at Wo Mei	Medium	Neg	Neg	Insig	Insig
Work Item B) – Change of Structural Form of Ho Chung Bridge						
LDR-B1	Ho Chung River	High	Neg	Neg	Insig	Insig
LDR-B2	Flood Plain East of Hiram's Highway	High	Neg	Neg	Insig	Insig
LDR-B3	Flood Plain West of Hiram's Highway	Medium	Neg	Neg	Insig	Insig

Note: Neg = Negligible / Inter = Intermediate / Insig = Insignificant / Mod=Moderate / Sig = Significant

Table 3.6.7: Significance of Residual Impacts to Landscape Character

ID No.	Description	Receiver Sensitivity	Magnitude of Change		Significance	
			Con	Op	Con	Op
Base Scheme						
LCU-3b	Hillside Settled Valley around Luk Mei Tsuen	High	Large	Large	Sig	Sig
LCU-5	CDA at Marina Cove	Low	Neg	Neg	Insig	Insig
Work item A) – Addition of Speed Arrester Bed						
LCU-1	Transport Corridor along Hiram’s Highway	Low	Small	Neg	Slight	Insig
LCU-1a	Settled Valley around Wo Mei Village	Medium	Neg	Neg	Insig	Insig
LCU-1b	Coastal Upland and Hillside above Nam Wai	High	Neg	Neg	Insig	Insig
Work item B) – Change of Structural Form of Ho Chung Bridge						
LCU-3a	Low Lying Settled Valley at Ho Chung	Medium	Neg	Neg	Insig	Insig
LCU-3b	Hillside Settled Valley around Luk Mei Tsuen	High	Neg	Neg	Insig	Insig
LCU-4	Coastal Plain at Ho Chung River Mouth	Low	Neg	Neg	Insig	Insig

Note: Neg = Negligible / Inter = Intermediate / Insig = Insignificant / Mod=Moderate / Sig = Significant

Table 3.6.8: Significance of Residual Impacts to Visual Receivers

ID No.	Description	Receiver Sensitivity	Magnitude of Change		Significance	
			Con	Op	Con	Op
Base Scheme						
VSR-30	Residents of Marina Cove	High	Inter	Small	Mod	Slight
VSR-45	Occupants of Units in Mixed Use Area	High	Inter	Small	Mod	Mod
VSR-47B	Road Users on Hiram’s Highway (Section B)	High	Large	Large	Sig	Sig
VSR-47C	Road Users on Hiram’s Highway(Section C)	High	Large	Large	Sig	Sig
VSR-B1	Pedestrians at Marina Cove Shopping Centre	High	Large	Inter	Sig	Mod
Work item A) – Addition of Speed Arrester Bed						
VSR-10	Walkers on Hillside Paths above Nam Wai	Low	Neg	Neg	Insig	Insig
VSR-16	Walkers on Ta Ku Ling Hill Paths	Low	Neg	Neg	Insig	Insig
VSR-47A	Road Users on Hiram’s Highway (Section A)	Medium	Inter	Small	Mod	Slight
VSR-A1	Residents at Wo Mei Village	High	Neg	Neg	Insig	Insig

ID No.	Description	Receiver Sensitivity	Magnitude of Change		Significance	
			Con	Op	Con	Op
Work item B) – Change of Structural Form of Ho Chung Bridge						
VSR-1	Occupants of Sai Kung Central Primary School	Medium	Small	Neg	Slight	Insig
VSR-25	Residents of Nam Pin Wai	High	Small	Neg	Mod	Insig
VSR-32	Residents of Berkeley Bay Villas	High	Inter	Small	Mod	Slight
VSR-42	Road Users on Ho Chung Road	Medium	Inter	Small	Mod	Slight
VSR-44	Occupants of ATV Studios	Low	Small	Neg	Slight	Insig
VSR-47B	Road Users on Hiram’s Highway (Section B)	High	Inter	Small	Mod	Slight
VSR-B1	Pedestrians at Marina Cove Shopping Centre	High	Small	Neg	Mod	Insig

Note: Neg = Negligible / Inter = Intermediate / Insig = Insignificant / Mod=Moderate / Sig = Significant

3.6.7 Environmental Monitoring and Audit

3.6.7.1 Given the landscape and visual impacts predicted, it is recommended that EM&A is undertaken during the design, construction and operational phases. The design stage EM&A will consist of auditing the detailed mitigation proposals. The construction and operational phase EM&A comprise auditing of the identified recommendations and mitigation measures together with planting and planting establishment by site inspection. The operational phase auditing should be conducted for one year during the contractor's maintenance period.

3.6.8 Conclusions

3.6.8.1 The project is generally in accordance with the statutory planning framework. However, it deviates from the OZP by impacting Green Belt areas at the Base Scheme (5,600m²), Luk Mei Tsuen Road (4,800m²) and the SAB (3,700m²).

3.6.8.2 The project has unavoidable construction phase Landscape and Visual Impacts resulting primarily from slope clearance, excavation, road and noise barrier construction and the storage of materials and plant. Further potential impacts are caused from temporary traffic arrangements and generated construction traffic.

3.6.8.3 The following permanent loss of landscape resources are noted:

- 2000m² of slope and vegetation along Hiram's Highway for the construction of the Base Scheme.
- 3700m² of slope and vegetation for the construction of the SAB;

- No resources are impacted as a result of the change of structural form of the Ho Chung River Bridge
- A total of 1950 existing trees have been surveyed covering the entire area of the Project. Approximately 260 trees are proposed to be transplanted and 1360 trees are proposed to be felled including 290 dead trees. None of the trees identified for removal are Registered Old and Valuable Trees. Application and approval for removal for all trees shall be obtained in accordance with Environment Transport and Works Bureau Technical Circular (Works) No. 3/2006.

3.6.8.4 Operational phase impacts result primarily from the permanent loss of landscape resources and their visual amenity, as well as the visual impact of the built works, particularly noise barriers.

3.6.8.5 The following mitigation measures are proposed to be undertaken:

Design Stage

- Minimising site area; and
- Refinement of architectural design aesthetics for above-ground structures.

Construction Phase

- No-intrusion of identified protection zone;
- Erection of decorative and screen hoardings; and
- Control of night-time lighting glare,

Operational Phase

- Compensatory Tree Planting – Approximately 820 new trees can be provided within the site areas of the project;
- Horizontal and slope greening; and
- Vertical Greening.

3.6.8.6 Following the introduction of landscape and visual mitigation measures, the following **Construction Phase Residual Impacts** to Landscape Resources, Landscape Character and Visually Sensitive Receivers is noted:-

- **Significant** Adverse Impacts to Landscape Resources at LDR-01: Woodland surrounding Slopes 7SED/C13 and 7SE-D/R16;
- **Significant** Adverse Impacts to Landscape Character at LCU-3b: Hillside Settled Valley around Luk Mei Tsuen; and

- **Significant** Adverse Impacts to Visual receivers at VSR-47B: Road Users on Hiram's Highway (Section B,) VSR-47C: Road Users on Hiram's Highway (Section C) and VSR-B1: Pedestrians at Marina Cove Shopping Centre.

3.6.8.7 Following the introduction of landscape and visual mitigation measures, the following **Operational Phase Residual Impacts** to Landscape Resources, Landscape Character and Visually Sensitive Receivers is noted:-

- **Moderate** Adverse Impacts to Landscape Resources at LDR-01: Woodland surrounding Slopes 7SED/C13 and 7SE-D/R16;
- **Significant** Adverse Impacts to Landscape Character at LCU-3b: Hillside Settled Valley around Luk Mei Tsuen; and
- **Significant** Adverse Impacts to Visual receivers at VSR-47B: Road Users on Hiram's Highway (Section B) and VSR-47C: Road Users on Hiram's Highway (Section C)

3.6.8.8 The impact of the westerly alignment on the Base Scheme as described above would result in a slight worsening of the residual impact to Landscape Resources and Landscape Character in Unit 3B. Hence, impacts to the Landscape are both identified as *Significant Adverse*.

3.6.8.9 On the other hand, in the FS-RES, residual impact to the Landscape Character Unit LCU-5 was previously identified as *Slight/Moderate Adverse*. The Base Scheme would result in an improvement to the residual impact to Landscape Resources and Landscape Character in LCU-5 to *Insignificant*.

3.6.8.10 For Visual Sensitive Receivers, the Base Scheme would result in an improvement on residual impact over the scenario assessed in FS-RES at VSR30 and VSR 45, which were both previously identified as *Significant Adverse*. The visual impact at VSR30 is now identified as *Slight Adverse* while the impact at VSR45 is now identified as *Moderate*.

3.6.8.11 The residual impacts of the Works Item A) and Works Item B) to the Landscape Resources, Landscape Character and VSRs are identified to range from *Insignificant* to *Moderate* during construction phase and *Insignificant* to *Slight* during the operational phase.

3.6.8.12 Within the overall project scope approximately 1360 trees will be felled, including many of large size located on slopes and 290 dead trees. However, no Old and Valuable Trees will be removed. Potentially 260 trees are suitable to be transplanted whilst 350 new trees are targeted to be planted in compensation. It would be difficult to fully replace the lost woodland resources due to their maturity as there is insufficient space available for further planting within the project scope.

3.7 Cultural Heritage

3.7.1 Base Scheme (Built Heritage)

3.7.1.1 A Built Heritage Impact Assessment (BHIA) for the road layout had been undertaken in the FS-RES, with a Study Area extending 50m from the Project Area boundary. The baseline information provided from the study identified one historical village in the vicinity of the project Study Area, Ho Chung. Ho Chung is a multi-surname village whose founding probably dates back to the mid-Ming period (Hase 2003). The clans associated with the village are the Lai, Wan, Lau, Tse and Cheung clans. The village is located along the side of the Ho Chung River and there is a modern concrete flood protection wall along the front of the village. This structure was built approximately 30 years ago and replaced a much earlier structure that was demolished at that time. Three resources associated with Ho Chung Village were identified in the project Study Area, two earth god shrines and the Che Kung Temple.

3.7.1.2 The previously undertaken BHIA identified one Graded Historic Building within the project Study Area, the Che Kung Temple, currently Grade 1. The original Che Kung temple at the site is believed to date back to the middle of the 16th Century (Hase 2003). The temple is dedicated to Che Kung, a general from the Late Song Dynasty who was associated with suppressing plagues and skills with medicine. The current temple is a Qing Dynasty vernacular building of two halls with three bays. It is the oldest of the two Che Kung Temples in Hong Kong (Hase 2003). No other buildings or structures in the Study Area have received graded status and there are no Declared Monuments in the Study Area.

3.7.1.3 A built heritage field survey was conducted as part of FS-RES. A total of 18 historic buildings and structures and 2 historical graves were identified within and in the vicinity of the project Study Area. As the study was at a preliminary stage, resources located within Ho Chung Village were also included to provide background information. None of the resources in Ho Chung Village were found to be impacted by the proposed works. As such, historical items located outside of the 50m Study Area will not be included in the review report. A site visit has been undertaken for this Review Report and a revised built heritage catalogue identifying 11 heritage buildings and structures and 3 historical graves has been included in **Appendix 3.6.1**.

Construction Phase

3.7.1.4 The current project study area for Hiram's Highway runs from the Nam Pin Wai Roundabout to Pak Wai and includes local access road works running from Luk Mei Tsuen Road to Ho Chung Road. A key plan is shown in **Figure 3.6.1** and there are 14 resources identified within a 50m boundary of the proposed works (shown on four 1:1000 scale maps showing the locations of the items and their relationship to the proposed works in **Figure 3.6.2** to **Figure 3.6.6**).

3.7.1.5 The proposed works consist of road improvement works, including provision of a roundabout at Pak Wai, widening of Hiram's Highway and a provision of a local

access road at Ho Chung. The Project associated impacts that may adversely affect the identified cultural heritage resources can be classified as follows:

- Any heritage resource located within close proximity to the works area may be adversely impacted through vibration and/or receive direct damage from construction works; and
- The access to temples, shrines and ancestral halls must be maintained throughout the construction phase.

3.7.1.6 This section will be divided into two parts, the first will present the impacts to built heritage resources, shown in **Table 3.7.1** and the second will present the impacts to historical graves shown in **Table 3.7.2**.

Table 3.7.1: Evaluation of Impacts to Historical Buildings and Structures from Base Scheme

Resource	Description of Works	Minimum Distance to Works	Impact Assessment
Tai Wong Yeh Shrine (HH-01)	Works associated with road widening	Within works area	The shrine will be rebuilt in a new location.
Che Kung Temple (HH-02)	Works associated with road widening.	Retaining Wall (Adjacent to Works Area) Temple (14m)	The construction of the original scheme concrete bridge will require the road level in front of the temple to be raised approximately 1.5 metres from its existing level. This will cause direct impacts to the retaining wall of the temple. The Temple is located in proximity to the proposed works and may be damaged by ground borne vibration. The road works are situated on the road and footpaths leading to the temple and safe public access may be impeded by the works.
Earth God Shrine (HH-03)	Works associated with road widening.	2m	The Shrine is located in close proximity to the proposed works and may be damaged by ground borne vibration and contact with machinery and equipment. The road works are situated on the road and footpaths leading to the shrine and safe public access may be impeded by the works.

Resource	Description of Works	Minimum Distance to Works	Impact Assessment
Earth God Shrine (HH-04)	Works associated with road widening	Adjacent to Works Area	The Shrine is located in proximity to the proposed works and may be damaged by ground borne vibration and contact with machinery and equipment. The road works are situated on the road and footpaths leading to the shrine and safe public access may be impeded by the works.
Kwan Tei Shrine (HH-05)	Works associated with road construction	50m	Based on the distance no impact is expected to arise from the construction works.
Tai Yuen Shui Temple (HH-06)	Works associated with road construction	24m	The Temple is a modern reinforced concrete building and based on the distance no impact is expected to arise from the construction works.
Milestone (HH-07)	Works associated with road widening	Within works area	The milestones are located in close proximity to the proposed works and may be damaged by contact with machinery and equipment.
Milestone (HH-08)	Works associated with road widening	Within works area	
Commemorative Stone Tablet (HH-09)	Works associated with road widening	Within works area	The construction works will require the removal of the stone from its current location.
Village Arch (HH-10)	Works associated with road widening	Within works area	The arch is located in close proximity to the proposed works and may be damaged by ground borne vibration and contact with machinery and equipment.
Lau Ancestral Hall (HH-11)	Works associated with road widening	33m	The Ancestral Hall is a modern reinforced concrete building and based on the distance no impact is expected to arise from the construction works.

Table 3.7.2: Evaluation of Impacts to Historical Graves from Base Scheme

Resource	Description of Works	Minimum Distance to Works	Impact Assessment
G1	Works associated with road widening	12m	The Grave is located in proximity to the proposed works and may be damaged by ground borne vibration
G2	Works associated with road widening	33m	Based on the distance no impact is expected to arise from the construction works.

G3	Works associated with road widening	8m	The grave does not contain any structural elements and will not be impacted by ground borne vibration. The 5 metre distance is considered to provide adequate protection and no additional buffer zone requirements will be required.
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Mitigation Measures

3.7.1.7 The following mitigation recommendations will be presented in **Table 3.7.3** and **Table 3.7.4** for resources as required from the findings of the impact assessment. The description below will provide the detailed requirements for each of the mitigation actions required:

- **Condition Survey:** A condition survey must be carried out by a qualified building surveyor or engineer in advance of works for Graded Historic Buildings and structures that may be affected by ground borne vibration. The Condition Survey Report should contain descriptions of the structure, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The condition survey report must be submitted to AMO for comment before construction activities commence. The contractor must implement the approved monitoring and precautionary measures.
- **Vibration Monitoring:** Vibration monitoring should be undertaken during the construction works to ensure that safe levels of vibration are not exceeded. A maximum level of 5mm/s for Grade 1 and 7.5mm/s for Grades 2 and 3 Historic Buildings should be adopted. It should be noted that the condition survey report should highlight if the limit should be lowered after the detailed study of the condition of the building. A monitoring schedule should be included in the condition survey report. The location of the proposed monitoring point on the building should avoid damaging the historic fabric and be approved by the owner.

For ungraded historical buildings and structures, vibration monitoring should be undertaken for the duration of the construction works in the vicinity and the maximum acceptable level of vibration will be set at 15mm/s. The location of monitoring points should be situated on the structure closest to the construction works, unless the maximum level is set lower than the standard 15mm/s, in which case monitoring points should be located on each affected structure. Installation of monitoring points must not damage the historic building fabric. The location of monitoring points (and access to the property for purposes of measurement) must be agreed with the property owner prior to installation.

- **Provision of Buffer Zones:** A buffer zone should be provided to separate the building from the construction works. The buffer zone should be clearly

marked out by temporary fencing. The buffer zone should be at least 5 metres unless site restrictions make this unfeasible. In this case the buffer zone should be made as large as the site restrictions allow.

- **Provision of Protective Covering:** Protective covering in the form of plastic sheeting placed on a movable fence should be provided for external walls and surfaces of historical buildings and structures in close proximity to works areas, i.e. areas where a buffer zone alone cannot provide protection from equipment and works activities.
- **Safe Public Access:** Any proposed works in close proximity to buildings or structures used by the public for religious, ritual or funerary purposes, such as shrines, ancestral halls, temples and graves have the potential to create an unsafe environment for members of the public. The contractor must ensure that safe public access, through provision of clearly marked paths separated from the construction works areas is provided for any such affected cultural heritage structure.
- **Preservation by Record:** The contractor must ensure that a full cartographic and photographic survey of the shrine should be conducted prior to demolition. The survey report should be submitted to AMO for approval.
- **Temporary Removal of Milestones and Commemorative Stone Tablet:** The construction works may not allow for adequate protective measures to be implemented for the three built heritage items (HH-07, HH-08 and HH-09). If it is determined that these items cannot be adequately protected in-situ, they must be temporarily removed from their current location and reinstated at the end of the construction phase. The contractor should prepare a methodology statement for the proposed removal process and ensure that the items will be safely stored during the construction works. The methodology statement should be submitted to AMO for approval prior to the construction phase. The milestones should be reinstated in their original locations and the commemorative stone tablet to a location as close as possible to its current one at the end of the construction phase.

3.7.1.8 The resources detailed in **Table 3.6.3** below have been identified as being impacted by the proposed works during the construction phase of the project and will require mitigation.

Table 3.7.3: Mitigation Recommendations for Historical Buildings and Structures from Base Scheme

Resource	Mitigation Recommendation
Tai Wong Yeh Shrine (HH-01)	Preservation by Record

Resource	Mitigation Recommendation
Che Kung Temple (HH-02)	As a Grade I Historic Building, the Alert, Alarm and Action (AAA) vibration limit will be set at 3/4/5 mm/s. A condition survey should be conducted prior to the construction works and vibration monitoring carried out during the construction phase as appropriate. A buffer zone should be provided around the retaining wall as large as site restrictions allow.
Earth God Shrine (HH-03)	Vibration monitoring carried out during the construction phase as appropriate. As the shrines are situated in close proximity to the works area a buffer zone minimum 5 m or as large as site restrictions allow should be provided for the duration of construction works in the vicinity. Protective covering in the form of plastic sheeting should be provided for the exterior surfaces of the shrine and safe public access should be provided.
Kwan Tei Shrine (HH-05)	No Mitigation Required.
Tai Yuen Shui Temple (HH-06)	No Mitigation Required.
Milestone (HH-07)	As the milestones are situated within the works area a buffer zone minimum 5 m or as large as site restrictions allow should be provided for the duration of construction works in the vicinity. Protective covering should be provided for the milestones as appropriate.
Milestone (HH-08)	During the detailed design stage it will be determined if adequate protective measures can be implemented for the milestones to remain in-situ during the construction works. If this cannot be achieved the milestones will be removed during the construction works and reinstated in their original location after the works have been completed.
Commemorative Stone Tablet (HH-09)	The stone tablet should be removed prior to the construction works and reinstated to a site as near to its original location as possible. This location will be determined at the detailed design stage.
Village Arch (HH-10)	As the arch is situated within the works area a buffer zone minimum 5 m or as large as site restrictions allow should be provided for the duration of construction works in the vicinity. Protective covering in the form of plastic sheeting should be provided for the arch as appropriate.
Lau Ancestral Hall (HH-11)	No Mitigation Required.

Table 3.7.4: Mitigation Recommendations for Historical Graves from Base Scheme

Resource	Mitigation Recommendation
G1	Vibration monitoring carried out during the construction phase as appropriate.
G2	No mitigation Required.
G3	No Mitigation Required.

3.7.2 Base Scheme (Archaeology)

3.7.2.1 Ho Chung is a known area of archaeological interest, despite the fact that several investigations such as Hong Kong University Archaeological Team in 1957 and the Hong Kong Archaeological Survey between 1982 and 1984 found no evidence for ancient occupation. It was not until the 1997-1998 Territory-wide Survey, that historical and prehistoric material (Neolithic and Bronze Age) were recovered from an area just west of Hiram's Highway on the alluvial plain (Hunan Institute 1998). A full scale excavation was carried out under the auspices of the AMO in 1999 as part of a road widening project and a wider range of materials and features dated to Late Neolithic, Bronze Age, Tang/Song and Ming/Qing Dynasties were recovered from the rescue excavation (AMO 1999). The extent of the Ho Chung Site of Archaeological interest in relationship to the proposed works is marked on **Figure 3.6.7**.

3.7.2.2 The Base Scheme includes the original road layout developed in Further Study and incorporates the objections and comments received during the gazettal process. The Base Scheme thus include minor design changes as discussed in **Section 2.2** and further elaboration in **Section 3.1.2**. However, the proposed impacted areas which are relevant in an archaeological impact assessment are the same as assessed under the previous FS-RES.

3.7.2.3 The Archaeological Impact Assessment (AIA) study in the FS-RES identified that there were no areas of archaeological interest within the Study Area. This assessment was based on desk-based review supplemented by a survey investigation. The survey was part of the Hiram's Highway dualling Archaeological Impact Assessment conducted in 1999 by the Archaeological Team of the Anthropology Department of Zhongshan University (Zhongshan University 2000). The survey investigation consisted of 23 auger holes and 8 test pit excavations located within the current Study Area. The field survey results showed that no archaeological deposits or features occur in the tested area.

3.7.3 Works Item A) Addition of Speed Arrester Bed

Built Heritage

3.7.3.1 A desk-based study and site visit was undertaken to identify the built heritage potential of the Study Area of the proposed SAB. No built heritage resources were identified within 50m of the proposed works area. No impacts to built heritage resources will result in the construction or operation of the SAB. No mitigation will be required.

Archaeology

- 3.7.3.2 A desk-based study and site visit was undertaken to identify the archaeological potential of the Study Area of the proposed SAB. The arrester bed will be located alongside the Ho Chung highway and will impact on cut slope, a secondary road and steep slopes (**Figure 3.6.8**). The desk-based results and field visit show that the proposed works will occur at topographical and disturbed landform areas of no archaeological interest. Therefore no impacts on archaeology will arise at the proposed SAB.

3.7.4 Works Item B) Change in Structural Form of Ho Chung Bridge

Built Heritage

- 3.7.4.1 No built heritage resources will be directly impacted by the change in the structural form of the bridge. However, there are three built heritage resources that will be affected by the proposed steel arch bridge construction: The Che Kung Temple (HH-02), An Earth God Shrine (HH-03) and a commemorative stone tablet (HH-09). The proposed change is in the form of the bridge and under the revised scheme the works will consist of the construction of a steel arch / truss bridge with cast in-situ top slab. As a result of this scheme, the existing road level in front of the Che Kung Temple will not need to be increased significantly and the impacts to the resources will be reduced from that of the original scheme. The following two tables (**Table 3.7.5** and **Table 3.7.6**) present the impacts and mitigation recommendations required for the three resources.

Table 3.7.5: Evaluation of Impacts for Historical Buildings and Structures from Change in Structural Form of the Ho Chung Bridge

Resource	Description of Works	Minimum Distance to Works	Impact Assessment
Che Kung Temple (HH-02)	Works associated with road widening	Retaining Wall (Adjacent to Works Area) Temple (14 m)	The construction of the proposed steel arch bridge will require the road level in front of the temple to be raised only slightly from its existing level. This will cause direct impacts to the retaining wall of the temple (but less severe than the original scheme). The Temple is located in proximity to the proposed works and may be damaged by ground borne vibration. The road works are situated on the road and footpaths leading to the temple and safe public access may be impeded by the works.
Earth God Shrine (HH-03)	Works associated with road widening	2 m	The Shrine is located in close proximity to the proposed works and may be damaged by ground borne vibration and contact with machinery and equipment. The road works are situated on the road and footpaths leading to the shrine and safe public access may be impeded by the works.
Commemorative Stone Tablet (HH-16)	Works associated with road widening	Within works area	The construction works will require the removal of the stone from its current location.

Table 3.7.6: Mitigation Recommendations for Historical Buildings and Structures from Change in Structural Form of the Ho Chung Bridge

Resource	Mitigation Recommendation
Che Kung Temple (HH-02)	As a Grade 1 Historic Building, the Alert, Alarm and Action (AAA) vibration limit will be set at 3/4/5mm/s. A condition survey should be conducted prior to the construction works and vibration monitoring carried out during the construction phase as appropriate. A buffer zone should be provided around the retaining wall as large as site restrictions allow.
Earth God Shrine (HH-03)	Vibration monitoring carried out during the construction phase as appropriate. As the shrine is situated within the works area a buffer zone minimum 5 m or as large as site restrictions allow should be provided for the duration of construction works in the vicinity. Protective covering in the form of plastic sheeting should be provided for the exterior surfaces of the shrine and safe public access should be provided
Commemorative Stone Tablet (HH-16)	The stone tablet should be removed prior to the construction works and reinstated to a site as near to its original location as possible. This location will be determined at the detailed design stage.

Archaeology

- 3.7.4.2 The proposed change of structural form to the Ho Chung Bridge is not expected to have any archaeological implications. The works will be undertaken in areas which have no archaeological potential, which in this case are stream banks.

3.8 Cumulative Impacts

- 3.8.1.1 As described in **Section 2 of the FS-RES**, this Project is tentatively scheduled to commence in July 2013 and it is anticipated that it will be completed by January 2016. There are no known relevant concurrent projects which would be undertaken during this time period. Thus significant cumulative environmental impacts are not expected.

3.9 Environmental Monitoring and Audit

3.9.1 Construction Phase EM&A Programme

Air Quality

- 3.9.1.1 An EM&A programme was recommended in FS-RES during the construction phase in order to monitor the TSP concentrations at selected ASRs and to verify the implementation and effectiveness of the mitigation measures. The ASRs where monitoring was recommended are Marina Cove, Luk Mei Village, Hiram's Villas and CCCSS and this is considered to be still valid.

- 3.9.1.2 It is considered that the proposed mitigation measures will control potential dust impacts from the SAB. It is recommended that the EM&A programme should be extended to include dust monitoring stations at Wo Mei Village and Nam Wei Village – see **Section 3.2.2.8** for the duration of the SAB construction works.
- 3.9.1.3 Therefore, the selected ASRs for the monitoring of TSP during construction phase are listed as below:
- (a) MC2 (Marina Cove);
 - (b) LA7 (Luk Mei Village);
 - (c) NW3 (Nam Wei Village);
 - (d) WM5 (Wo Mei Village);
 - (e) HV (Hiram's Villa); and
 - (f) CCC2 (Cheng Chek Chee Secondary School).

Noise

- 3.9.1.4 In order to verify the implementation and effectiveness of the mitigation measures, it was recommended in FS-RES that the following NSRs to be monitored for noise impacts during the construction phase and this is still considered to be valid:
- Pak Wai Village;
 - Marina Cove (MC);
 - Luk Mei Villahe (LA7);
 - Che Kung Temple near Ho Chung Road; and
 - Cheng Chek Chee Secondary School (CCCSS).

Ecology

- 3.9.1.5 During the construction of the SAB it will be important to instigate measures to avoid intrusion into the CA by the Contractor and minimise human disturbance to it. It is recommended that the works area boundary should be clearly marked on plans and also physically demarcated on the site before beginning the clearance and removal of vegetation to create the works area. The Contractor should be instructed to only clear vegetation up to the marked boundary and strictly ensure that no unnecessary clearance beyond this boundary occurs.
- 3.9.1.6 Once the clearing work is completed, and at an early stage of commencement of works in the works area, the proposed boundary fencing should be erected along the boundary of the works area to prevent vehicle movements and encroachment of personnel into the CA. No openings in the fencing should be provided on the

western side of the works area to avoid access to the CA. Any necessary gates in this fencing should be locked and the key kept by the site manager for official use only.

- 3.9.1.7 Regular checking of the works site clearance area and the work site boundaries should be undertaken by resident site staff (RSS) to ensure that they are not breached and that damage does not occur to the surrounding areas. Any damage to the fencing should be repaired without delay.

Landscape and Visual

- 3.9.1.8 RSS will ensure adequate protection to be provided for all retained trees and those ready for transplant.

Cultural Heritage

- 3.9.1.9 In terms of built heritage, mitigation measures are required for nine built heritage resources: Tai Wong Yeh shrine (HH-01), Che Kung Temple (HH-02), earth god shrines (HH-03 and HH-04), milestones (HH-07 and HH-08), commemorative stone tablet (HH-09), village arch (HH-10) and grave G1. The details of the mitigation measures are presented in **Table 3.7.3** and **Table 3.7.4**. The implementation of these mitigation measures will need to be audited as part of the EM&A programme during the pre-construction and construction phases to ensure that they are appropriately implemented.
- 3.9.1.10 In terms of terrestrial archaeology, no areas of archaeological potential have been identified and no impacts are predicted and no construction phase EM&A is recommended. However, as a precautionary measure, it is recommended that if any antiquity or supposed antiquity is discovered during the course of the excavation works undertaken by the contractor, the discovery shall be reported to the AMO immediately and all necessary measures taken to preserve it.

3.9.2 Operational Phase EM&A Programme

Air Quality

- 3.9.2.1 As no adverse residual impacts are predicted during the operational phase no EM&A is considered to be required and none is proposed.

Noise

- 3.9.2.2 In order to verify the effectiveness of the noise barriers, it was recommended in FS-RES that the top floors of a Marina Cove NSR and a Luk Mei Village NSR are the monitoring locations for operational traffic noise monitoring and this is still considered valid.

Ecology

- 3.9.2.3 No operational phase ecological EM&A is recommended.

Landscape and Visual

- 3.9.2.4 HyD's maintenance division is responsible to carry out monitoring all street furniture, road and all soft landscape at regular interval during operational phase.

Cultural Heritage

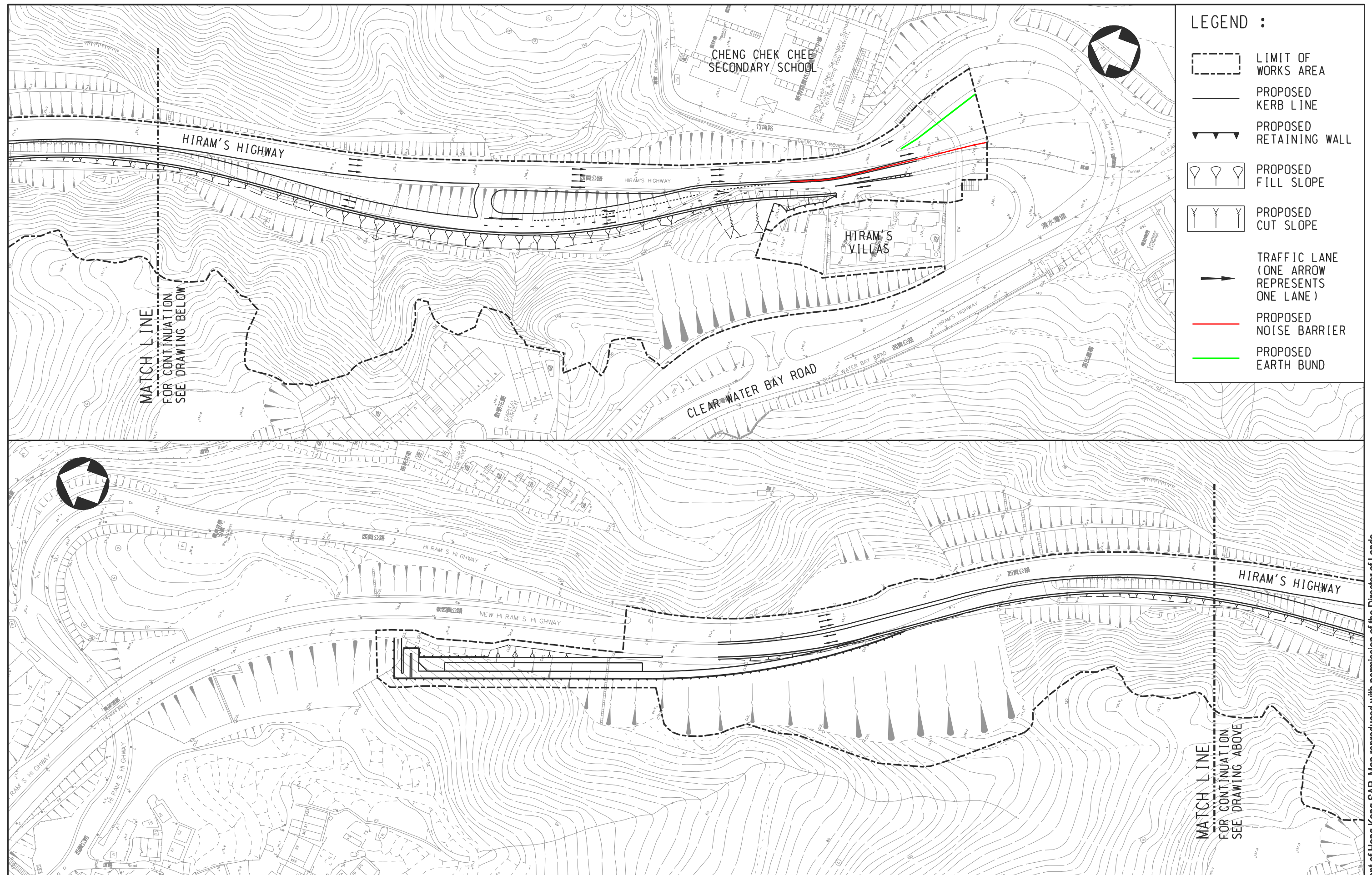
- 3.9.2.5 No operational phase cultural heritage EM&A is recommended.

Figures

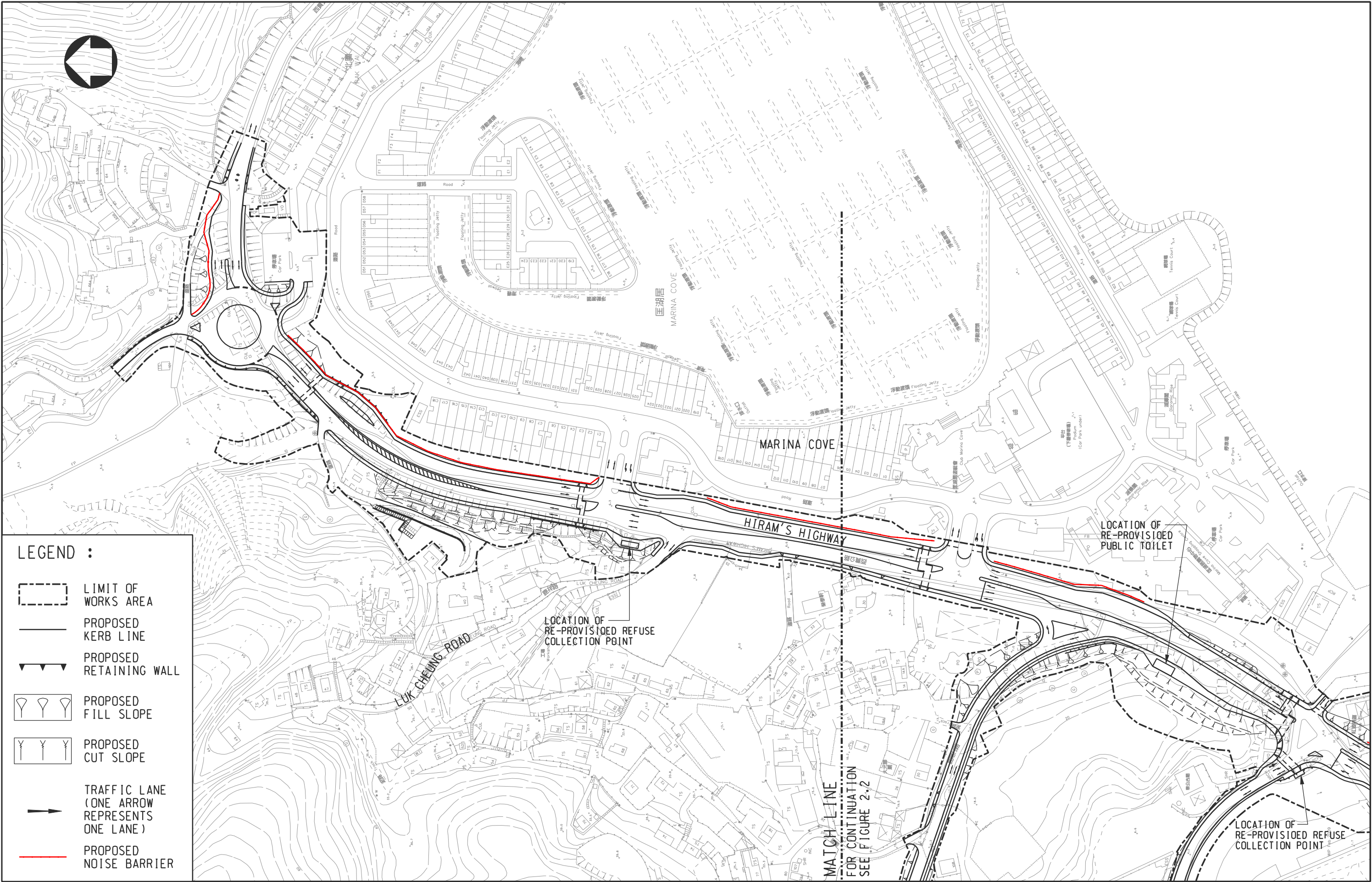
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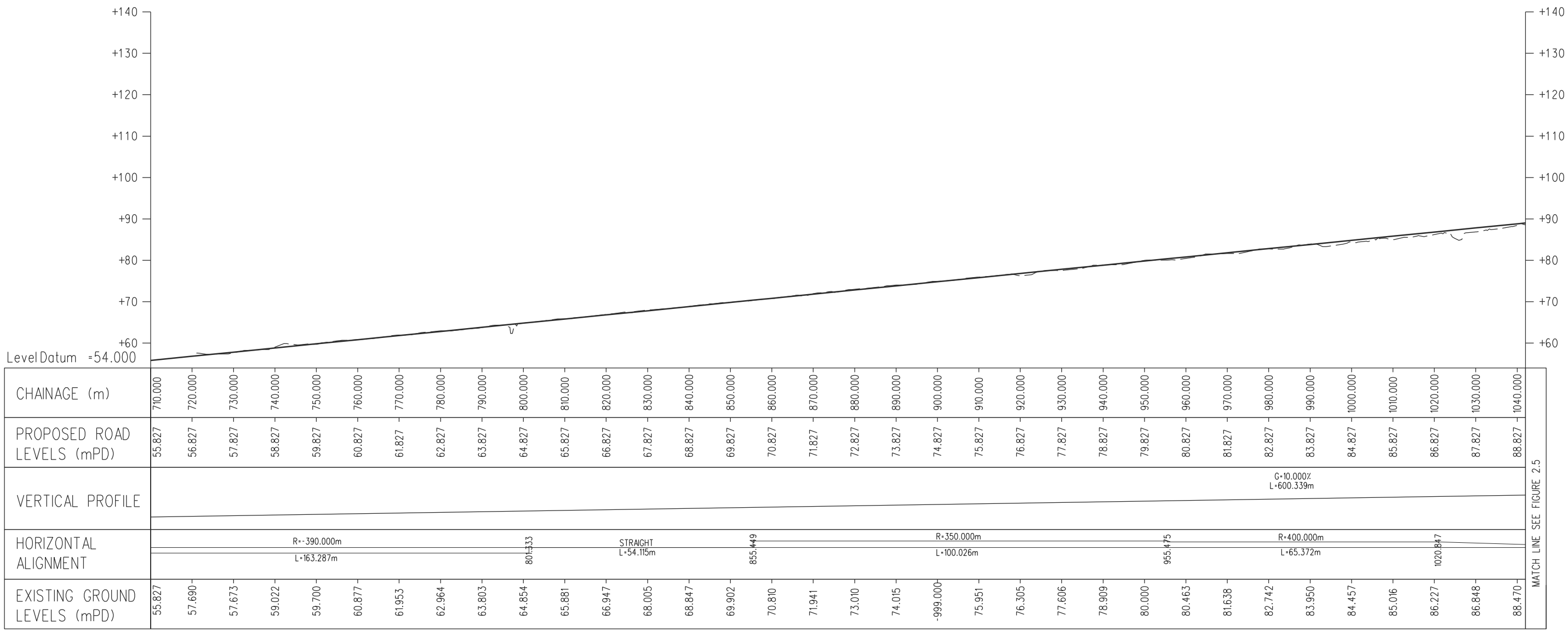
**Dualling of Hiram's Highway between Clear Water Bay Road
and Marina Cove and Improvement to Local Access To Ho Chung
– Design and Construction**

Engineering Review Report (Final)

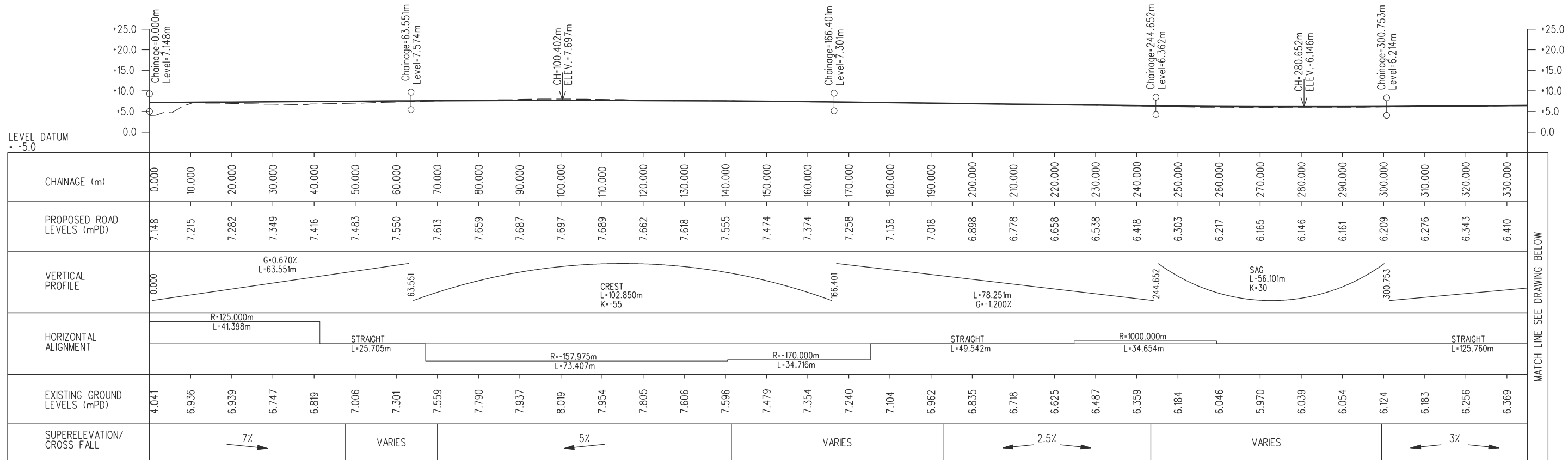


- LEGEND :
- LIMIT OF WORKS AREA
 - PROPOSED KERB LINE
 - PROPOSED RETAINING WALL
 - PROPOSED FILL SLOPE
 - PROPOSED CUT SLOPE
 - TRAFFIC LANE (ONE ARROW REPRESENTS ONE LANE)
 - PROPOSED NOISE BARRIER
 - PROPOSED EARTH BUND





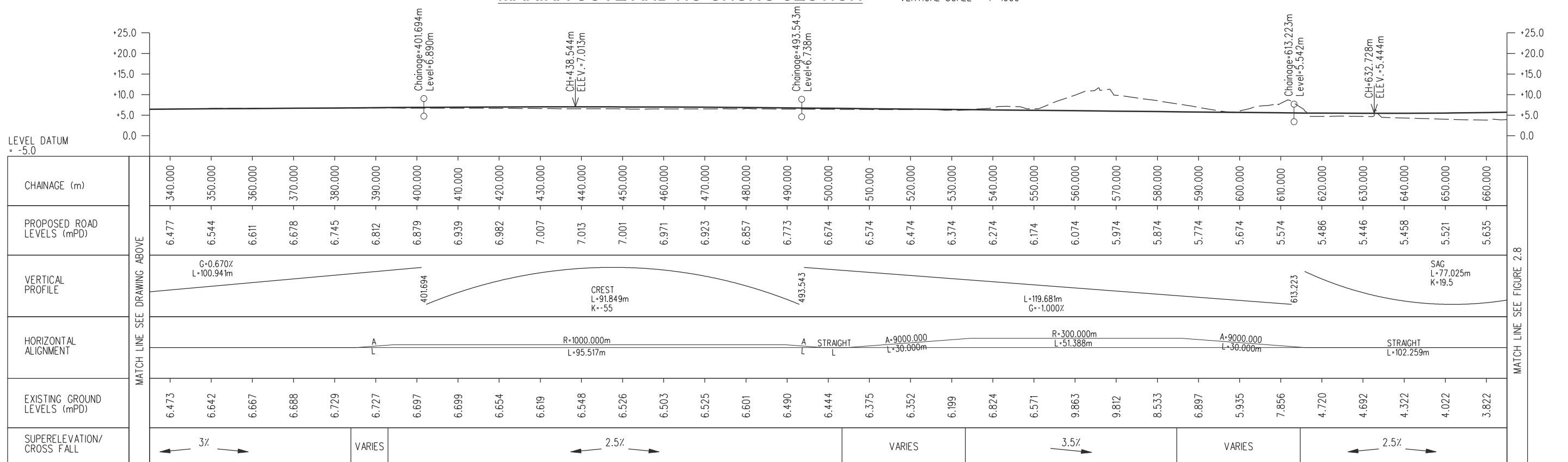
HIRAM'S VILLAS SECTION HORIZONTAL SCALE 1 : 1000
VERTICAL SCALE 1 : 1000



MARINA COVE AND HO CHUNG SECTION

HORIZONTAL SCALE 1: 1000
VERTICAL SCALE 1: 1000

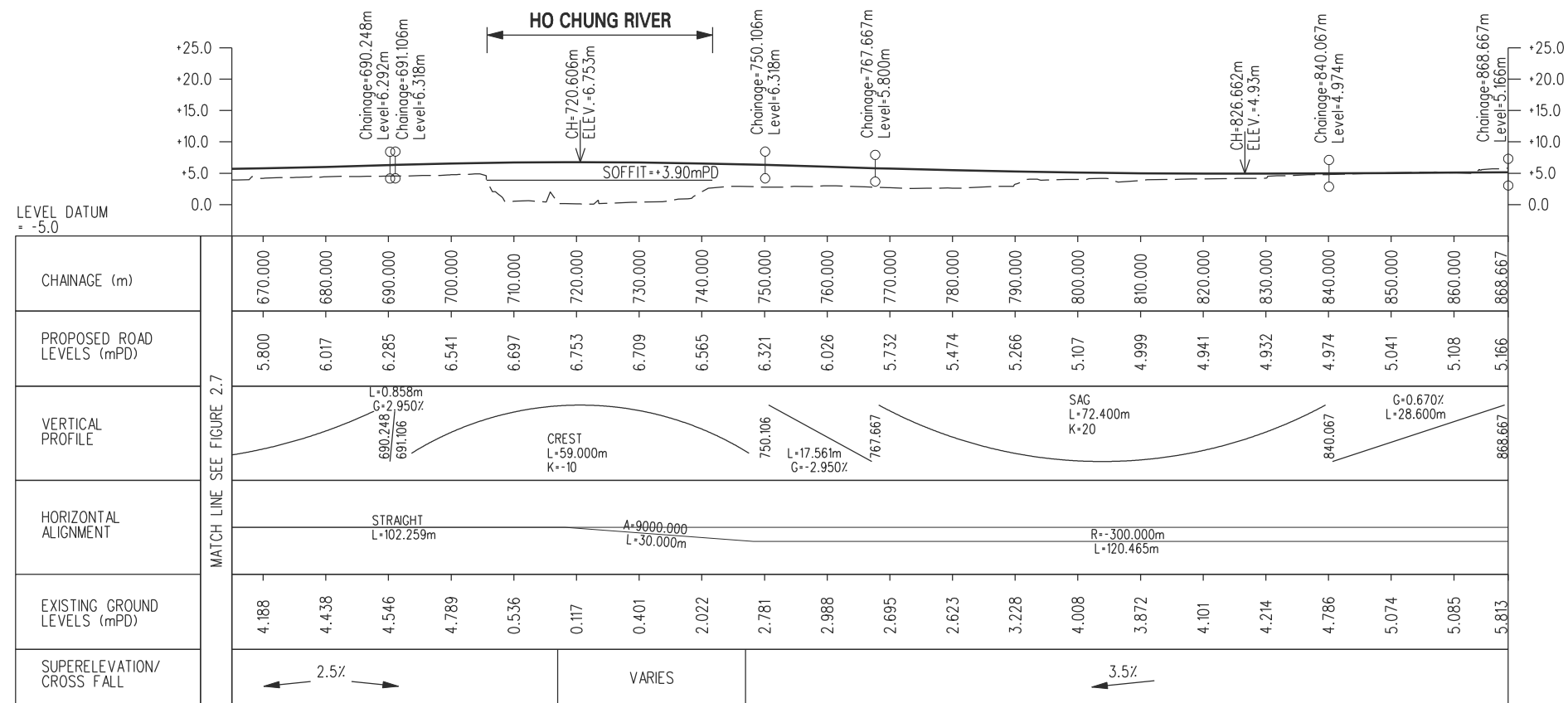
DESIGN SPEED : 50 km/h



MARINA COVE AND HO CHUNG SECTION

HORIZONTAL SCALE 1: 1000
VERTICAL SCALE 1: 1000

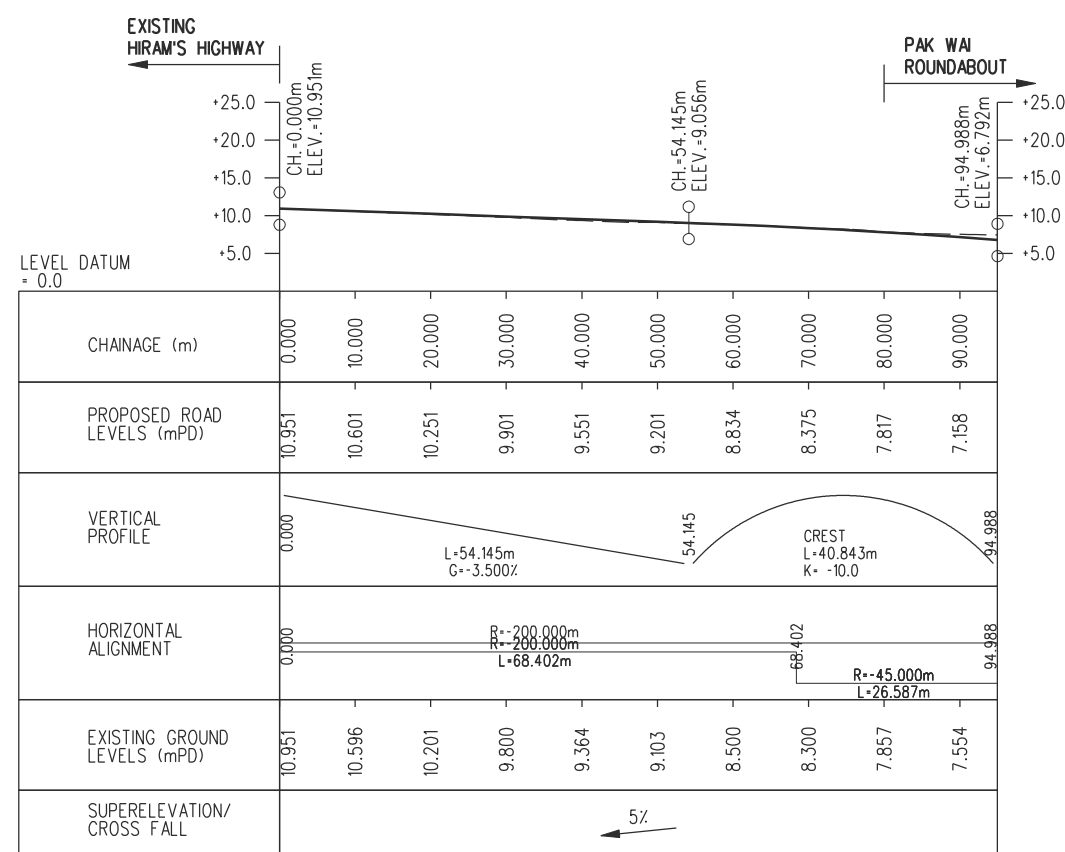
DESIGN SPEED : 50 km/h



MARINA COVE AND HO CHUNG SECTION

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:1000

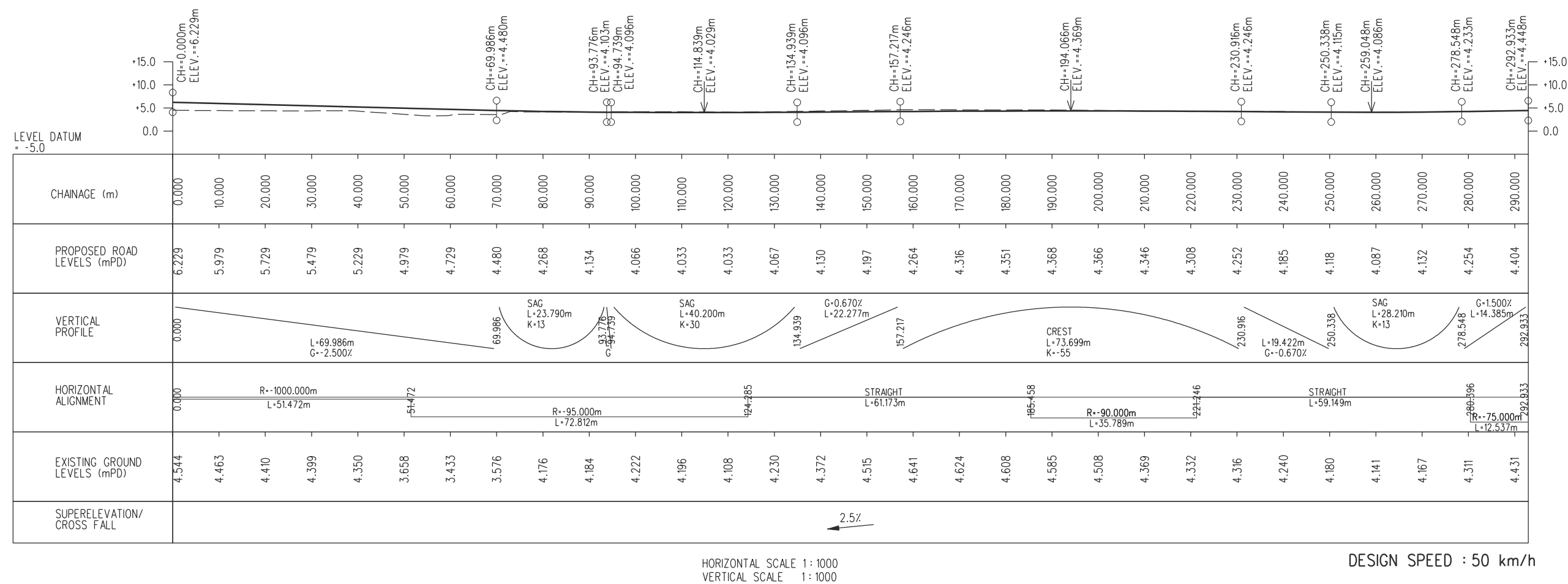
DESIGN SPEED : 50 km/h



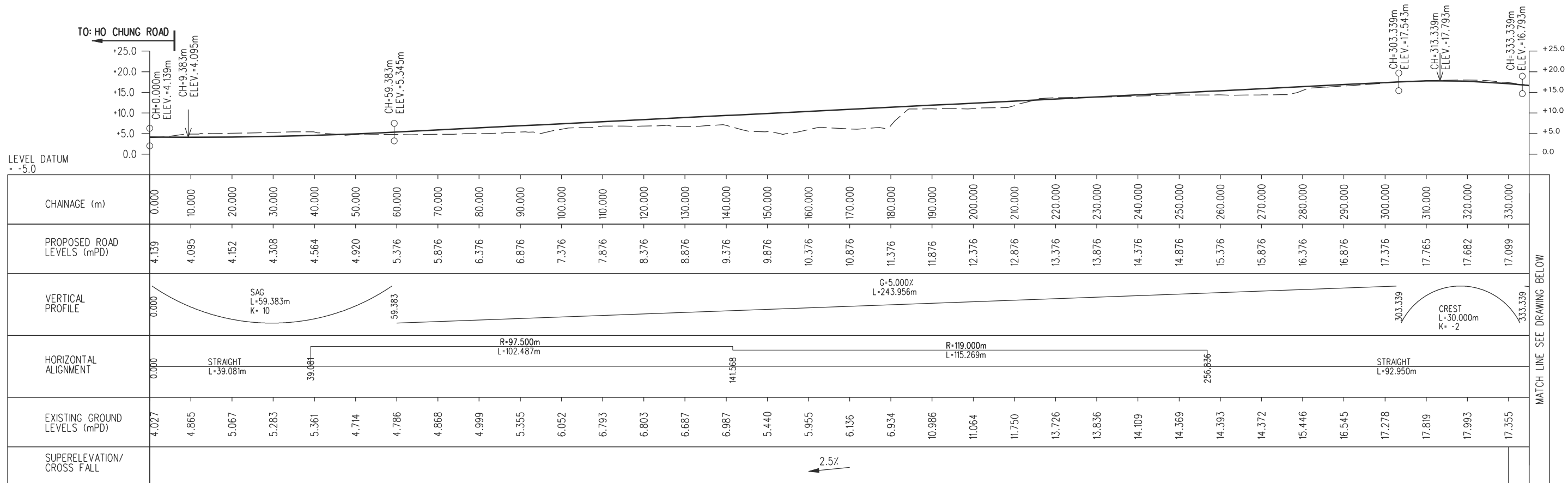
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:1000

DESIGN SPEED : 50 km/h

VERTICAL PROFILE OF HIRAM'S HIGHWAY (EAST OF PROPOSED PAK WAI ROUNDABOUT)



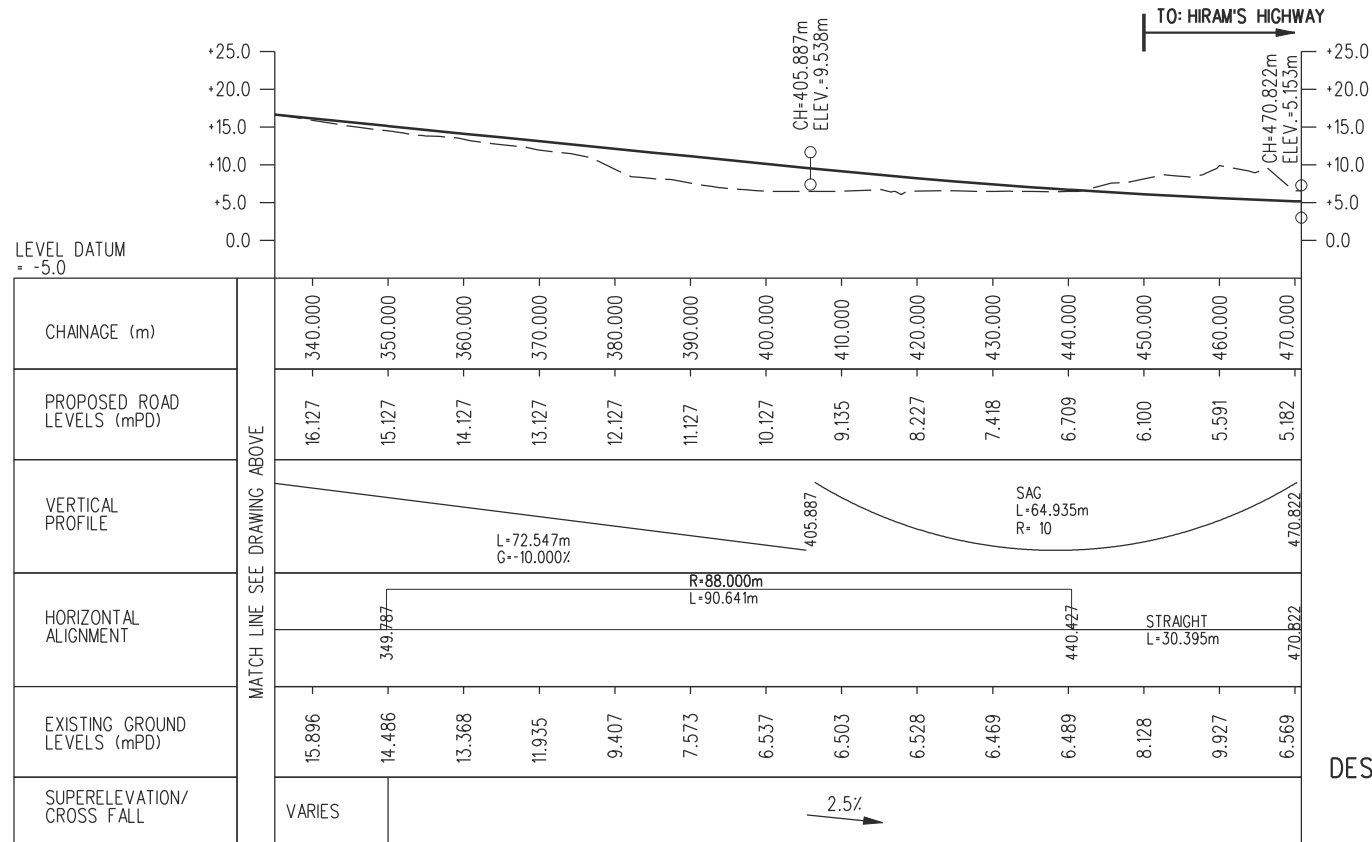
HO CHUNG ROAD



ACCESS ROAD

HORIZONTAL SCALE 1 : 1000
VERTICAL SCALE 1 : 1000

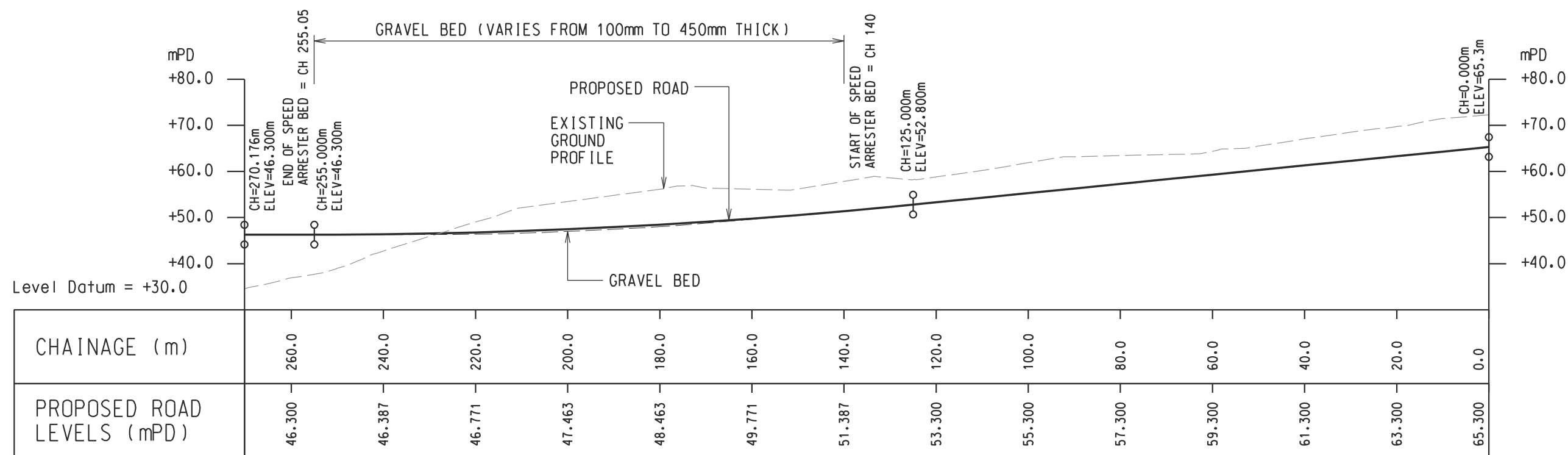
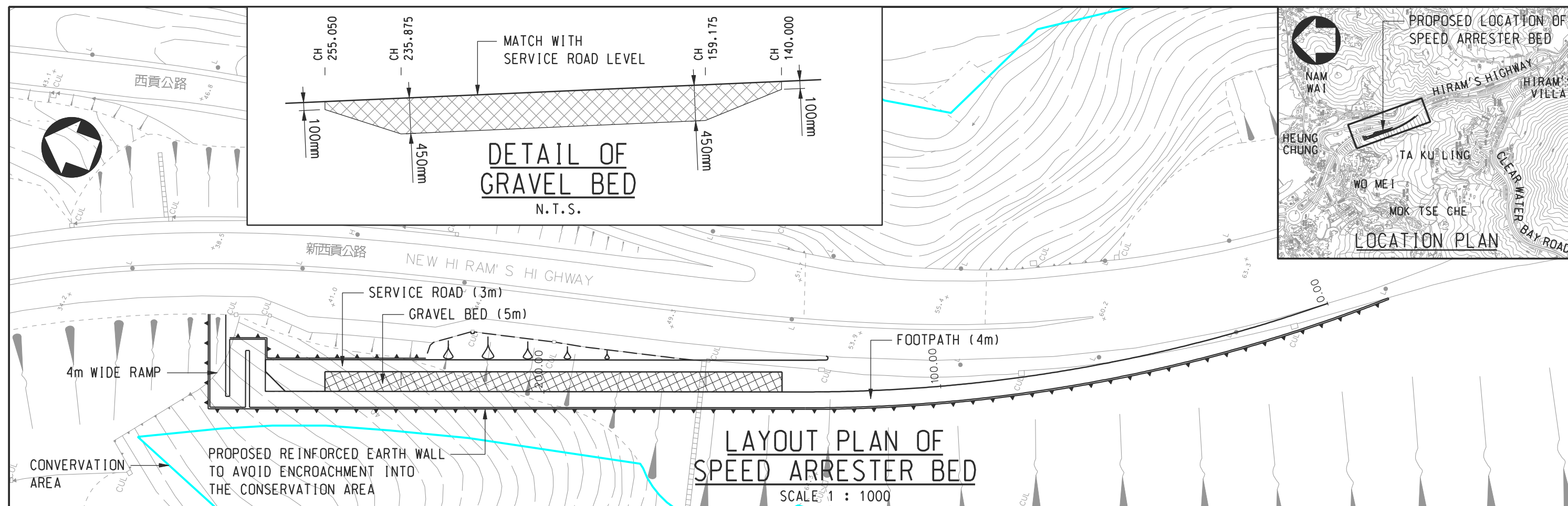
DESIGN SPEED : 50 km/h



DESIGN SPEED : 50 km/h

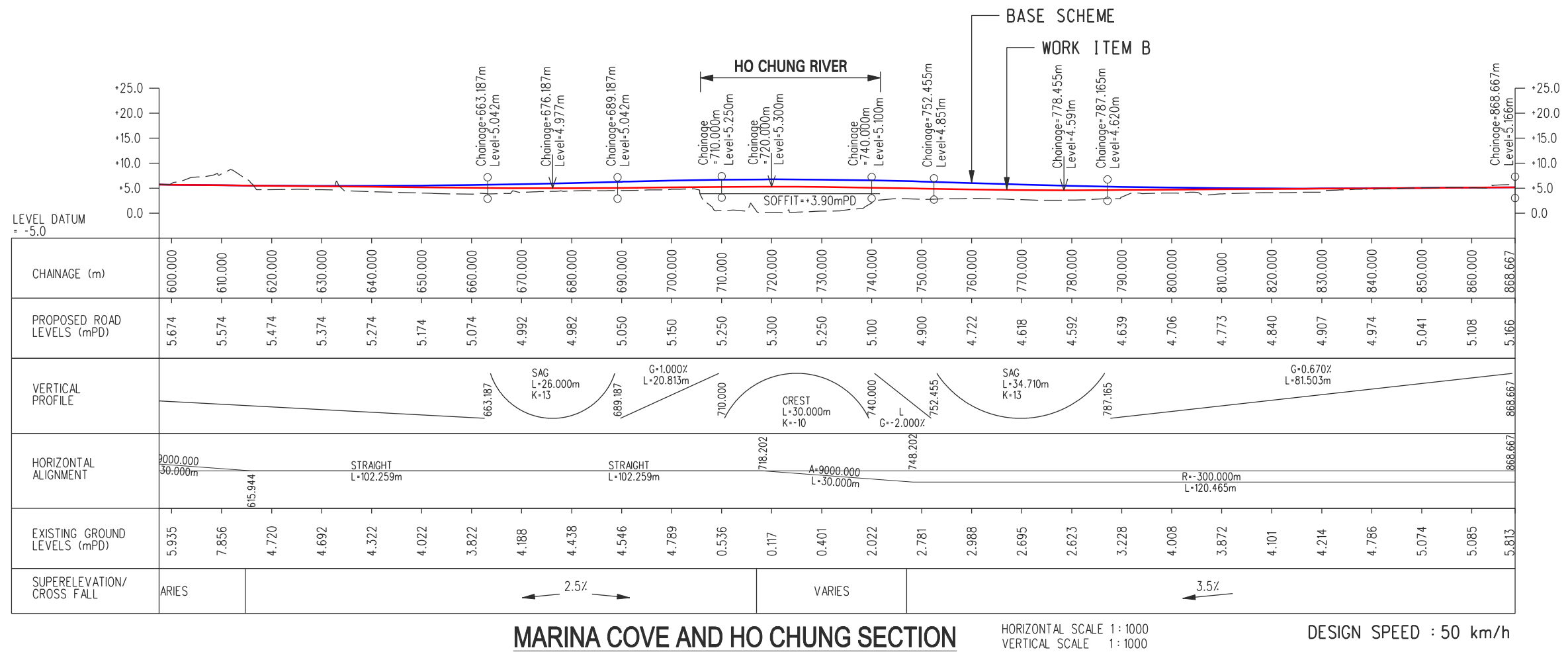
ACCESS ROAD

HORIZONTAL SCALE 1 : 1000
VERTICAL SCALE 1 : 1000

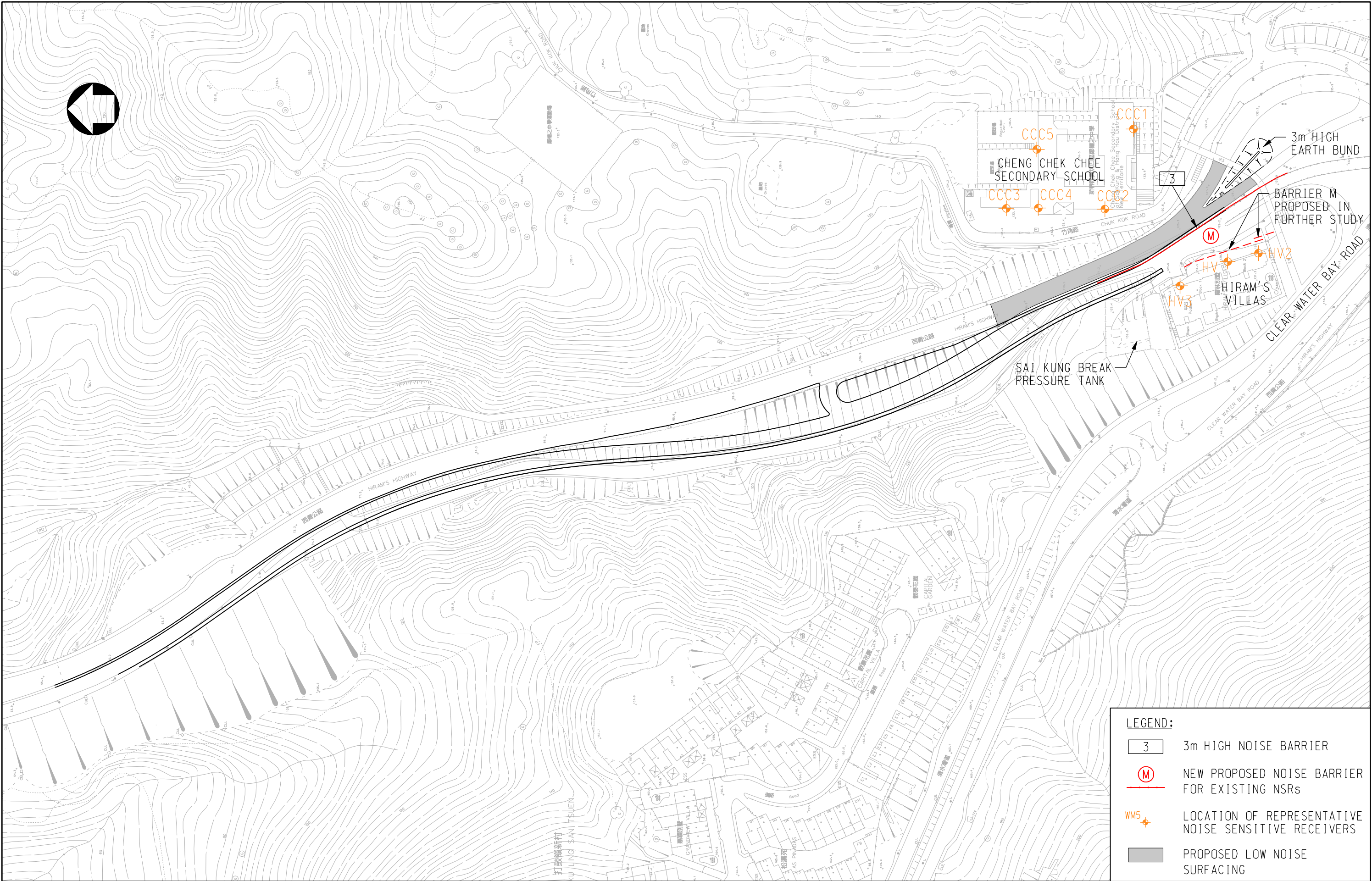


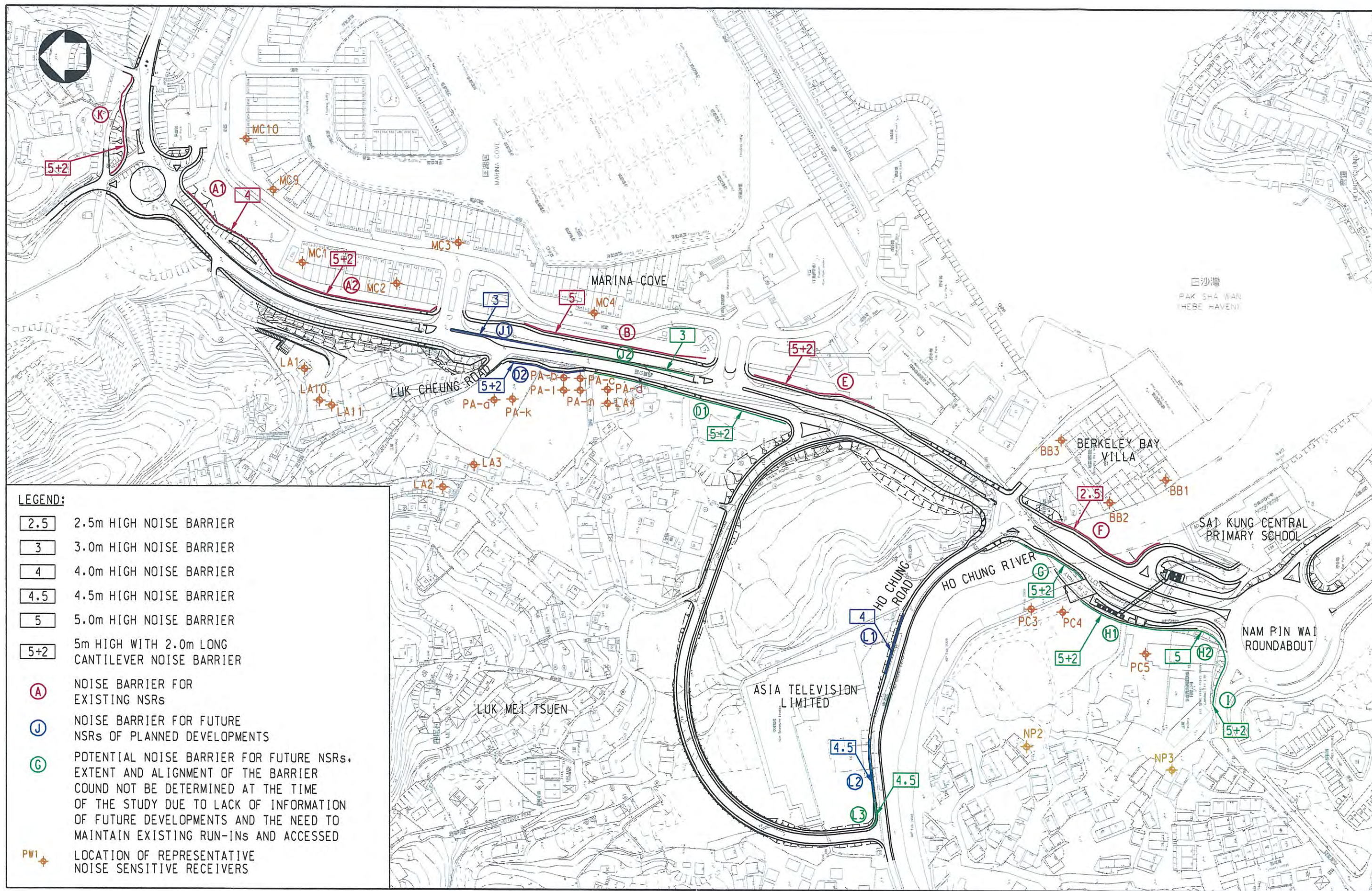
LONGITUDINAL SECTION OF SPEED ARRESTER BED

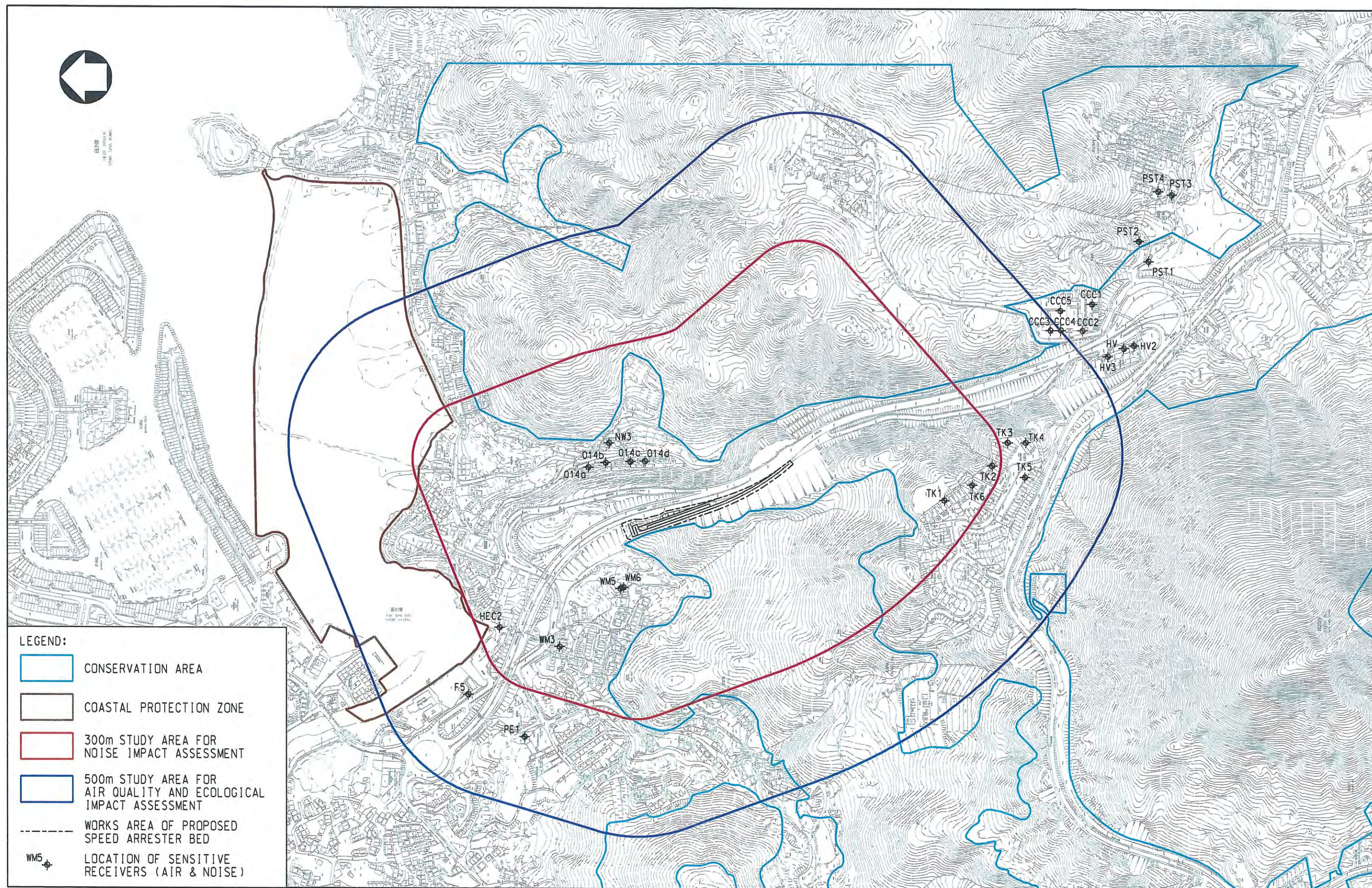
HORIZONTAL SCALE 1 : 1000
VERTICAL SCALE 1 : 1000

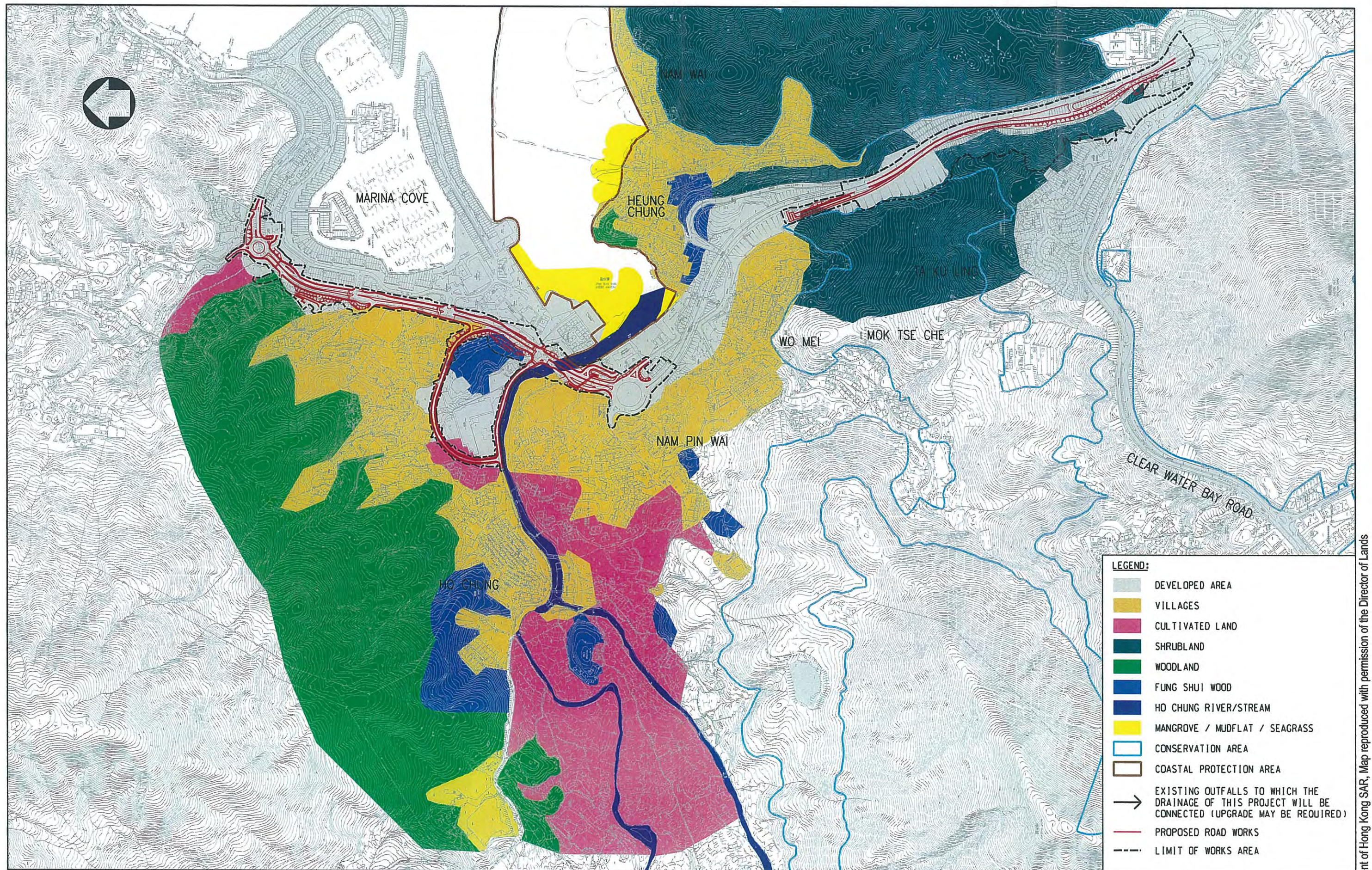


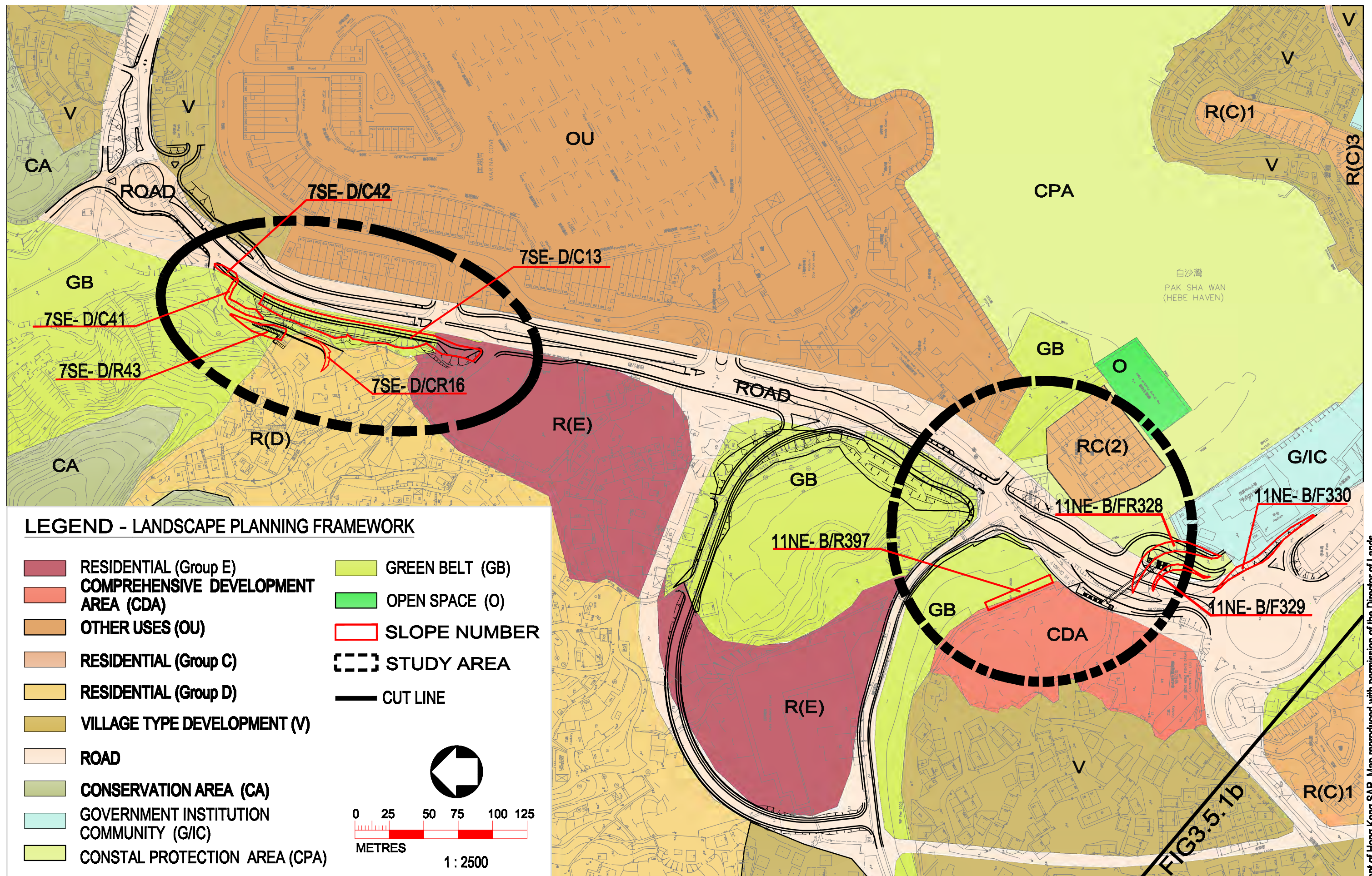
PEN TABLE : K:_STANDARD\MICROSTATION\PILOT\MEL.TBL
PLOT DRIVER : K:\91295 Hiram's Highway Stage 1D&C\CAD ADMIN\A3_colour V8i.plt

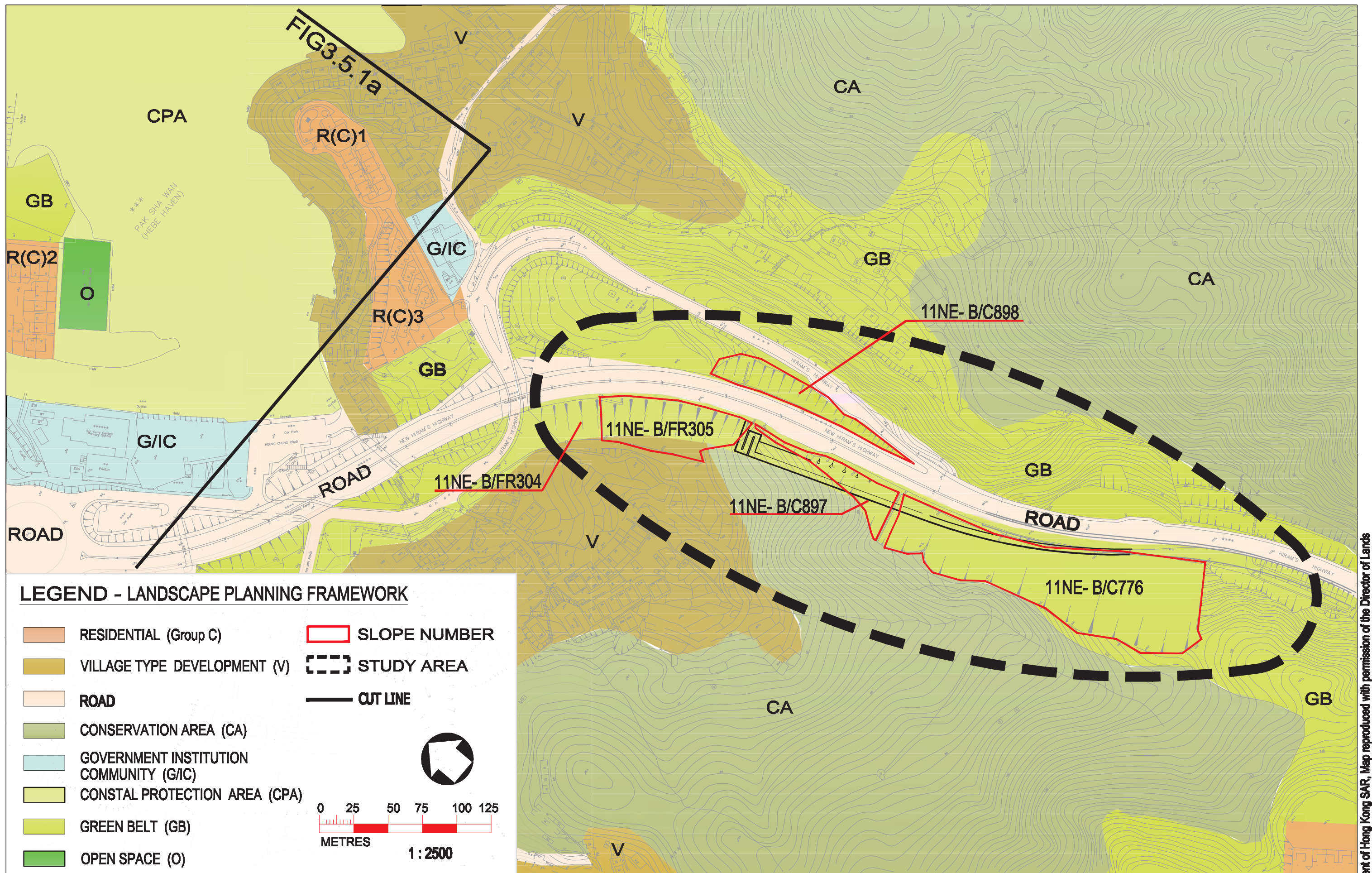


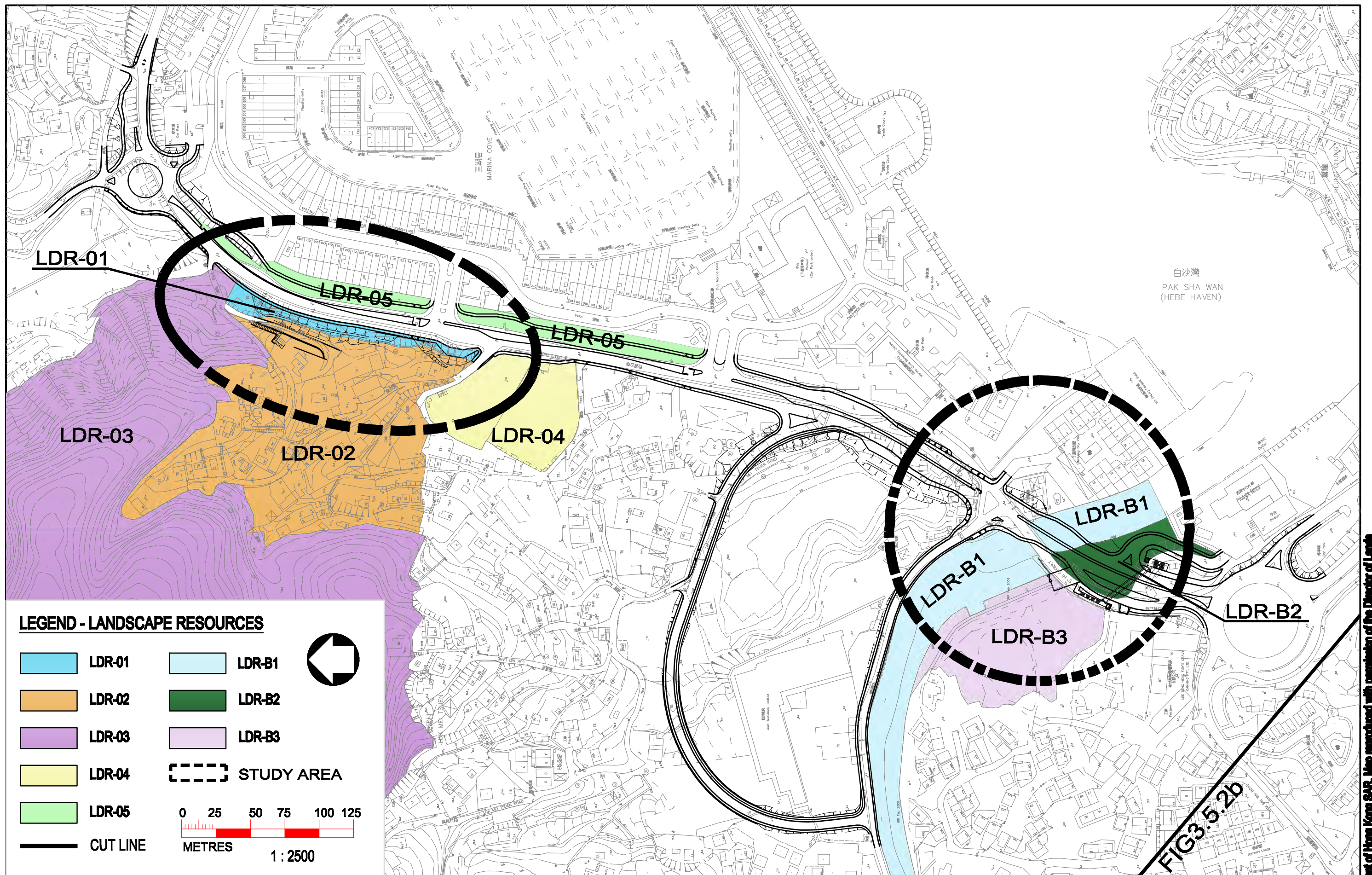












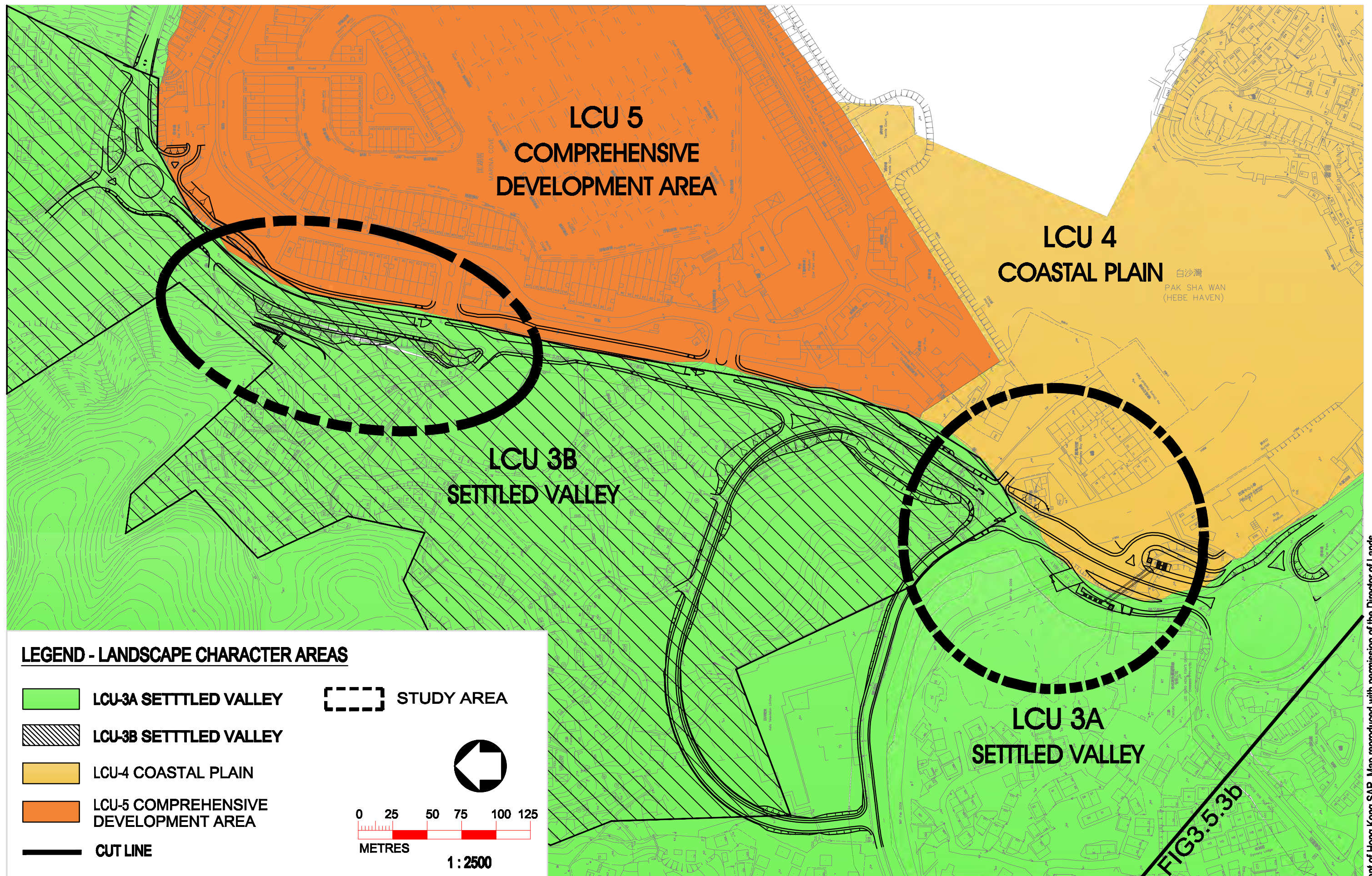
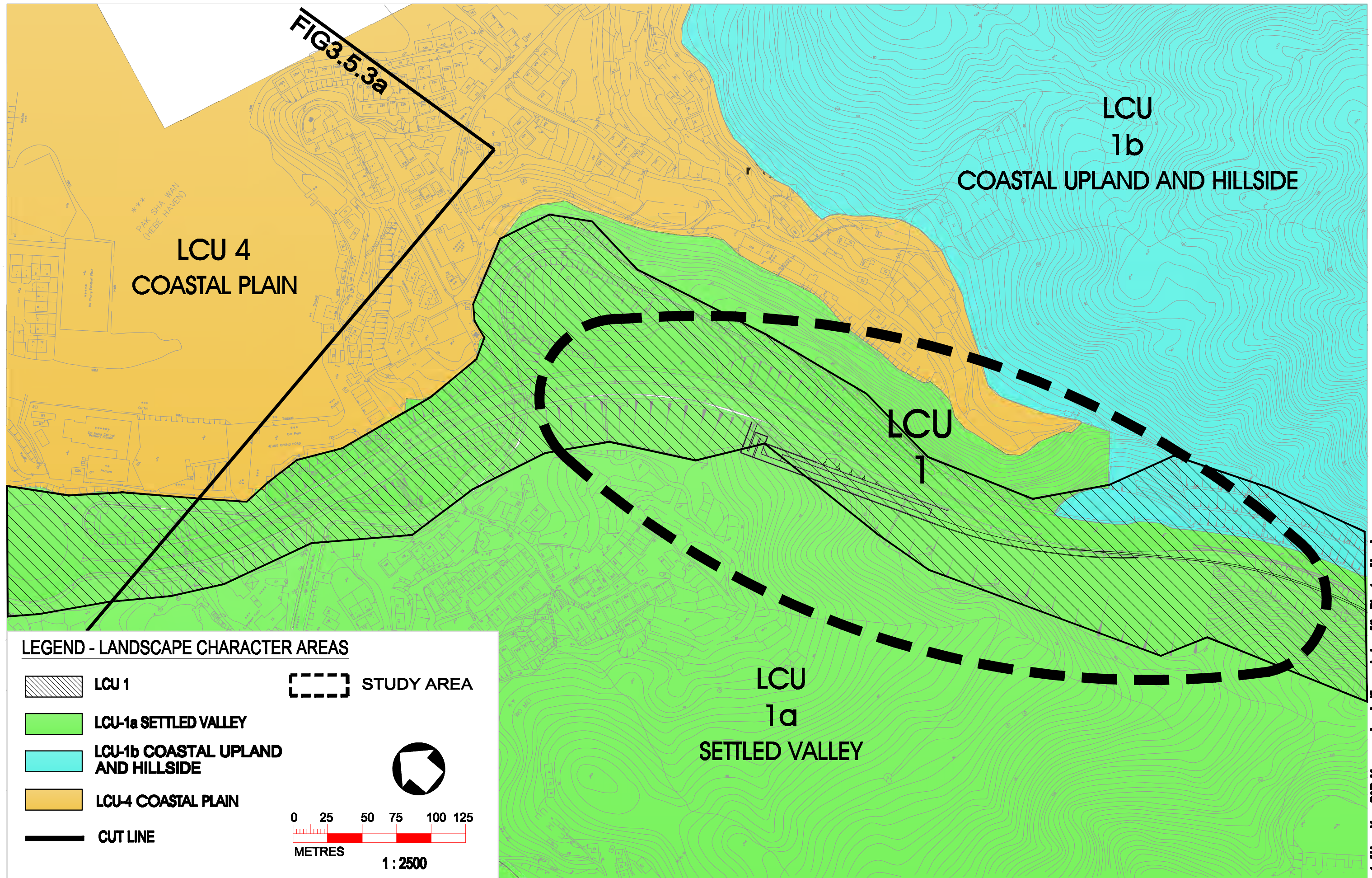


FIG3.5.3a



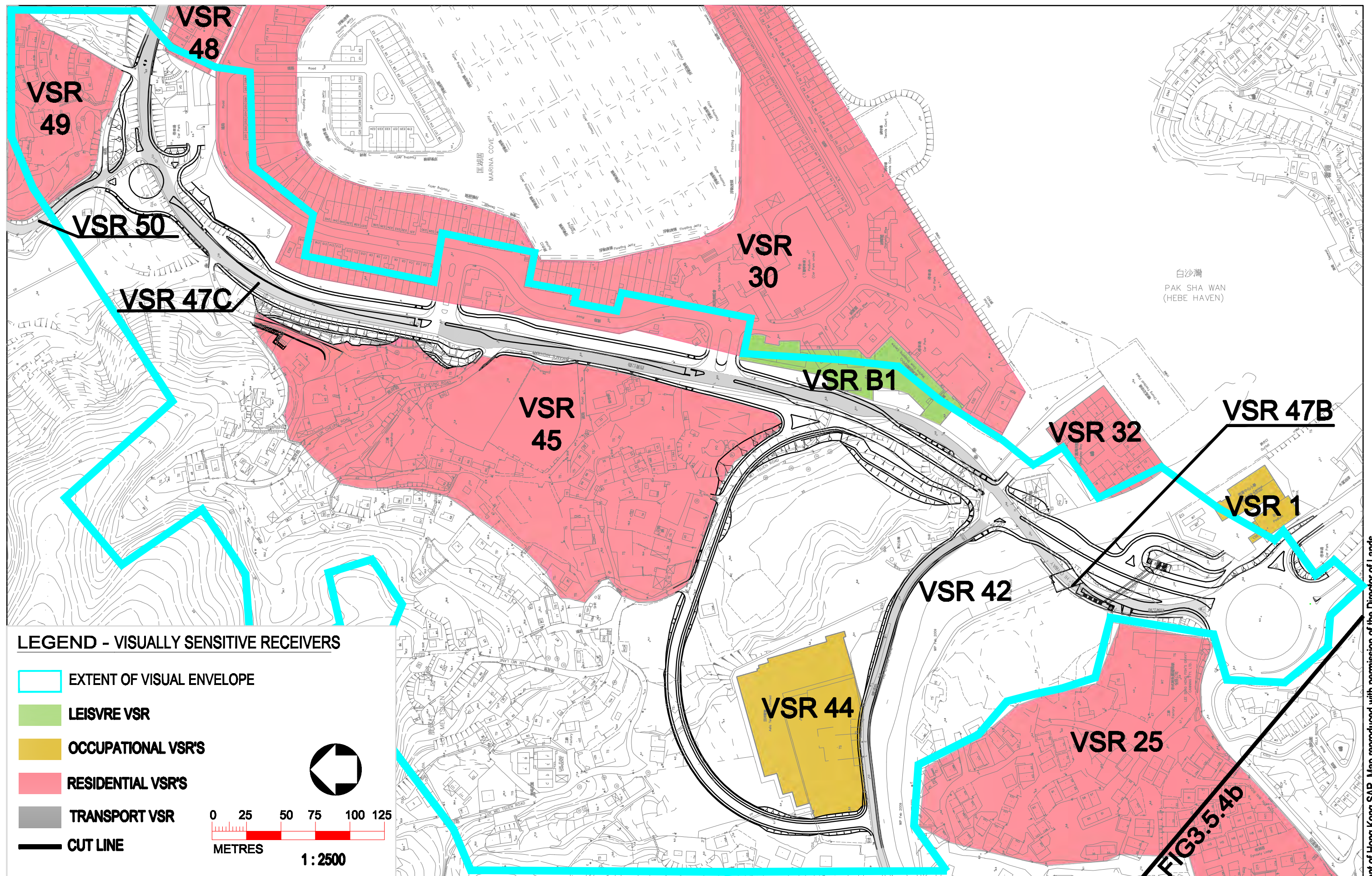
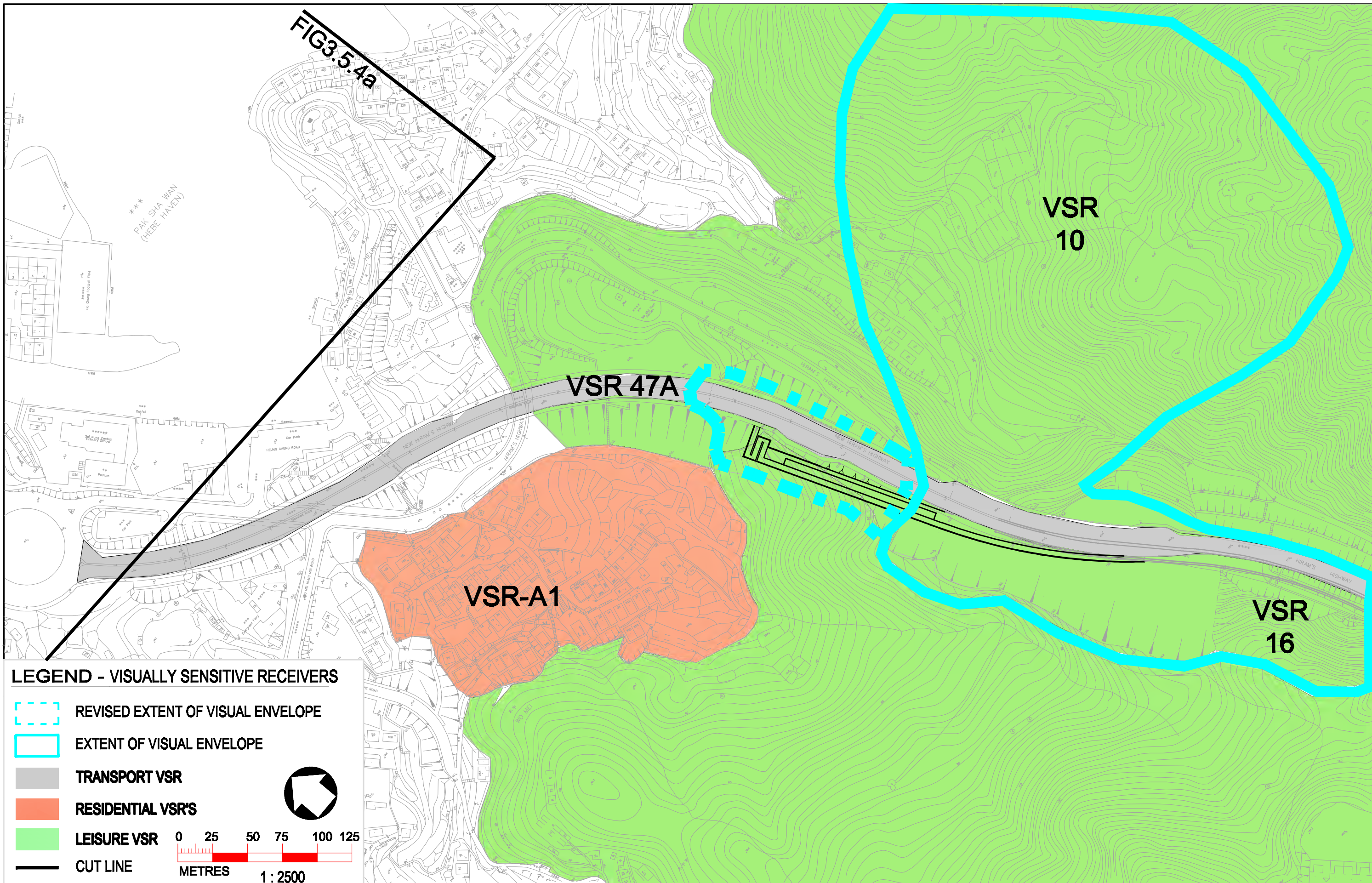




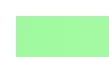



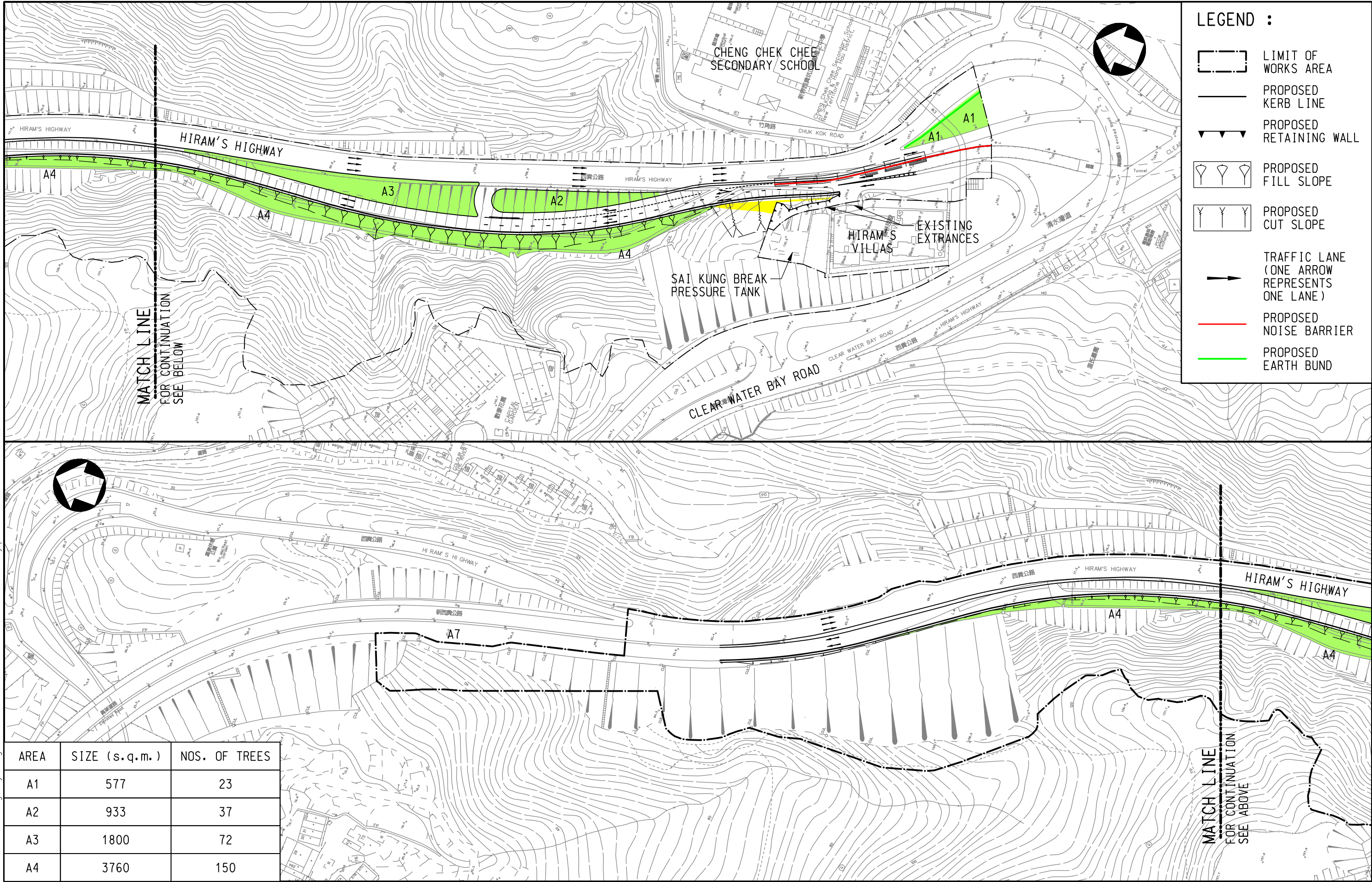
FIG3.5.4a



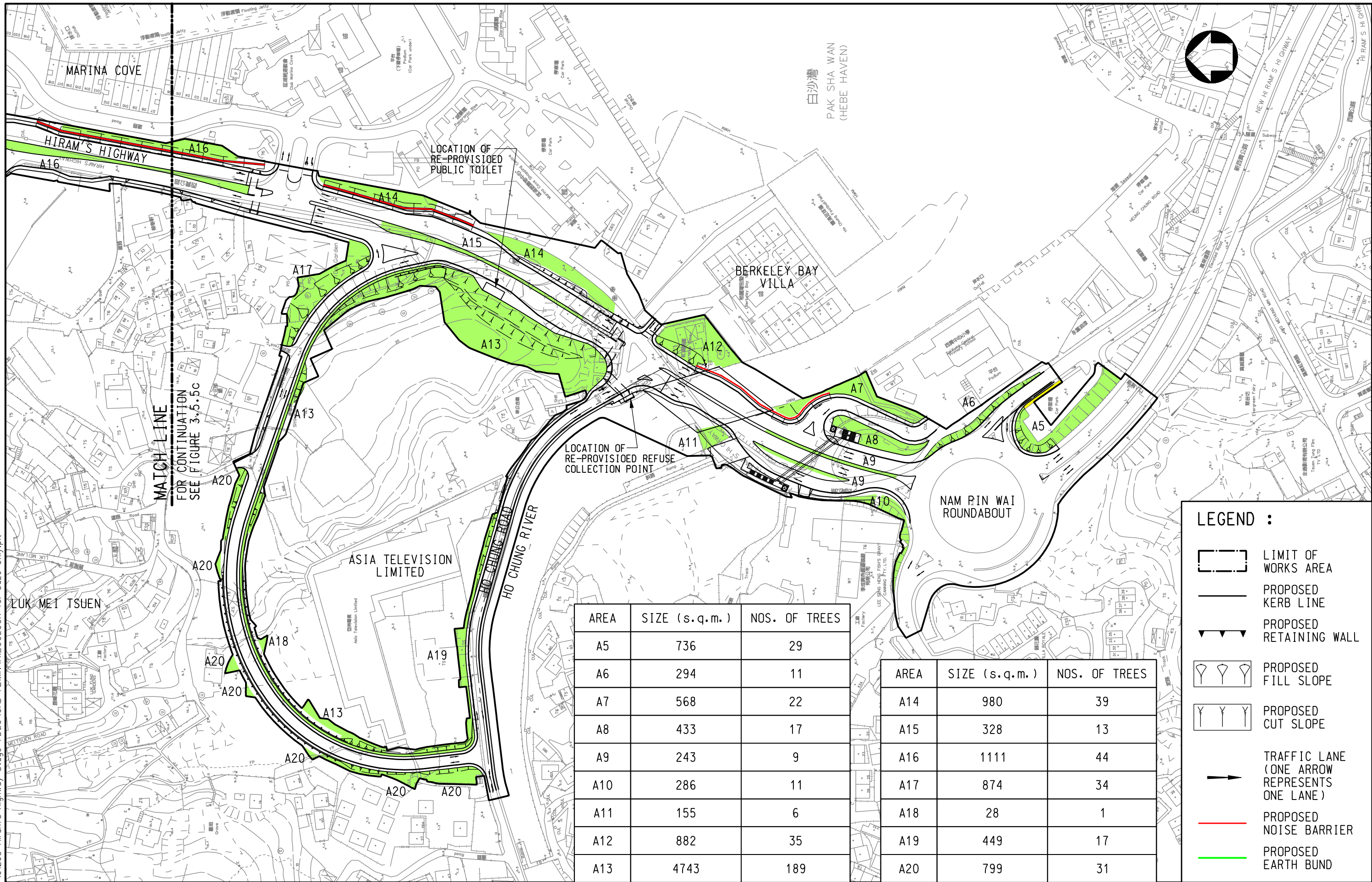
LEGEND - VISUALLY SENSITIVE RECEIVERS

-  REVISED EXTENT OF VISUAL ENVELOPE
 -  EXTENT OF VISUAL ENVELOPE
 -  TRANSPORT VSR
 -  RESIDENTIAL VSR'S
 -  LEISURE VSR
 -  CUT LINE
- 0 25 50 75 100 125
METRES
1 : 2500

PEN TABLE : K:_STANDARD\MICROSTATION\PILOT\MIEL.TBL
PLOT DRIVER : K:\91295 Hiram's Highway Stage 1 D&C\CAD ADMIN\A1 COLOUR for Gaze Only.plt



PEN TABLE : K:_STANDARD\MICROSTATION\PILOT\MEL.TBL
PLOT DRIVER : K:\91295 Hiram's Highway Stage 1 D&C\CAD ADMIN\A1 COLOUR for Gaze Only.plt



PEN TABLE : K:_STANDARD\MICROSTATION\PLT\MIEL.TBL
PLOT DRIVER : K:\91295 Hiram's Highway Stage 1D&C\CAD ADMIN\A1_COLOUR for Gaze Only.plt

