

DRAINAGE SERVICES DEPARTMENT  
THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION

**Agreement No. CE 50/2001**

**Drainage Improvement in Sha Tin and Tai Po -  
Design and Construction**

**Drainage Improvement Works in  
Upper Tai Po River**

**Project Profile**

**June 2005**

Maunsell Consultants Asia Ltd.

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## 1. BASIC INFORMATION

### Project Title

- 1.1 The title of this project is known as “Agreement No. CE50/2001 Drainage Improvement in Sha Tin and Tai Po”.

### Purpose and Nature of the Project

- 1.2 Upon completion of the Sha Tin and Tai Po Drainage Master Plan (DMP) Study, Drainage Services Department (DSD) of the Hong Kong SAR Government commissioned Maunsell Consultants Asia Ltd. (Maunsell) to undertake Agreement No. CE50/2001 (DS) Drainage Improvement in Sha Tin and Tai Po – Design and Construction (hereinafter referred to as “the Assignment”), for implementing the drainage improvement works at various locations to alleviate the potential flooding problems in Sha Tin and Tai Po districts.
- 1.3 Amongst various project work items as proposed under the Assignment, the drainage improvement works proposed at Upper Tai Po River (hereinafter referred to as “the Project”) is classified as a designated project under I.1(b)(ii) in Schedule 2 Part 1 of the Environmental Impact Assessment Ordinance (EIAO) (Cap. 499) in the category of ‘a *drainage channel or river training and diversion works which discharges or discharge into an area which is less than 300m from the nearest boundary of an existing or planned site of cultural heritage*’. (details refer to **Section 1.8**)

### Name of Project Proponent

- 1.4 The Project Proponent is Consultants Management Division of Drainage Services Department (DSD) of the Hong Kong SAR Government.

### Location and Scale of Project

- 1.5 The Upper Tai Po River starts from Ta Tit Yan of Tai Mo Shan and flows from southwest to northeast alongside the Wilson Trail, with the watercourse flowing northward joining the Lam Tsuen River towards Tai Po Market. Both active and abandoned cultivated lands are found to the east of Upper Tai Po River. Village settlements, including those located at San Uk Ka and Lai Chi Shan, are mainly established on the west and northeast bank of the river channel.
- 1.6 It is proposed that approximately 0.6km of the Upper Tai Po River will be improved to enhance the hydraulic performance of the river. The improvement works comprise the re-profiling of the channel and realignment of the channel at the upstream, inclusion of gabions for bank protection whilst providing a natural channel bed. The design of the improvement works has taken the guidelines stipulated in the DSD Technical Circular No. 2/2004 “Protection of natural rivers and streams from adverse Impacts arising from construction works” and ETWB TC (W) No. 5/2005 ‘Protection of natural streams/rivers from adverse impacts arising from construction works’ into account. Of the 0.6km long proposed works, improvement to only one half of the river will be applied to about 0.15km long river in response to the views gathered from Environmental Protection Department (EPD), Agriculture, Fisheries and Conservation Department (AFCD) and the local Green Groups during previous consultations and site visits, leaving the remaining half of the river untouched to preserve the natural habitats. Re-provisioning of footbridges and footpaths would also be included in the proposed improvement works.
- 1.7 To ensure an adequate hydraulic capacity of the Upper Tai Po River, the proposed improvement works should be connected and discharged to the existing channelised section of Tai Po River located at Sheung Wun Yiu. **Drawing No. 1.1** shows the location plan of the Project and **Drawing No. 1.2** shows the general layout of the Project.



### **Number and Types of Designated Project Covered by the Project Profile**

- 1.8 In accordance with Category I.1(b)(ii) of Part 1, Schedule 2 of the EIAO, works proposed at any river channel which discharges into an area which is less than 300m from the nearest boundary of an existing site of cultural heritage would be classified as a designated project. The concerned section of Upper Tai Po River would discharge into an area which would be less than 300m from two sites of cultural heritage, namely the Wun Yiu Pottery Kilns and Fan Sin Temple, both of which are declared monuments under the *Antiquities and Monuments Ordinance*. Hence, the Project is classified as a designated project under the EIAO. Locations of these two sites of cultural heritage are illustrated in **Drawing No. 3.1**.

### **Name and Telephone Number of Contact Person(s)**

- 1.9 All queries regarding the Project can be addressed to the project proponent:

Project Engineer: Mr. C. M. Chan  
Post: Engineer/Consultants Management 4  
Department: Drainage Services Department  
Division: Consultants Management Division  
Location: 42/F, Revenue Tower, Wanchai  
Tel: 2594 7268  
Fax: 2827 8526  
Email: [lcmchan@dsd.gov.hk](mailto:lcmchan@dsd.gov.hk)

## **2. OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME**

### **Implementation and Planning of the Proposed Project**

- 2.1 The design and supervision of the construction works for the Project will be carried out by Maunsell as part of the Assignment. The proposed works will be implemented by Contractor(s) to be appointed by the Project Proponent, DSD, who will then be responsible for the operation and maintenance of the completed drainage works.

### **Tentative Project Timetable**

- 2.2 The preliminary design of the proposed works was completed in mid 2003 and the detailed design will be completed by mid 2006.
- 2.3 Construction of the proposed drainage works is scheduled to commence in October 2006 and for completion by end 2009. A preliminary construction programme is given in **Drawing No. 2.1**.

### **Interactions with Other Projects**

- 2.4 No other major project is identified to be carried out concurrently in the vicinity of the proposed drainage improvement works in Upper Tai Po River.

### 3. MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

#### Description of Major Elements of the Surrounding Environment

- 3.1 The environmental assessments covering the areas in the vicinity of the Project site include cultural heritage, noise, air quality, water quality, waste management, ecology and landscape and visual resources.

#### *Cultural Heritage*

- 3.2 Two sites of cultural heritage (Declared Monuments) were identified within 300m of the proposed work areas, as described below. **Drawing No. 3.1** shows their relevant locations.

#### Remains of a Pottery Kiln at Wun Yiu Village

- 3.3 Pottery kilns began operating at this site during the late Ming Dynasty. The families associated with the kilns were the Man and Tse clans. Operations ceased during the Coastal Evacuation, but were resumed after resettlement by the Ma clan. The kilns continued the operation until 1932, when they were forced to close because of increased competition from other kilns in Guangdong that were manufacturing inexpensive porcelain. The site became a Declared Monument in 1983<sup>1</sup>.

#### Fan Sin Kung Temple at Sheung Wun Yiu

- 3.4 The temple was built in the late 18<sup>th</sup> century. It is the only temple in Hong Kong dedicated to Fan Sin, who represents the three brothers according to legend and were the first to use clay to make earthen wares. It underwent an extensive renovation in 2000 and was a Declared Monument in the same year<sup>1</sup>.

#### *Ecology*

- 3.5 The drainage improvement works would not affect any sites of recognised conservation importance (e.g., the nearest Tai Mo Shan Country Park is over 130m away). The proposed works would, however, affect the Upper Tai Po River which falls under the definition of an important habitat, under Appendix A, Annex 16, of the *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM), being "over 100 metres of natural stream course or river of significant length". As such, an ecological assessment is required for the proposed works, as stipulated in Appendix A, Annex 16 of the *EIAO-TM*.
- 3.6 Ecological baseline for the proposed works area and adjacent habitats up to 500m from the works boundary (hereafter referred to as the Study Area) was determined through a review of relevant literature and field surveys. Ecological surveys of the Study Area were conducted from August 2002 to July 2003, comprising habitat/vegetation, avifauna, herpetofauna/mammals, terrestrial insects and freshwater community surveys. Surveys were conducted by direct observation, listening for calling animals, searching potential micro-habitats and trapping/netting aquatic fauna. Further to these surveys, a joint site visit to the Upper Tai Po River was conducted in conjunction with several local Green Groups in October 2004 to discuss potential ecological impacts and proposed mitigation measures.
- 3.7 A habitat map of the Study Area is presented in **Drawing No. 3.2**. Representative photographs of habitats are given in **Appendix 3.1**. Plant species recorded in the Study Area are listed in **Appendix 3.2**. Faunal species recorded in the Study Area are listed in **Appendix 3.3**. Key findings of the ecological surveys were as follows:

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<sup>1</sup> Antiquities and Monuments Office of the Leisure and Cultural Services Department, Hong Kong. *Wun Yiu Kiln Site and the Fan Sin Temple*, 2002.

- ♣ The middle sections of the Upper Tai Po River (including proposed works areas) were found to be relatively disturbed, modified and polluted, and were considered of moderate ecological value only. Upstream sections of the River (above the proposed works area) were found to be more natural, and were considered of high ecological value. Several bird, herpetofauna and fish species of conservation importance were recorded from the River, but mostly in upstream sections that would fall outside of the proposed works area.
- ♣ Hong Kong Newt (*Paramesotriton hongkongensis*) was recorded from the Upper Tai Po River, approximately 450m upstream of the proposed works area (i.e. above the proposed works area). Although the Newts are locally common in Hong Kong, this species has a restricted regional and global distribution, having only been recorded from Hong Kong and coastal Guangdong Province (Karsen *et al.*, 1998)<sup>2</sup>. The large, secure population of Newts in Hong Kong is therefore considered of potential global concern by Fellowes *et al.* (2002)<sup>3</sup>. Additionally, the Newts are a protected species under Hong Kong Legislation, being listed under the *Wild Animals Protection Ordinance, Cap. 170*.
- ♣ In total, 6 species of fish were recorded from the Upper Tai Po River. Four of these species are common and widespread in Hong Kong, and are not considered of conservation importance. The other two (*Parazacco spilurus* and *Pseudobagrus trilineatus*), are considered of conservation importance. *Parazacco spilurus*, Predaceous Chub, was found to be abundant in various upstream locations of the Upper Tai Po River (i.e. above the proposed works area). The Chub is a locally common species, found in many streams with moderate-high flow rates and relatively good water quality. However, the species is classified as vulnerable in the China Red Data Book (Yue and Chen, 1998)<sup>4</sup> due to its restricted global range. A single *Pseudobagrus trilineatus* (Three-lined Chinese Stream Catfish) was recorded in the southern tributary of the river, about 350m upstream of the proposed works area. The fish was captured close to dusk from a stream section with moderate-swift flow rates and a boulder/cobble substrate. This species was only recently discovered in Hong Kong, with one adult and a juvenile caught in a pond in eastern Sai Kung in 1997 (Cheung, 1998)<sup>5</sup>. *Pseudobagrus trilineatus* is endemic to Guangdong and has previously only been recorded in streams of the Dongjiang (East River) catchment (Pan, 1990)<sup>6</sup>. Populations of *Pseudobagrus trilineatus* in Hong Kong are considered of global conservation concern by Fellowes *et al.* (2002)<sup>3</sup>, due to restricted and declining local, regional and global populations of this species.
- ♣ Seventeen dragonfly species were recorded from the Study Area, all recorded species are common and widespread in Hong Kong.

### Noise

- 3.8 The landuse in the vicinity of the Study Area for Upper Tai Po River consists of predominantly village settlements and Green Belt. A medium-density residential development *The Paramount* is found 120m to the northeast of the Study Area.
- 3.9 No major noise source was identified in the vicinity of the Study Area apart from the minor traffic along some local access roads. The ambient noise level is expected to be low.

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<sup>2</sup> Karsen, S., Lau, M. and Bogadek, A. (1998) *Hong Kong Amphibians and Reptiles*. 2<sup>nd</sup> edition. The Provisional Urban Council, Hong Kong.

<sup>3</sup> Fellowes, J.R., Lau, M.W.N., Dudgeon, D., Reels, G.T., Ades, G.W.J., Carey, G.J., Chan, B.P.L., Kendrick, R.C., Lee, K.S., Leven, M.R., Wilson, K.D.P. & Yu, Y.T. (2002) Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong. *Memoirs of the Hong Kong Natural History Society* 25: 123-159.

<sup>4</sup> Yue, P and Chen, Y. comps. 1998. *China Red Data Book of Endangered Animals –Pisces*. ed. S. Wang. Beijing: Science Press.

<sup>5</sup> Cheung, K.W. (1998) Two new freshwater fish for Hong Kong. *Porcupine!* 17: 16-17p

<sup>6</sup> Pan, J.H. (ed.) (1990). *The Freshwater Fishes of Guangdong Province*. Guangdong Science and Technology Press, Guangdong, China, p.589.

### ***Air Quality***

- 3.10 The existing air quality near the proposed project site would be mainly contributed by emissions from vehicular traffic on nearby road networks. In the absence of in-situ monitoring data, reference is made to the annual average concentrations of major air pollutants measured at EPD's nearest monitoring stations (i.e. Tai Po Station) for the last 5 years. The 5-year annual average TSP levels at Tai Po station is  $58\mu\text{gm}^{-3}$  according to *Air Quality 1999-2003*.

### ***Water Quality***

- 3.11 The water quality in the Tai Po River is monitored under the EPD routine river water quality monitoring programme. River water quality monitoring data for the year 2003 at station TR13 showed the overall compliance rate of the Tai Po River achieved a full compliance with the Water Quality Objectives (WQO) of pH, suspended solids, dissolved oxygen and Chemical Oxygen Demand (COD), and further improvement with the 5-day Biochemical Oxygen Demand (BOD<sub>5</sub>) objective. The river had an overall WQO compliance rate of 98% with a "good" Water Quality Index (WQI). An increase in the overall compliance rate of 1% from the preceding year was observed. However, due to pollution from unsewered villages in the catchment, the *E. coli* level in 2003 remained very high at 41,000 cfu/100mL.

### ***Visual and Landscape Resources***

#### Landscape Resources

- 3.12 Key landscape resources (LR) within 300m from the proposed project area generally contain:
- ♣ Natural woodlands
  - ♣ Shrublands
  - ♣ Trees/vegetation/agricultural fields in nearby villages/buildings and amenity areas/slopes
  - ♣ Natural rivers
- 3.13 LR including physical and cultural resources within the landscape impact study area are described and mapped in **Drawing No. 3.3**.

#### Landscape and Visual Character Areas

- 3.14 Three major landscape and visual character areas (LCA) have been identified within the study area which are:
- ♣ Wun Yiu Settled Valley
  - ♣ Tai Po Kau Residential Urban Fringe
  - ♣ Lin Au Uplands
- 3.15 Locations and relevant descriptions of the LCA are illustrated in **Drawing No. 3.4**.

### **Existing and Planned Sensitive Receivers**

#### ***Cultural Heritage***

- 3.16 According to guidelines provided in *Annex 19* of *EIAO-TM*, two built features were identified in the built heritage survey as summarised in the table below.

**Table 3.1 Built Heritage Features Identified in the Field Survey**

Location	Resource	Minimum Distance from Works Boundary	Intervening Landscape
Wun Yiu Village	Remains of Pottery Kilns	150 m	Village Structures And Road
Sheung Wun Yiu	Fan Sin Temple	80 m	Village Structures

### Ecology

- 3.17 The key ecological sensitive receiver identified in the Study Area was Upper Tai Po River. In accordance with the *EIAO-TM Annex 8* criteria, the ecological importance of the River has been evaluated in **Table 3.2** below.

**Table 3.2 Ecological Value of Upper Tai Po River**

Criteria	Ecological Value
Naturalness	The sections of the River comprising the proposed works area were found to be relatively disturbed, modified and polluted. Upstream sections of the River (upstream and above the proposed works area) were found to be more natural.
Size	The width of River varied from approximately 8-20m
Diversity	Moderate
Rarity	The fish <i>Parazacco spilurus</i> and <i>Pseudobagrus trilineatus</i> , amphibian <i>Paramesotriton hongkongensis</i> , and Chinese Pond Heron ( <i>Ardeola bacchus</i> ), Little Egret ( <i>Egretta garzetta</i> ) and Wood Sandpiper ( <i>Tringa glareola</i> ) recorded at the upstream of the Upper Tai Po River (i.e. outside the proposed works area).
Recreatability	Previously modified sections of the river have moderate recreatability, more natural sections of river have low recreatability only.
Fragmentation	N/a.
Ecological linkage	Upstream reaches of the Upper Tai Po River flow through area zoned as Country Park.
Potential value	With appropriate management and removal of pollution sources, the ecological value of the River could be increased.
Nursery ground	No significant records.
Age	N/a.
Abundance/Richness of Wildlife	Moderate.
<b>Ecological value</b>	<b>Middle Section (including the proposed works area): Moderate</b> <b>Upstream Section (above works area): High</b>

- 3.18 Mid-Downstream areas of the Upper Tai Po River (including the proposed works area) were considered of limited ecological value due to existing physical modification of the watercourse and pollution impacts, which limited the value of these stretches of the river to aquatic communities. Indeed, neither the Hong Kong Newt (*Paramesotriton hongkongensis*) nor the fishes including Predaceous Chub (*Parazacco spilurus*) and Three-lined Chinese Stream Catfish (*Pseudobagrus trilineatus*) were recorded from the more disturbed downstream sections of the river (including the proposed works area) during the ecological surveys. Nevertheless, downstream sections of the river are relatively unmodified compared to the majority of lowland rivers/streams in Hong Kong, therefore these sections are still considered of moderate ecological value. The ecological value of the Upper Tai Po River upstream of the proposed works area was considered high due to relatively diverse aquatic communities, and the presence of fish and amphibian species of conservation interest.

### Noise

- 3.19 For the purpose of noise impact assessment, representative noise sensitive receivers (NSRs) within 300 m from the site boundary were identified. Representative NSRs were selected in accordance with the criteria in the *EIAO-TM* to evaluate the potential noise impacts. **Table 3.3** summarises the selected NSRs for the noise impact assessment. The locations of representative NSRs in the vicinity of the proposed work areas are illustrated in **Drawing No. 3.5**.

**Table 3.3 Representative Noise Sensitive Receivers**

NSR	Location	Horizontal Separation from Nearest Site Boundary (m)	Use
UTP1	54B, Sheung Wun Yiu	5	Residential
UTP2	Village House in Lai Chi Shan	10	Residential
UTP3	Village House near Upper Tai Po River	3	Residential
UTP4	Village House near Upper Tai Po River	3	Residential
UTP5	Village House near Upper Tai Po River	2	Residential
UTP6	Village House near Upper Tai Po River	2	Residential
UTP7	Village House near Upper Tai Po River	5	Residential
UTP8	Village House near Upper Tai Po River	5	Residential
UTP9	49A, Pun Shan Chau	7	Residential
UTP10	Village House near the proposed access road	2	Residential
UTP11	49G, San Uk Ka	42	Residential

### Air Quality

- 3.20 Based on the criteria set out in *Annex 12* of the *EIAO-TM*, representative air sensitive receivers (ASRs) have been identified close to the Project site. A brief description of the representative ASRs is summarized in **Table 3.4** and the corresponding locations are shown on **Drawing No. 3.6**.

**Table 3.4 Representative Air Sensitive Receivers**

ASR	Location	Horizontal Separation from Nearest Site Boundary (m)	Use
AUTP1	54B, Sheung Wun Yiu	5	Residential
AUTP2	Village House in Lai Chi Shan	10	Residential
AUTP3	Village House near Upper Tai Po River	3	Residential
AUTP4	Village House near Upper Tai Po River	3	Residential
AUTP5	Village House near Upper Tai Po River	2	Residential
AUTP6	Village House near Upper Tai Po River	2	Residential
AUTP7	Village House near Upper Tai Po River	5	Residential
AUTP8	Village House near Upper Tai Po River	5	Residential
AUTP9	49A, Pun Shan Chau	7	Residential
AUTP10	Village House near the proposed access road	2	Residential
AUTP11	49G, San Uk Ka	42	Residential

### ***Water Quality***

- 3.21 Within the study area, the downstream water body of the Upper Tai Po River would be considered as the water sensitive receiver in close vicinity to the proposed works area.

### ***Visual and Landscape Resources***

- 3.22 Based on the criteria set out in the *EIAO-TM Annexes 10 and 18*, and in accordance with *EIAO Guidance Note No. 8/2002*, representative primary Zone of Visual Influence (ZVI) and Visually Sensitive Receivers (VSR) have been identified close to the Project site. A brief description of the ZVI and VSR is provided below:

#### Zones of Visual Influence

- 3.23 The study area would be taken to include the Zones of Visual Influence (ZVI) covering the areas from which the proposed drainage works area can be seen. Since the works run through lower ground level of agricultural field, road, village and urban area, the view of VSR is generally defined by an accessibly selected point of the nearest agricultural field, road, village housing and street on ground level or buildings at a higher level.
- 3.24 The primary ZVI in this Project would be identified by taking into account the not so large scale works and abundant vegetation screening along drainage channel and the convex profile of the slope toward the drainage channel.

#### Visually Sensitive Receivers

- 3.25 Visually sensitive receivers (VSR) within the ZVI whose views will be affected by the scheme are generally grouped as follows:
- ♣ Views from residents of nearby villages (e.g. Wun Yiu Village & Lai Chi Village) and buildings (e.g. the Paramount & Tat Nga Court)
  - ♣ View from drivers/pedestrians of nearby roads (e.g. Lane at San Uk Kai, Wun Yiu Section of Tolo Highway & Tat Wan Road)
- 3.26 The VSR in both construction and operational phases are illustrated in **Drawing No. 3.7**.



#### 4. POSSIBLE IMPACT ON THE ENVIRONMENT

##### Outline of Processes Involved

- 4.1 The construction tasks for the proposed drainage improvement works at Upper Tai Po River together with the envisaged duration of each task are shown in **Drawing No. 2.1**. The typical construction plant adopted for various construction activities can be referred to **Appendix 4.1**. The construction plants to be applied to this Project should be practical in completing the works within the schedule. Based on the preliminary design information, percussive piling would not be adopted for the proposed Project.

##### Potential Environmental Impacts

##### *Cultural Heritage*

##### Nature of Potential Impacts during Construction Phase

- 4.2 Any heritage resource located in close proximity to the works area may be impacted through vibration, receive direct damage and/ or dust from construction works.

##### Assessment of Impacts during Construction Phase

- 4.3 **Table 4.1** presents the details of the assessment of the potential impacts during construction phase. The major vibration sources from the construction works will include limited sheet piling works and minor pile foundations for reprovisioning of footbridges. Non-percussive piling techniques will be adopted and no heavy vibratory plant will be employed. Hence, the potential adverse impact on the built heritage due to vibration is not anticipated.

**Table 4.1 Assessment of Impacts to Built Features Identified in the Study Area – Construction Phase**

Location	Resource	Minimum Distance (Works Boundary)	Intervening Landscape	Adverse Impacts
Wun Yiu Village	Remains of Pottery Kilns	150 m	Village Structures and Road	No adverse direct impacts would result from the project as the distance of the recorded resources from the works provides an adequate buffer zone.  The proposed construction activities may impose minor indirect impacts to the identified resources through vibration.
Sheung Wun Yiu	Fan Sin Temple	80 m	Village Structures	

- 4.4 The extent of the work areas of the Project has been minimised as far as practicable, to maximise the separation from the two sites of cultural heritage and minimise any potential indirect impacts on the recorded resources through noise/vibration, dust and/or site runoff from the proposed construction activities. Such indirect impacts would be expected to be minor on the following grounds:

- ♣ Small scale of construction works involved
- ♣ Limited scope of vibratory plant for the construction works

- ♣ Adequate buffer zones between the works area and recorded resources

4.5 However, given the heritage importance of the identified resources, precautionary environmental measures are recommended as detailed in **Section 5**. With implementation of such measures, adverse impacts on cultural heritage would not be envisaged.

#### Nature of Potential Impacts during Operational Phase

4.6 The impacts associated with this phase of the project are of an aesthetic nature, as the surrounding environment of the historical villages may be altered through the construction of project-associated features, such as the channeling of river.

#### Assessment of Impacts during Operational Phase

4.7 The assessment of impacts for this phase takes into account distance as in the assessment for the construction phase, the surrounding landscape and orientation of the resources, and whether or not the proposed works would cause any adverse aesthetic impacts and/ or changes to the existing environment.

4.8 Impacts to the built heritage resources during the operational phase of the Project are presented in **Table 4.2**.

**Table 4.2 Assessment of Impacts to Built Features Identified in the Study Area – Operational Phase**

Location	Resource	Minimum Distance (Works Boundary)	Direction Faced and Orientation to alignment	Surrounding Landscape	Adverse Impacts
Wun Yiu Village	Remains of Pottery Kilns	150 m	East/ Various	Village Structures And Road	The newly channelled river and upgraded footpaths would cause minor adverse aesthetic impacts to the overall cultural character of the valley.
Sheung Wun Yiu	Fan Sin Temple	80 m	East/ Towards	Village Structures	

### **Ecology**

#### Potential Impacts

4.9 Several potential ecological impacts resulting from construction and operation phase activities have been identified. These would include:

- ♣ Direct impact to approximately 0.6km of lowland river habitat and aquatic communities (including dragonfly nymphs) and associated riparian habitats due to construction of drainage improvement measures.
- ♣ Direct loss of habitats adjacent to drainage improvement works (resulting from straightening/widening of existing river channel and construction of ancillary structures). The approximate areas of affected habitats comprise 0.39ha Village/Developed Area, 0.14ha Cultivated Land and 0.07ha Shrubland.
- ♣ Indirect impact to aquatic communities downstream of the works areas due to water quality impacts (e.g., increased sedimentation, potential spills of oils and other pollutants).

- ♣ Indirect impacts to habitats and associated fauna adjacent to works areas resulting from increased human activities/disturbance such as noise-generating construction plant.
- ♣ Indirect disturbance to habitats resulting from storage or dumping of construction material.
- ♣ Potential direct and indirect impacts to aquatic and riparian communities resulting from routine maintenance works such as removal of accumulated sediments and control of vegetation.
- ♣ Due to the widening and straightening of the drainage channel, regular flow rates within the channel could be greater than in the existing watercourse, leading to impacts to aquatic communities. Furthermore, because of the increased capacity of the improved drainage channel, discharge during peak-flow events (such as after extended periods of heavy rain) could be higher than in the existing river channel. Increased discharge could affect aquatic communities, with increased flow rates 'washing out' aquatic and riparian plants and animals.

### Impact Evaluation

#### *Impacts to Upper Tai Po River*

- 4.10 The primary potential ecological impact resulting from the Project would be direct impact to the moderate ecological value Upper Tai Po River. The scale of this impact would be determined largely by the design of the proposed drainage improvement works. Ecological requirements have been considered during the design of the channel improvements, with the following key features included:
- ♣ Following excavation works, the channel bed would be lined with natural materials such as small cobbles and boulders. To closely re-create existing conditions, materials collected from the existing riverbed during the construction phase would be incorporated into the newly excavated channel. These materials would include large boulders found in the existing river that form a potentially important microhabitat for herpetofauna.
  - ♣ The depth of the excavated channel and placement of substrates (e.g., boulders) would be varied to re-create the pool-riffle sequence found in the existing natural river.
  - ♣ Channel banks would be trapezoidal, and lined with rock-filled gabion. Pits would be provided in the gabion bank to allow for planting and establishment of riparian vegetation.
- 4.11 Using the basic design parameters described in **Section 1.6** and illustrated in **Drawing No. 1.2** for reference, potential ecological impacts to the Upper Tai Po River from construction/operation phase activities have been evaluated according to *Table 1 of Annex 8* of the *EIAO-TM*, and are summarised in **Table 4.3** below.

**Table 4.3 Overall Impact Evaluation to Upper Tai Po River**

Evaluation Criteria	Overall Impact Evaluation
Habitat quality	The sections of the River comprising the proposed works areas were found to be relatively disturbed, modified and polluted, and were considered of moderate ecological value only.
Species	Temporary loss of foraging habitat and disturbance to some avifaunal species of conservation interest (e.g., Chinese Pond Heron, Little Egret, Wood Sandpiper).  <i>Parazacco spilurus</i> , <i>Pseudobagrus trilineatus</i> and <i>Paramesotriton hongkongensis</i> were recorded outside of the proposed works area at Upper Tai Po River. However, the range of these species could extend further downstream to the proposed works area.
Size/Abundance	0.6km directly affected.
Duration	Direct impacts would last for the duration of the construction phase, and a

Evaluation Criteria	Overall Impact Evaluation
	period of re-colonisation during the operation phase.  Periodic minor disturbance throughout the operation phase due to routine maintenance (e.g., de-silting works).
Reversibility	Direct impacts would be largely reversible; the new drainage channel is expected to provide suitable habitats for aquatic and riparian communities previously recorded from the river.  Periodic minor increase in disturbance during operational phase would be temporary and reversible.
Magnitude	The scale of the impacts is considered moderate.
Overall impact conclusion	<b>Construction Phase: Moderate</b> <b>Operation Phase: Low</b>

- 4.12 Direct impacts to Upper Tai Po River are considered moderate in scale during and immediately after the construction phase. During this period, there would be localised disturbance to aquatic and riparian communities. This may include disturbance to *Parazacco spilurus* as this species was found at various upstream locations above the proposed works area in the ecological survey. Relatively minor impacts are predicted for *Pseudobagrus trilineatus* and *Paramesotriton hongkongensis* as these species were observed some distance upstream of the proposed works area, i.e. 350m and 450m away respectively. However, it is possible that the range of these species extends further downstream, and construction phase activities could disturb individuals of these species inhabiting downstream sections of the river. Impacts to aquatic invertebrates (including dragonfly nymphs) are considered relatively minor, given that only common and widespread species would be affected. Overall impacts to the river are rated moderate in scale only, as the design of drainage channel would provide a suitable habitat for existing aquatic communities recorded in the river. Following the re-establishment of aquatic and riparian habitats, longer-term impacts would be relatively minor.
- 4.13 Construction methods described in **Drawing No. 2.1 and No. 4.1** would serve to limit impacts to aquatic communities in the river due to increased sedimentation and/or water quality impacts. Containment measures such as bunds and barriers would be used within the river to minimize the impacts upon the downstream water body. With these measures in place, sedimentation is expected to have only local and temporary effects on water quality and aquatic ecology. These impacts are therefore considered relatively minor.
- 4.14 Impacts to waterfowl and other wildlife using the river would result from temporary loss of feeding habitats and disturbance caused by increased human activity and noisy construction phase activities. These impacts are considered minor, as construction phase disturbance impacts would be temporary in nature, and the newly improved drainage channel is expected to provide suitable foraging grounds for waterfowl and other wildlife using the existing river habitat.
- 4.15 It is anticipated that there will be less O&M requirements for the river after the completion of the Project. Operation phase activities at the newly improved drainage channel would include periodic maintenance works such as clearance of overgrown vegetation within the channel and de-silting works. These works are expected to cause only temporary and local disturbance to aquatic communities and other wildlife using the channel, and are therefore considered a minor impact.
- 4.16 During regular (i.e., non-spate) conditions, the amount of water in the improved channel would be similar to water levels in the existing river. Additionally, the improved channel would have a natural substrate, and a riffle/pool sequence similar to the existing river. As such, no substantial increase in regular flow rate is anticipated, and regular flow conditions are expected to be much the same as in the existing river. No impact to aquatic communities is therefore anticipated to result from modified flow rates during regular flow conditions.

- 4.17 Due to the increased capacity of the improved drainage channel, discharge during peak-flow events (such as after extended periods of heavy rain) could be higher than in the existing river. Increased discharge could affect aquatic communities, with increased flow rates 'washing out' aquatic and riparian plants and animals.
- 4.18 Flooding events in watercourses is a natural and relatively frequent phenomenon in Hong Kong owing to the monsoonal climate which delivers heavy rains in summer, causing watercourses to flow in spate. During spate, aquatic communities are affected due to increased flow rates causing "washing-out" of aquatic and riparian plants and animals. Locally, lotic communities are well adapted to survive flood spates. For example: many insects with aquatic life-cycle larval stage time the emergence of adult stage before the wet season, therefore avoiding peak flow events. Stream fish also have behavioural adaptations to high flow rate by taking refuge between bottom substrate on the streambed.
- 4.19 Improvement works to the river would not be expected to cause significant impact to stream organisms beyond natural impacts under normal summer flood spates. During higher magnitude flood events, flow velocity in the channelised stream with improved drainage capacity would be expected to be greater than in the existing channel. These infrequent and temporary high flow rate conditions are not expected to have long-term negative adverse impacts on aquatic communities in the river. Impacts on aquatic insects are unlikely to be substantial due to their avoidance of high flow conditions. Owing to the natural substrate of the channel, freshwater stream fish populations would have suitable streambed refuges to escape temporary high flow conditions.

#### Impacts to Other Habitats

- 4.20 Impacts to other habitats resulting from the proposed works would include the loss of approximately 0.6ha of cultivated land, village/developed habitat and shrubland. These impacts are considered minor because of the small areas and low or low-moderate ecological value of the affected habitats. Impact assessment for other habitats is summarised in **Table 4.4** below.

**Table 4.4 Overall Impact Evaluation to Other Habitats**

<b>Evaluation Criteria</b>	<b>Other Habitats</b>
Habitat quality	The quality of habitats affected by the proposed works is generally low.
Species	No direct impact to species of conservation interest, although there may be potential indirect impact to the wildlife.
Size/Abundance	Direct impacts to 0.6ha of Village/Developed Area, Cultivated Land and Shrubland habitats.
Duration	Loss of low quality habitat would be permanent.  Indirect impacts such as noise disturbance would be largely limited to the construction phase.
Reversibility	Loss of low quality habitat would be permanent.  Indirect disturbance impacts would be temporary and reversible.
Magnitude	The scale of the impact is considered low.
<b>Overall impact conclusion</b>	<b>Low</b>

## **Noise**

### Construction Phase

#### *Potential Sources of Environmental Impacts*

- 4.21 The potential source of noise impact during the construction phase of the Project would be the use of powered mechanical equipment (PME) for various construction activities as indicated in **Drawing No. 2.1**. The sound power levels (SWL) of PME for various construction activities are given in **Appendix 4.1**. The assumptions of on-time percentage and the number of PME are expected to be practical in completing the works within the schedule.
- 4.22 The proposed construction activities would be generally small in scale. However, since NSRs were identified in proximity to the proposed work areas, adverse noise impacts due to the use of PME would likely be expected at these receivers if no noise control measures are implemented during the works period.

#### *Prediction and Evaluation of Impacts*

- 4.23 Based on the proposed plant inventory as shown in **Appendix 4.1**, cumulative noise impacts arising from various construction activities were predicted.
- 4.24 The unmitigated construction noise levels at representative NSRs are presented in **Table 4.5**. A sample calculation of construction noise level for the unmitigated scenario is provided in **Appendix 4.2**.

**Table 4.5 Ranges of Unmitigated Construction Noise Levels**

NSR	Predicted Noise Levels, dB(A)	EIAO-TM Normal Daytime Construction Noise Criteria, dB(A)
UTP1	54 - 87	75
UTP2	55 - 86	75
UTP3	64 - 96	75
UTP4	62 - 88	75
UTP5	56 - 97	75
UTP6	63 - 96	75
UTP7	64 - 95	75
UTP8	58 - 96	75
UTP9	52 - 90	75
UTP10	48 - 96	75
UTP11	47 - 77	75

- 4.25 The assessment results showed that predicted cumulative noise levels at representative NSRs would range from 47 to 97dB(A). The maximum level of exceedance predicted would be 22dB(A). Mitigation measures would thus be considered necessary to alleviate the construction noise impacts, as presented in **Section 5**.

### Operation Phase

- 4.26 During the operation phase, no activity would be carried out in the proposed drainage channel apart from normal maintenance works. Therefore, no adverse operational noise impact is expected.

### ***Air Quality***

#### Construction Phase

##### *Potential Sources of Impacts*

- 4.27 Potential impacts arising from the construction of the proposed drainage channel would include dust nuisance and gaseous emissions from the construction plant and vehicles. The major construction activities for the Project which would be potential sources of construction dust in the Study Area include earthworks and backfilling for the box culvert / bridge and channel construction. It is anticipated that dust would be generated from excavation, material handling and wind erosion from the site.
- 4.28 Odour may also be released when excavated materials are lifted from the river.

##### *Prediction and Evaluation of Impacts*

- 4.29 The improvement works at Upper Tai Po River would comprise the re-profiling of the channel and realignment of the channel, inclusion of gabions for bank protection whilst maintaining the existing channel bed. Dust impact due to excavation, material handling and wind erosion is expected to be relatively minor as the excavated material would mainly be from the river and would be of high moisture content. Given the high moisture content of spoils, small scale of construction activities and implementation of appropriate mitigation measures and good site practices, no adverse dust impact would be expected.
- 4.30 The main source of odour from construction activities would be from the decomposing organic material trapped within river sediments to be excavated. However, in view of the results of the sediment quality characterization survey carried out in January 2004 together with the river water quality monitoring data published by EPD for the year 2003, the river water quality was generally good and concentration of organic materials in the river sediment were not considered high. As such, adverse odour impact from the excavated materials would not be expected. However, in order to minimise potential odour nuisance, caution and expedience should be used when dealing with excavated or any permitted stockpiled materials. With implementation of the mitigation measures as described in **Section 5**, no adverse impact of odour would be expected during the construction stage of the Project.

#### Operation Phase

- 4.31 During the operation phase, no other activity would be carried out in the proposed drainage channel apart from normal maintenance works. Therefore, no adverse air quality impact such as dust and odour is expected.

### ***Water Quality***

#### Construction Phase

- 4.32 Potential sources of water quality impact associated with the construction of the proposed drainage improvement works have been identified and include:
- ♣ construction site runoff and drainage
  - ♣ general construction activities
  - ♣ sewage effluent produced by on-site workforce
  - ♣ river channel excavation works



#### *Construction Runoff and Drainage*

- 4.33 Runoff from the construction works areas may contain increased loads of sediments, other suspended solids and contaminants. Potential sources of pollution from site drainage include:
- ♣ runoff and erosion from exposed soil surfaces, earth working areas and stockpiles
  - ♣ release of grouting and cement materials with rain wash
  - ♣ wash water from dust suppression sprays
  - ♣ fuel and lubricants from maintenance of construction vehicles and mechanical equipment
- 4.34 Sediment laden runoff during construction works for the drainage improvements to Upper Tai Po River if uncontrolled may carry pollutants (adsorbed onto the particle surfaces) into the downstream sections of the river channel. Mitigation measures should be implemented to control construction site runoff and drainage from the works areas, and to prevent runoff and drainage water with high levels of suspended solids from entering the river channel.

#### *General Construction Activities*

- 4.35 On-site construction activities may cause water pollution from the following:
- ♣ uncontrolled discharge of debris and rubbish such as packaging, construction materials and refuse
  - ♣ spillages of liquids stored on-site, such as oil, diesel and solvents etc, are likely to result in water quality impacts if they enter the river channel or storm water drains
- 4.36 Good construction and site management practices should be observed to ensure that litter, fuels and solvents do not enter the river channel.

#### *Sewage Effluents*

- 4.37 Domestic sewage would be generated from the workforce during the construction phase. However, this temporary sewage can be adequately treated by interim sewage treatment facilities, such as portable chemical toilets, which can be installed within the construction site. It is unlikely that sewage generated from the site would have a significant water quality impact, provided that sewage is not discharged directly to the river channel nor local storm water drainage system, and chemical toilets are used and properly maintained.

#### *River Channel Excavation Works*

- 4.38 In order to minimize the potential impacts on water quality during the reprofiling works for the Upper Tai Po River, the excavation works to widen the river channel and lower the riverbed would be carried out in sections and in dewatered condition. Containment measures such as temporary earth bunds and barriers would be used to prevent water from entering the works area. **Drawing No. 4.1** shows the schematic design of the temporary drainage division. A bund would be constructed in the middle of the channel to surround the area to be excavated and the water flow diverted to one half of the channel. Excavation would be carried out in the dewatered section of the channel. Upon completion, excavation would be carried out in the other half of the channel by switching the two ends of the bunds to enclose the area to be excavated. This could effectively isolate the excavating section from the river water. Excavation works would be in small-scale and carried out by mini-backhoe. With such mitigation measures in place, potential impacts on downstream water quality would be therefore minimized by restricting the excavation works to within an enclosed dewatered section of the channel.



- 4.39 This works arrangement would provide a dewatered zone for excavation works within the river channel and would prevent the transportation of suspended sediment downstream. It is anticipated that any elevations in suspended solids concentrations during the diversion works would be only limited to the bottom depth of the water column during the placement of the bund or barrier and that any re-suspended sediment would settle quickly on the channel bed, close to the area of disturbance. This kind of minimal disturbance would unlikely cause any unacceptable water quality impacts on the downstream water body.
- 4.40 With the implementation of the working method controls as described above, it is anticipated that unacceptable water quality impacts would not arise at the downstream water body during the channel excavation works.

#### Operation Phase

- 4.41 Maintenance desilting of the Upper Tai Po river channel would be carried out by mini-backhoes and would be substantially less intensive than the construction phase excavation works. The channel desilting works would be confined in a small works zone which is isolated from the rest of the channel by temporary barrier walls. This arrangement would provide a dewatered zone for desilting work and would prevent the transportation of suspended sediment downstream. Furthermore, desilting works would be carried out in dry season when the river flow is low to further minimize the potential for impacts on downstream water quality.

#### ***Waste Management***

#### Construction Phase

- 4.42 The construction activities to be carried out for the proposed Project would generate a variety of wastes that can be divided into distinct categories based on their composition and ultimate method of disposal. The identified waste types include:
- ♣ construction and demolition (C&D) materials
  - ♣ chemical waste
  - ♣ general refuse
- 4.43 The nature of each type of waste arising is described below, together with an evaluation of the potential environmental impacts associated with these waste arisings.

#### *Construction and Demolition (C&D) Materials*

- 4.44 Construction of the drainage improvement works to Upper Tai Po River comprise reprofiling works which would involve lowering the inverts and widening of the existing river channel. The excavated materials would comprise mostly soil, sand, gravel and small rocks.
- 4.45 A sediment quality characterization survey was carried out in January 2004 to characterize the level of contamination in the riverbed material of Upper Tai Po River. The works comprised sampling by hand-auger at five locations within the river channel to obtain samples for chemical testing. The samples were described as alluvium sand. The methodology for the sampling and laboratory testing of the riverbed samples was agreed with EPD prior to the commencement of the survey.
- 4.46 The riverbed samples were tested in the laboratory for metals concentrations including chromium, copper, mercury, lead, cadmium, nickel, zinc, silver and arsenic; and concentrations of organic compounds: total polychlorinated biphenyls and polyaromatic hydrocarbons.
- 4.47 The chemical testing results of the riverbed samples were compared with the classification criteria presented in *ETWB TCW No. 34/2002*. The chemical testing results indicate that Category M

material was found at two sampling locations (S6 and S7) in terms of lead and Category L material was found at three sampling locations (S4, S5 and S8).

- 4.48 Uncontaminated excavated material from the reprofiling works would be suitable for disposal to a public filling area. The reported level of lead in the samples collected at sampling locations S6 and S7 within the Upper Tai Po River did not exceed the Dutch B level<sup>7</sup>. The excavated riverbed soil at sampling locations S6 and S7 is therefore proposed to be reused on-site as backfilling material for gabion lining (approximately 1,500 m<sup>3</sup>).
- 4.49 The total volume of excavated material to be generated from the drainage improvement works was estimated to be approximately 15,550 m<sup>3</sup>. A breakdown of the estimated volumes of C&D material is presented in **Table 4.6**. It is anticipated that approximately 2,100 m<sup>3</sup> of the excavated material would be of suitable characteristics for reuse on-site as fill material, e.g. in the construction of embankments. It is proposed that small cobbles and rocks from the existing river be reused in the re-created channel bed as far as possible, subject to suitable size requirements. Surplus excavated soil and rock (approximately 13,450 m<sup>3</sup>) would be transported by trucks to the designated barging point for disposal at the designated public filling area, or transported directly to the public filling area.

**Table 4.6 Summary of C&D Material Volumes**

Excavated material other than rock & artificial hard material <sup>(1)</sup> (m <sup>3</sup> )	Excavated rock (m <sup>3</sup> )	Excavated artificial hard material <sup>(2)</sup> (m <sup>3</sup> )	Total C&D material (m <sup>3</sup> )	C&D material to be reused on site (m <sup>3</sup> )	C&D material to be delivered to and reused in public filling areas (m <sup>3</sup> )
13,950	800	800	15,550	2,100	13,450

#### *Chemical Waste*

- 4.50 The maintenance and servicing of construction plant and equipment may possibly generate some chemical wastes, for instance, cleaning fluids, solvents, lubrication oil and fuel. Maintenance of vehicles may also involve the use of a variety of chemicals, oil and lubricants.
- 4.51 Since the drainage improvement works would be carried out in close proximity to residential dwellings and downstream area of Tai Po River, chemical wastes arising during the construction phase may pose environmental, health and safety hazards if not stored and disposed of in an appropriate manner as stipulated in the *Waste Disposal (Chemical Waste) (General) Regulations*. The potential hazards include:
- ♣ toxic effects to workers
  - ♣ adverse impacts on water quality from spills and associated adverse impacts on fresh water biota
  - ♣ fire hazards
- 4.52 Materials classified as chemical wastes would require special handling and storage arrangements before removal for appropriate treatment at the Chemical Waste Treatment Facility at Tsing Yi. Wherever possible opportunities should be taken to reuse and recycle materials. Provided that the handling, storage and disposal of chemical wastes are in accordance with these requirements, adverse environmental impacts are not expected to result.

<sup>7</sup> Dutch Ministry of Public Housing, Land-Use and Environment Guidelines (the Dutch Guidelines) (1994) are used as reference criteria by the EPD for classification of contaminated soil. In general, remediation is required for soil contamination above the Dutch B level.

### *General Refuse*

- 4.53 Throughout construction, the workforce would generate general refuse comprising food scraps, waste paper, empty containers, etc. Release of general refuse into the Upper Tai Po river channel should not be permitted as introduction of these wastes is likely to have detrimental effects on water quality in the area. Rapid and effective collection of site wastes would be required to prevent waste materials being blown around by wind, flushed or leached into the aquatic environment, and odour nuisance. The work areas may also attract pests and vermin if the waste storage area is not well maintained and cleaned regularly. Disposal of refuse at sites other than approved waste transfer or disposal facilities can also result in similar impacts.
- 4.54 With the implementation of the recommended waste management practices at the site, adverse environmental impacts would not arise from the storage, handling and transportation of refuse.

### ***Landscape Impact***

#### Construction Phase

- 4.55 Changes of the landscape resources (LR) and landscape character areas (LCA) associated with the proposed drainage improvement works are summarised below. Details of the magnitude of changes to LR and LCA in the construction phase are given in **Appendix 4.3**.
- ♣ *Impacts on trees and agricultural fields:* Works of the river widening, construction of gabion channel towards the area, associated regrading works to adjacent ground and the related construction activities in the area would change the following LR due to impacts on trees and agricultural fields:
    - Approximately 3 trees in Ha Wun Yiu Village (DP2-LR3)
    - Approximately 100 trees and agricultural field in Pun Shan Chau (DP2-LR9); some of the affected trees are not capable of being transplanted due to the steep slopes
    - Approximately 50 trees in San Uk Kai Village (DP2-LR10)
    - Approximately 200 trees and agricultural field at San Uk Kai (DP2-LR12)
  - ♣ *Changes of natural Upper Tai Po River* (DP2-LR8): Potential loss of approximately 0.6km of natural stream course and associated riparian vegetation and natural boulders due to construction of gabion channel and associated works.
  - ♣ *Changes of landscape and visual character area* (DP2-LCA1): Construction activities in the temporary works sites along Upper Tai Po River would change the landscape and visual character of Wun Yiu Settled Valley.

#### Operation Phase

- 4.56 There would be changes to landscape resources (LR) in the operational phase due to residual effect of the construction impacts on trees. In addition, there would be changes to the landscape and visual character areas (LCA) due to permanent above water drainage structures. Details of the magnitude of changes to LR and LCA in the operational phase are given in **Appendix 4.3** and summarised as follows:
- ♣ *Impacts on trees and agricultural field:* Re-alignment of the slope profile and impact on trees at the villages/agricultural fields due to the permanent alignment and widening of drainage channel.
    - Trees in Ha Wun Yiu Village (DP2-LR3)

- Trees and Agricultural Field in Pun Shan Chau (DP2-LR9)
- Trees in San Uk Kai Village (DP2-LR10)
- Trees and Agricultural Field at San Uk Kai (DP2-LR12)
- ♣ *Changes of natural Upper Tai Po River (DP2-LR8):* Long term change of the nature of the river components e.g. natural boulders river embankment due to the permanent design of gabion walled channel.
- ♣ *Changes of landscape and visual character area (DP2-LCA1):* Changes to the landscape and visual character area in Wun Yiu Settled Valley due to the permanent design and widening alignment of gabion drainage channel.

### **Visual Impact**

#### Construction Phase

- 4.57 There would be changes in view for VSR overlooking the drainage channel alignment due to the impacts on mature trees, temporary works sites and works areas, and the general construction activities, and associated works, and utilities and road and traffic diversion measures. VSR with adverse impacts of substantial significance before mitigation are highlighted below. Details of the magnitude of changes in view for VSR in the construction phase are given in **Appendix 4.4**.
- ♣ *Substantial visual impacts* on the residents of Wun Yiu Village (DP2-R1) and the residents / engagers of Pun Shan Chau agricultural fields (DP2-GB1) due to the vicinity of the VSR and the location of the construction site.
  - ♣ *Substantial to moderate visual impacts* on the drivers / pedestrians of Tat Wan Road (DP2-T3) because of the works completion in the Temporary Works Areas.

#### Operation Phase

- 4.58 Impacts in the operational phase would result from changes in view experienced by VSR in the vicinity of the permanent change of the nature of the original natural stream-course. There would also be remaining impacts due to the loss of large mature trees in the construction phase. Some VSR with adverse impacts of substantial/moderate significance before mitigation are highlighted below. Details of the magnitude of changes in view for VSR in the operation phase should be referred to **Appendix 4.4**.
- ♣ *Substantial visual impacts* on the residents / engagers of Pun Shan Chau agricultural fields (DP2-GB1) due to the impacts on mature trees in the long term and the impact arising from the change of the river nature and the widening of the river alignment.
  - ♣ *Moderate visual impacts* on the drivers / pedestrians of Tat Wan Road (DP2-T3), residents of Lai Chi Village (DP2-R2) and Wun Yiu Village (DP2-R1) due to the impacts on trees on the embankment of the road or mature trees in the long term and the impact arising from the change of the river nature and the widening of the river alignment.

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

### Environmental Protection Measures to be Incorporated in the Design

#### *Cultural Heritage*

##### Construction Phase

- 5.1 Although all the drainage improvement works are located at sufficient distances from the recorded resources as a precautionary measure, specific construction method/equipment should be adopted to avoid vibration impacts on the two identified Declared Monuments during the construction phase.
- 5.2 Monitoring of vibration impacts should be conducted during the construction works to ensure no damage to the existing structures of the resources.
- 5.3 Other environmental protection measures for controlling impacts of construction noise, dust and site drainage, including the use of quieter PME, implementation of dust suppression measures as specified in the *Air Pollution Control (Construction Dust) Regulation* and site practices outlined in *ProPECC PN1/94 "Construction Site Drainage"*, would minimise any indirect disturbance to the identified built heritage resources.

##### Operational Phase

- 5.4 The only identified impacts to built heritage resources during the operational phase would be in relation to aesthetic aspects and therefore mitigation for landscape and visual impacts should be followed.

##### Residual Environmental Impacts

- 5.5 With the implementation of the recommended mitigation measures, carrying out of vibration monitoring to ensure that the levels of vibration associated with the construction phase do not exceed the threshold limit, it is anticipated that no adverse impacts on the Remains of Pottery Kilns and Fan Sin Temple would be expected.
- 5.6 Adverse impact in relation to aesthetic aspects would not be expected provided that proposed mitigation measures for landscape and visual impacts to be implemented during the operation phase.
- 5.7 Overall, with the implementation of the proposed mitigation measures in construction and operation stages, the identified sites of cultural heritage would be preserved and the Project would comply with the requirements of *Annex 19* of the *EIAO-TM*.

#### *Ecology*

##### Construction Phase

- 5.8 To minimise and compensate for impacts resulting from the proposed works, a more 'ecologically-friendly' channel design has been adopted over the standard, trapezoidal concrete lined channel used in many early drainage improvement projects. Details of the channel design are described in **Sections 1.6** and **4.14**, and illustrated in **Drawing No. 1.2**. Following public consultation, the channel design was further refined to minimise ecological impacts. Key improvements to the design include:

- ✱ The existing riverbed contains many large boulders that form a potentially important microhabitat for herpetofauna. Under the original channel design, these boulders would have

been permanently removed from the Channel. Under the revised design, these large boulders would be returned to the riverbed following excavation works.

- ♣ Under the previous channel design, the improvement works would affect both banks of the river. Under the revised design, works from Ch. 0.0m - Ch. 150m would be along one bank of the river only; approximately 150m of the existing, natural riverbank on the western side of the river would be retained (**Drawing No. 1.2** refers).

- 5.9 The proposed works at the Upper Tai Po River have the potential to impact fish and amphibian species of conservation interest. To minimize these potential impacts, it is recommended that capture-surveys of the proposed works areas be conducted prior to the commencement of construction works in the channel. The surveys should include the Three-lined Chinese Stream Catfish (*Pseudobagrus trilineatus*), Predaceous Chub (*Parazacco spilurus*) and Hong Kong Newt (*Paramesotriton hongkongensis*). Any of these species caught during the surveys should be re-located to areas of the watercourse upstream of the proposed works areas. Capture-surveys of fish and amphibians are an obvious and simple measure that would prevent direct injury to species of conservation importance during the construction phase: there would be no technical difficulties in implementing the capture-surveys. A similar approach to preventing impacts to aquatic species of conservation importance has been recommended in previously approved EIA Reports such as EIA-075/2002 (Improvement to Tung Chung Road between Lung Tseng Tau and Cheung Sha). The capture surveys should be conducted in the dry season by a suitably qualified ecologist(s) appointed by the Project Proponent.
- 5.10 Measures should be implemented to minimise potential sedimentation and other water quality impacts to areas downstream of the proposed works areas. Excavation works within the river channel should be restricted to an enclosed dewatered section of the river, with containment measures such as bunds and barriers used within the river to minimize the impacts upon the downstream water body. Site runoff should be directed towards regularly cleaned and maintained silt traps and oil/grease separators to minimise the risk of sedimentation and pollution of river water. The silt and oil/grease separators should be appropriately designed for the local drainage and ground conditions. To minimize leakage and loss of sediments during excavation in narrow channel, tightly sealed closed grab excavators should be deployed where material to be handled is wet.
- 5.11 To ensure some areas of relatively undisturbed habitat are maintained, excavation works would be limited to sections 50-100m long at any one time. Furthermore, flow to areas downstream of proposed works areas will be maintained at all times during the construction phase.
- 5.12 Noise mitigation measures including the use of quiet construction plant and temporary noise barriers should be implemented to minimise disturbance to habitats adjacent to the works areas.
- 5.13 Standard good site practice measures should be implemented throughout the construction phase. The measures should include:
- ♣ Placement of equipment or stockpile in designated works areas and access routes selected on existing disturbed land to minimise disturbance to natural or moderate-high ecological value habitats.
  - ♣ Construction activities should be restricted to work areas that should be clearly demarcated. The work areas should be reinstated after completion of the works.
  - ♣ Waste skips should be provided to collect general refuse and construction wastes. The wastes should be disposed of timely and properly off-site.
  - ♣ General drainage arrangements should include sediment and oil traps to collect and control construction site run-off.
  - ♣ Open burning on works sites is illegal, and should be strictly prohibited.



- 5.14 Planting of trees and other vegetation along the banks of the newly improved drainage channel would provide compensation for unavoidable tree felling and loss of riparian vegetation resulting from the proposed works. Compensatory planting should make use of native plant species with flowers/fruits attractive to wildlife.

#### Operation Phase

- 5.15 Potential operational phase activities in the newly improved drainage channel would be limited to periodic channel maintenance such as de-silting. Impacts to aquatic communities resulting from these activities are expected to be minor. Nevertheless, the following measures are recommended to minimise potential impacts resulting from operational phase activities:

- ♣ To minimise sedimentation, de-silting should be limited to the dry season (November-March).
- ♣ For maintenance desilting of the re-profiled river channel, temporary barrier walls should be used to provide a dewatered zone for desilting work.
- ♣ The implementation of de-silting and other activities that could disturb aquatic fauna should be phased to ensure some areas of relatively undisturbed habitat remain available for resident aquatic fauna at all times.
- ♣ Waste material produced during de-silting should be disposed of in a timely and appropriate manner.

#### Ecological Monitoring & Audit

- 5.16 Considered as one of the key environmental protection measures, a monitoring programme of the newly improved drainage channel is recommended to verify the accuracy of the predictions of the ecological assessment study and to monitor the effectiveness of ecological mitigation measures (section 5.5.1 of *Annex 16* of the *EIAO-TM* refers), as outlined below.

- 5.17 A proposal containing further details of relevant monitoring and auditing requirements will be submitted to Environmental Protection Department (EPD) and Agriculture, Fisheries and Conservation Department (AFCD) for approval prior to the commencement of the construction works of the Project. Specialist input required for ecological mitigation and monitoring/auditing will be provided as part of the construction works supervision by qualified ecologists working in the Design and Construction Assignment with over 6 years of relevant ecological experience.

- 5.18 Baseline data will be collected several months before the commencement of the construction phase, covering at least 3 months at the end of the wet season (September/October) and start of the dry season (November/December). Baseline surveys would be conducted at the same time as capture surveys for faunal species of conservation interest recorded from the river (section 5.9 refers) Data collected will include the following parameters:

- ♣ Water quality (e.g., dissolved oxygen, pH, conductivity, salinity, BOD, nutrient concentrations)
- ♣ Sediment characteristics
- ♣ Water flow
- ♣ Avifauna species and densities
- ♣ Aquatic macroinvertebrate community species composition and abundance
- ♣ Fish community species composition and abundance
- ♣ Adult odonate community species composition and abundance
- ♣ Aquatic, emergent and riparian vegetation community species composition and abundance

- 5.19 During construction phase, site inspections by the ecologists on a weekly basis will be conducted to monitor and audit the proper implementation of ecological mitigation measures, ensuring that the 'ecologically friendly' features of the channel design are effectively implemented, and disturbance impacts to the river and surrounding habitats are kept to a minimum, and (as stated in section 5.5.1 of *Annex 16* of the *EIAO-TM*) to monitor the effectiveness of mitigation measures.
- 5.20 During operational phase, ecological monitoring covering the same parameters as the baseline monitoring will be conducted monthly for 2 years after the completion of works. It is expected that ecological communities will have re-colonised and established in the newly improved section of river within this period. However, the need for further operation phase monitoring will be reviewed at the end of this 2 year period.
- 5.21 Monthly ecological monitoring reports on the findings of monitoring will be submitted to EPD and AFCD for review. A final report summarising the monitoring results over the entire monitoring period will be prepared to serve as a reference for future projects of this kind.

#### Residual Environmental Impacts

- 5.22 Direct impacts to aquatic and riparian habitats at the Upper Tai Po River during and immediately after the construction phase are rated moderate. However, no major long-term residual ecological impacts to the river are anticipated. With the proposed mitigation measures in place, it is expected that aquatic communities found in the river would re-colonise the newly improved drainage channel. Further to this, the loss of riparian vegetation would be compensated for through tree planting and other landscaping works. Residual impacts would therefore be limited to temporary and reversible disturbance during periodic maintenance works. Measures would be implemented to minimise impacts resulting from these works. Overall, residual impacts to the Upper Tai Po River are considered acceptable.
- 5.23 Residual impacts to other habitats resulting from the proposed works would include the loss of small areas of cultivated land, village/developed area and shrubland. As the affected habitats are of low or low-moderate ecological value, and no species of conservation interest would be directly affected, these impacts are considered minor.
- 5.24 Overall, it is expected that no substantial adverse residual ecological impacts would result from the proposed works, and that with the implementation of the proposed mitigation measures, the Project would comply with the requirements of *Annex 16* of the *EIAO-TM*.

#### **Noise**

##### Construction Phase

##### *Good Site Practice*

- 5.25 Although the noise mitigation effects are easily quantifiable and the benefits may vary with site conditions and operating conditions, good site practices are easy to implement and do not impact upon the works schedule. The site practices listed below should be followed during each phase of construction:
- ♣ Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction program.
  - ♣ Silencers or mufflers on construction equipment should be utilized and should be properly maintained during the construction program.
  - ♣ Mobile plant, if any, should be sited as far from NSRs as possible.



- ♣ Machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum.
- ♣ Plant known to emit noise strongly in one direction should, wherever possible, be orientated so that the noise is directed away from the nearby NSRs.
- ♣ Material stockpiles and other structures should be effectively utilised, wherever practicable, in screening noise from on-site construction activities.

#### *Adoption of Quieter PME*

- 5.26 In order to alleviate the construction impacts on the NSRs, the adoption of quieter PME is recommended. The type of quieter PME adopted in this assessment is not a must that the Contractors have to use specific items of plant for the construction operations. The Contractors are allowed to use other type of quieter PME, which have the same total SWL, to meet their needs.
- 5.27 A list of quieter PME recommended for adoption during the construction phase is presented in **Table 5.1** and **Appendix 5.1**. The quieter PME adopted in the assessment were taken from the BS5228: Part 1:1997. It is confirmed that the proposed list of quieter PME is practical to be used in completing the works within the schedule.

**Table 5.1 Quieter PME Recommended for Adoption during Construction Phase**

Powered Mechanical Equipment (PME)	Reference	Sound Power Level (SWL)
Excavator / Loader	BS C3/97	105
Dump Truck	BS C9/39	103
Generator	CNP103	95
Crane	BS C7/114	101
Vibratory Roller	BS C3/116	106
Vibratory Poker	BS C6/32	100
Concrete Lorry Mixer	BS C6/23	100
Water Pump	CNP283	85

#### *Use of Temporary Barrier*

- 5.28 The erection of purpose-built temporary barriers along the boundaries of the work areas would also be considered as an effective noise mitigation provided that the line of sight between the noise sources and the affected NSRs are blocked. Barrier material of surface mass in excess of 7kg/m<sup>2</sup> is desirable to achieve the maximum screening effect. The minimum height of a barrier should be such that no part of the noise source would be visible from the NSR being protected.
- 5.29 Having taken account the surrounding NSRs in the various works areas, the predicted noise impacts as well as the access, safety and operational requirements, a 2m high vertical barrier could be provided to alleviate the noise impact predicted at the affected NSRs. **Drawing No. 5.1** shows the location of the proposed temporary noise barriers.
- 5.30 Based on the site survey, all the NSRs within the Study Area are low-rise in nature of one to three storey high. In addition, the majority of the channel construction works would be undertaken below the ground levels of the NSRs. As such, the line of sight of the NSRs to the construction site could be totally screened by the temporary noise barriers erected along the work area boundary. This would thus allow a reduction the predicted noise level of 10dB(A) as per the *GW-TM*.

#### *Mitigated Construction Noise Impacts*

- 5.31 Mitigated construction noise levels were predicted at various NSRs (**Table 5.2** refers) taking into account the noise reduction provided by the above-mentioned mitigation measures. A sample

calculation of construction noise levels for the mitigated scenario is provided in **Appendix 5.2**. Ranges of mitigated and unmitigated construction noise levels predicted at representative NSRs are both shown in **Table 5.2**.

**Table 5.2 Ranges of Unmitigated and Mitigated Construction Noise Levels**

NSR	Unmitigated Noise Levels, dB(A)	Mitigated Noise Levels, dB(A)	Mitigation Measures Proposed
UTP1	54 - 87	40 - 66	Quieter PME & Temporary Barrier*
UTP2	55 - 86	50 - 75	Quieter PME
UTP3	64 - 96	44 - 75	Quieter PME & Temporary Barrier*
UTP4	62 - 88	48 - 67	Quieter PME & Temporary Barrier*
UTP5	56 - 97	46 - 75	Quieter PME & Temporary Barrier*
UTP6	63 - 96	44 - 75	Quieter PME & Temporary Barrier*
UTP7	64 - 95	45 - 75	Quieter PME & Temporary Barrier*
UTP8	58 - 96	45 - 75	Quieter PME & Temporary Barrier*
UTP9	52 - 90	42 - 69	Quieter PME & Temporary Barrier*
UTP10	48 - 96	38 - 75	Quieter PME & Temporary Barrier*
UTP11	47 - 77	47 - 66	Quieter PME

Notes: \*10 dB(A) noise reduction was assumed with the use of temporary barrier.  
 EIAO-TM Normal Daytime Construction Noise Criteria is 75dB(A).

- 5.32 As shown in **Table 5.2**, with the adoption of practicable noise mitigation measures, construction noise levels due to the proposed works at Upper Tai Po River would comply with the *EIAO-TM* daytime construction noise criteria. The proposed mitigation measures and plant have made reference to the projects with of similar nature and conditions in Hong Kong. The recommended measures and plants are applicable and available to this Project, and they are expected to be practical in completing the works within the schedule.
- 5.33 As one of the environmental protection measures, weekly construction noise monitoring at representative NSRs should be carried out to ensure the above noise mitigation measures would be implemented properly.

#### Residual Environmental Impacts

- 5.34 With the recommended mitigation measures in place, no adverse residual construction noise impact would be expected.

#### ***Air Quality***

##### Construction Phase

##### *Construction Dust*

- 5.35 To ensure compliance with the guideline level and AQO at the ASRs, the *Air Pollution Control (Construction Dust) Regulation* should be implemented and good site practices should be incorporated in the contract clauses to minimize construction dust impact. A number of practical measures are listed below:
- \* Use of regular watering to reduce dust emissions from exposed site surfaces and unpaved road, with complete coverage, particularly during dry weather.

- ♣ Use of frequent watering for particularly dusty static construction areas and areas close to ASRs.
- ♣ Tarpaulin covering of all dusty vehicle loads transported to, from and between site location.
- ♣ Establishment and use of vehicle wheel and body washing facilities at the exit points of the site.
- ♣ Routing of vehicles and positioning of construction plant at the maximum possible distance from ASRs.

#### *Odour*

- ♣ Cover any odorous stockpiled excavated materials with tarpaulin, and remove off-site within 1 day of work to avoid any odour nuisance arising.

- 5.36 Weekly site inspections to inspect the proper implementation of the above-recommended control measures should be conducted during construction phase of the Project.

#### Residual Environmental Impacts

- 5.37 With the implementation of the proposed dust suppression measures, good site practices along with regular environmental audits, no adverse residual construction phase air quality impact would be expected.

#### ***Water Quality***

##### Construction Phase

- 5.38 The excavation and widening works for the drainage improvements to the Upper Tai Po river channel should be carried out in sections (approximately 50-100m in length) and in dewatered condition. Special construction method by adopting containment measures such as bunds and barriers should be used within the river channel and the excavation works restricted to within an enclosed dewatered section of the channel (See **Drawing No. 4.1**). Although flooding of the proposed contaminant section seldom occurs during the dry season, the excavation should consider to temporarily stop when flood water enter the containment causing leakage of runoffs to stream water. This method of channel excavation is feasible and practical as proposed by the Project Engineer and should be specified in the contract document for implementation.
- 5.39 The site practices outlined in *ProPECC PN 1/94 "Construction Site Drainage"* should be followed as far as practicable during the drainage improvement works in order to minimise surface runoff and the chance of erosion, and also to retain and reduce any suspended solids prior to discharge. These practices include the following items:
- Before commencing any site formation work, all sewer and drainage connections should be sealed to prevent debris, soil, sand etc. from entering public sewers/drains.
  - Temporary ditches should be provided to facilitate run-off discharge into appropriate watercourses, via a silt retention pond.
  - Sand/silt removal facilities such as sand traps, silt traps and sediment basins should be provided to remove sand/silt particles from runoff to meet the requirements of the Technical Memorandum standard under the *Water Pollution Control Ordinance*. The design of silt removal facilities should be based on the guidelines provided in *ProPECC PN 1/94*. All drainage facilities and erosion and sediment control structures should be inspected monthly and maintained to ensure proper and efficient operation at all times and particularly during rainstorms.
  - Water pumped out from foundation excavations should be discharged into silt removal facilities.

- During rainstorms, exposed slope surfaces should be covered by a tarpaulin or other means. Other measures that need to be implemented before, during, and after rainstorms are summarized in *ProPECC PN 1/94*.
- Exposed soil areas should be minimized to reduce potential for increased siltation and contamination of runoff.
- Exposed soil surfaces should be protected by paving or fill material as soon as possible to reduce the potential of soil erosion.
- Open stockpiles of construction materials or construction wastes on-site of more than 50 m<sup>3</sup> should be covered with tarpaulin or similar fabric during rainstorms.

- 5.40 Disposal of any slurry water would need to comply with the *Technical Memorandum - Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* under the *Water Pollution Control Ordinance*.
- 5.41 Debris and refuse generated on-site should be collected, handled and disposed of properly to avoid entering the river channel and local storm water drains. Stockpiles of cement and other construction materials should be kept covered when not being used.
- 5.42 Oils and fuels should only be used and stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents to nearby water bodies, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. The bund should be drained of rainwater after a rain event.
- 5.43 Temporary sanitary facilities, such as portable chemical toilets, should be employed on-site. A licensed contractor would be responsible for appropriate disposal and maintenance of these facilities.
- 5.44 Weekly site audits should be carried out during construction phase of the Project to inspect the construction activities at all works areas to ensure the above water pollution control measures are properly implemented.

#### Operation Phase

- 5.45 For maintenance desilting of the Upper Tai Po re-profiled river channel, temporary barrier walls should be used to provide a dewatered zone for desilting work. Maintenance desilting should be carried out during periods of low flow in the dry season.

#### Residual Environmental Impacts

- 5.46 With the full implementation of the recommended mitigation measures for the construction and operation phases of the proposed Project, no adverse residual impact on water quality is anticipated.

### **Waste Management**

#### Construction Phase

- 5.47 Appropriate waste handling, transportation and disposal methods for all waste arisings generated during the construction works should be implemented to ensure that construction wastes do not enter the river channel and coastal waters.
- 5.48 It is not anticipated that adverse waste management related impacts would arise, provided that good site practices are strictly followed. Recommendations for good site practices during the construction activities include:

- ♣ Nomination of approved personnel, such as a site manager, to be responsible for good site practices and making arrangements for collection of all wastes generated at the site and effective disposal to an appropriate facility.
- ♣ Training of site personnel in proper waste management and chemical waste handling procedures.
- ♣ Provision of sufficient waste disposal points and regular collection for disposal.
- ♣ Covering of stockpiled excavated material by tarpaulin.
- ♣ Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers.
- ♣ Separation of chemical wastes for special handling and appropriate treatment at the Chemical Waste Treatment Facility.
- ♣ Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors.
- ♣ A recording system for the amount of wastes generated, recycled and disposed (including the disposal sites) should be proposed.
- ♣ A Waste Management Plan should be prepared and submitted to the Engineer for approval. One may make reference to *ETWB TCW No. 15/2003* for details.

5.49 In order to monitor the disposal of C&D material at landfills and public filling areas, as appropriate, and to control fly tipping, a trip-ticket system should be included as one of the contractual requirements. One may make reference to *ETWB TCW No. 31/2004* for details. The use of a trip-ticket system would be required to avoid any illegal or unplanned dumping of waste generated by the Project.

5.50 Good management and control can prevent the generation of significant amounts of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include:

- ♣ Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal.
- ♣ To encourage collection of aluminium cans by individual collectors, separate labelled bins should be provided to segregate this waste from other general refuse generated by the work force.
- ♣ Any unused chemicals or those with remaining functional capacity should be recycled.
- ♣ Maximising the use of reusable steel formwork to reduce the amount of C&D material.
- ♣ Prior to disposal of C&D waste, it is recommended that wood, steel and other metals should be separated for re-use and / or recycling to minimise the quantity of waste to be disposed of to landfill.
- ♣ Proper storage and site practices to minimise the potential for damage or contamination of construction materials.
- ♣ Plan and stock construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste.

5.51 The C&D material generated from the drainage improvement works would comprise public fill, being excavated soil and small rocks. To minimise off-site disposal of public fill, the excavated material with suitable characteristics/size should be reused on-site as fill material as far as practicable, such

as for construction of embankments, and small cobbles and rocks should be used in the construction of the re-created channel bed. The excavated riverbed material at the upstream section of Upper Tai Po River (Chainage CH 0.232 to CH 0.592) should be reused on-site as backfilling material for gabion lining.

- 5.52 When disposing C&D material at a public filling area, the material should only consist of soil, rock, concrete, brick, cement plaster/mortar, inert building debris, aggregates and asphalt. The material should be free from marine mud, household refuse, plastic, metals, industrial and chemical waste, animal and vegetable matter, and other material considered to be unsuitable by the Filling Supervisor.
- 5.53 Use of water-tight trucks would be required for the transportation of excavated riverbed material to the designated barging point for disposal at the designated public filling area, or transported directly to the public filling area.
- 5.54 If chemical wastes are produced at the construction site, the Contractor would be required to register with the EPD as a Chemical Waste Producer and to follow the guidelines stated in the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*. Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately. Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosives, flammable, oxidizing, irritant, toxic, harmful, corrosive, etc. The Contractor should use a licensed collector to transport and dispose of the chemical wastes generated at the Chemical Waste Treatment Centre at Tsing Yi, or other licenced facility, in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation*.
- 5.55 General refuse should be stored in enclosed bins or compaction units separate from C&D material. A reputable waste collector should be employed by the contractor to remove general refuse from the site, separately from C&D material. An enclosed and covered area is preferred to reduce the occurrence of 'wind blown' light material.
- 5.56 To determine if wastes are being managed in accordance with approved procedures and waste management plan, and to check the implementation of recommended good site practices and other waste management mitigation measures, an audit near the commencement of construction works, and thereafter regular audits on a quarterly basis are recommended.

#### Residual Environmental Impacts

- 5.57 With the implementation of the recommended mitigation measures for the handling, transportation and disposal of the identified waste arisings, unacceptable residual impacts would not be expected during the construction of the proposed drainage improvement works.

#### ***Landscape and Visual Impacts***

- 5.58 Based on the *WBTC 14/2002* and *ETWB TC No. 2/2004, Maintenance of Vegetation and Hard Landscape Features*, landscape and visual mitigation measures are recommended for the construction and operational phases.

#### Construction Phase

- ♣ Preservation and protection of the existing natural stream-course outside the works areas e.g. the upper part of the river inside Tai Mo Shan Country Park.
- ♣ The slope stabilisation works to the existing slopes at the edge of Natural woodland of Lai Chi Shan and Pun Shan Chau should be undertaken in such a manner so as to avoid impact on the stream course.



- ♣ The works site and working methods for the construction of the whole drainage channel works site should be designed so as to retain and protect all existing large trees along the edge of the site.
- ♣ All retained trees should be recorded photographically at the commencement of the contract, and carefully protected during construction by fencing them off from the rest of the works.
- ♣ Trees unavoidably affected by the works should be transplanted where practical. Sufficient time for necessary tree root and crown preparation periods prior to moving the trees should be allowed in the project programme.
- ♣ Topsoil, where identified, should be stripped and stored for re-use in the construction of the soft landscape works, where practical.
- ♣ The potential for soil erosion should be reduced by minimising the extent of vegetation disturbance on site and by providing a protective cover (e.g. plastic sheeting or a grass cover established by hydro-seeding) over newly exposed soil.
- ♣ Control night lighting and prevent glare to surrounding VSR by directing all security lighting downward into works sites and works areas.

#### Operation Phase

- ♣ All above water level structures, including gabion drainage walls, footpath, footbridge in village environs etc should be sensitively designed in a manner that responds to the existing and planned urban context, and minimises potential adverse landscape and visual impacts.
  - ♣ An attractive hard and soft landscaped amenity strip should be created along the strip of land beside the footpath in village environs along the drainage channel. Tall shade trees should be provided alongside footpaths and pedestrian areas for the comfort of pedestrians.
  - ♣ Gabion walls should be provided with planting strips to allow planting of herbaceous plant or self-clinging climbing plants along the top of the walls, sufficient to cover the entire walls in time.
  - ♣ Compensatory Tree Planting for all felled trees should be provided to the satisfaction of relevant Government departments.
  - ♣ Any exposed engineering features such as drainage channel, access steps, safety railings etc should be coloured 'earth' colours to blend in with the surrounding landscape.
  - ♣ Attractive soft landscape for footpath in village environs along drainage channel and other visible structures so as to provide a visual softening and greening effect.
  - ♣ All footpath areas in village environs and hard and soft landscape areas disturbed during construction should be reinstated to equal or better quality, to the satisfaction of the relevant Government departments.
- 5.59 A detailed landscape plan for the project should be developed and submitted to the relevant Government Departments for their approval during the detailed design stage. This will also delineate the final boundaries for responsibility.
- 5.60 All mitigation measures should be implemented in the detailed design and construction phase, so that they are in place at the commissioning of the DSD.
- 5.61 The design, implementation and maintenance of landscape and visual mitigation measures should be checked by site supervision and monitoring to ensure that the intended mitigation effects are fully realised.

### Residual Landscape Impact

#### *Construction Phase*

- 5.62 Residual landscape impacts on most of the LR and LCA are moderate. Given that the temporary nature of the construction works, no long-term adverse residual impact of substantial significance would be envisaged during the construction phase after implementation of the recommended mitigation measures. The residual construction impacts on LR and LCA are detailed in **Appendix 4.3**.

#### *Operation Phase*

- 5.63 Residual operation impacts on LR and LCA are detailed in **Appendix 4.3**. It is considered that there would be no residual impacts of substantial significance on any LR or LCA in the operational phase resulting from the Projects. Residual adverse landscape impacts of moderate significance in the operation phase that would be solely attributable to the project would be at the river channel. The remaining residual impacts in the operation phase would be either slight adverse or insubstantial.

### Residual Visual Impact

#### *Construction Phase*

- 5.64 Taken the full mitigation measures into account, there would be changes in view for VSR overlooking the drainage channel alignment due to the impacts on mature trees, temporary works sites and works areas, general construction activities and associated works, and utilities and road and traffic diversion measures. The residual visual impacts of the construction of gabion channel on most of the VSR are *moderate but temporary* in construction stage. Details are provided in **Appendix 4.4**.

#### *Operation Phase*

- 5.65 The residual impacts for VSR are mostly evaluated as *Slight to Insubstantial* after implementation of the recommended mitigation measures (**Appendix 4.4** refers). **Drawing No 5.2** and **No. 5.3** show the photomontage of the existing view, the operation phase without mitigation measure and also implemented with mitigation measure (after 1 day and 10 years).

### **Severity, Distribution and Duration of Environmental Effects**

- 5.66 No adverse residual environmental impacts are anticipated with the implementation of the recommended mitigation measures during the construction and operation stages of the Project.
- 5.67 In the operation phase, flood prevention is a long term benefit to protect nearby villages from flooding and avoid danger to human life and damage to properties.

### **Further Implications**

- 5.68 Between July and October 2004 a public consultation with green groups and local villagers including site visits for the proposed river improvement works was conducted. The public views gathered have been considered and, where appropriate, incorporated into the scheme being developed. In particular, the comments from the local conservation groups to consider improving only one side of the river and to retain the remaining half of the river, with a view to preserving the natural riverbeds and minimising as far as practicable the extent of the proposed works, had been appropriately incorporated in the latest design (refer to Section 5.8). Key parties consulted include:



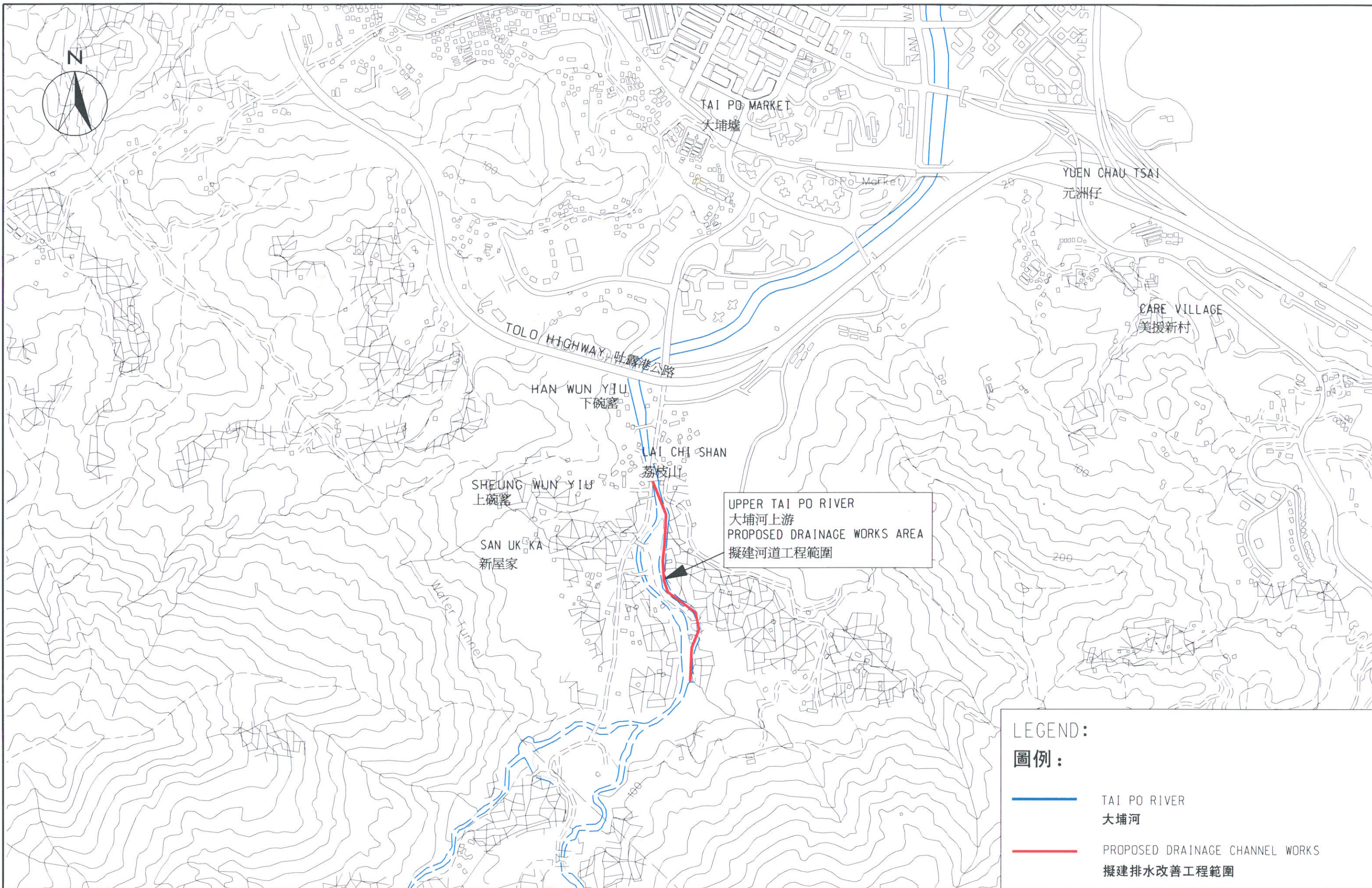
- ♣ Tai Po District Council
- ♣ Village Representatives from various villages around Upper Tai Po River
- ♣ Tai Po Environmental Association
- ♣ Kadoorie Farm & Botanic Garden
- ♣ Hong Kong Bird Watching Society
- ♣ WWF Hong Kong
- ♣ Green Power
- ♣ The Conservancy Association
- ♣ Friends of the Earth
- ♣ Greenpeace

## **6. USE OF PREVIOUSLY APPROVED EIA REPORTS**

- 6.1 No previously approved EIA reports were referenced for this project.

## Drawings



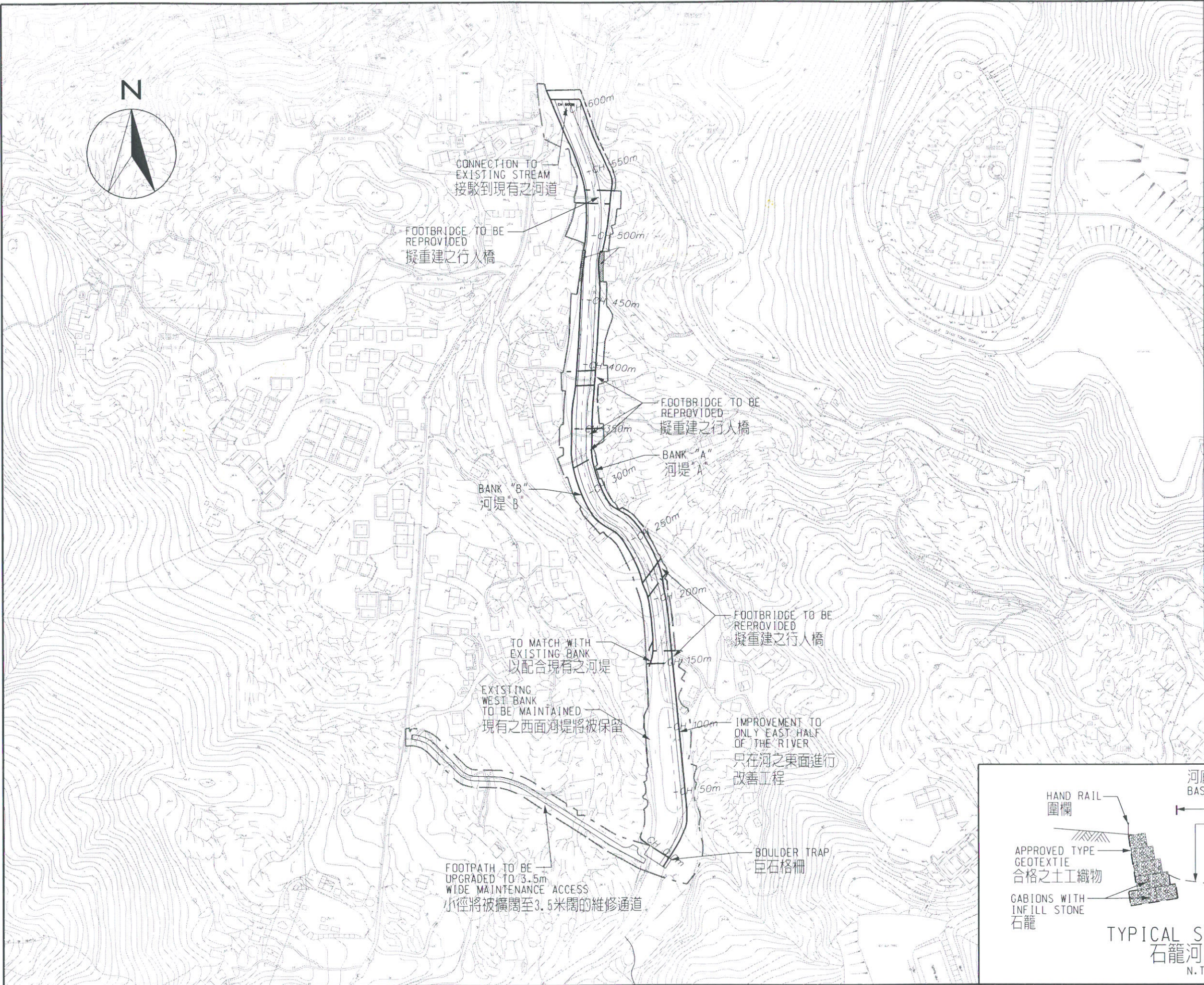


LEGEND:

圖例:

- TAI PO RIVER  
大埔河
- PROPOSED DRAINAGE CHANNEL WORKS  
擬建排水改善工程範圍

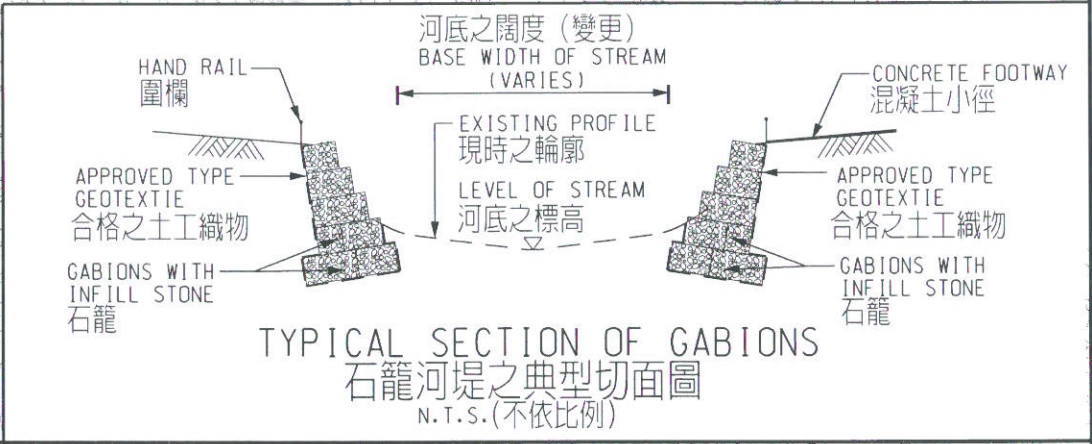




- NOTES:  
注解:
1. ALL CHAINAGES ARE IN KILOMETRES UNLESS OTHERWISE INDICATED.  
除特別說明外，所有里程距離以公里為單位。
  2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM (mPD).  
所有標高以米（高於主水平基準）為單位。
  3. GABION SHALL BE PROVIDED AT BOTH SIDES AND ALONG THE FULL LENGTH OF THE REPROFIED STREAMCOURSE.  
石籠將沿河堤兩岸鋪設。

LEGEND:  
圖例:

CH	CHAINAGE 里程距離
E.I.L.	EXISTING INVERT LEVEL 現時之河底標高
I.L.	PROPOSED INVERT LEVEL 擬建之河底標高
B.L.	BANK LEVEL 河堤標高
——	EXISTING CHANNEL 現時之河道
——	PROPOSED CHANNEL 擬建之河道



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Management Consultants Ltd

AGREEMENT NO. CE 50/2001 (DS) DRAINAGE IMPROVEMENT IN SHA TIN AND TAI PO - DESIGN AND CONSTRUCTION  
協議編號CE 50/2001 (DS) 沙田及大埔雨水排放系統改善工程 - 設計和建造  
DRAINAGE CHANNEL IMPROVEMENT TO UPPER TAI PO RIVER  
大埔河上游之河道改善工程

SCALE	A3 1:3000	DATE	MAY 2005
CHECK		DRAWN	GON
JOB NO.	A01602(003)	DRAWING No.	1.2
		REV	



Activity Description 工序	2006			2007												2008								
	Oct 十月	Nov 十一月	Dec 十二月	Jan 一月	Feb 二月	Mar 三月	Apr 四月	May 五月	Jun 六月	Jul 七月	Aug 八月	Sep 九月	Oct 十月	Nov 十一月	Dec 十二月	Jan 一月	Feb 二月	Mar 三月	Apr 四月	May 五月	Jun 六月	Jul 七月	Aug 八月	Sep 九月
Works at Bank B (河堤'B'工程)																								
Site Clearance (地盤平整)																								
Piling (打樁)																								
Channel Construction & Excavation (河道挖掘及建設)				Ch. 301-600			Ch. 150-300																	
Backfilling* (工地回填*)							Ch. 301-600	Ch. 150-300																
Upgrading Existing Footpath to Maintenance Access (擴闊現有小徑為維修通道)																								
Works at Bank A* (河堤'A'工程*)																								
Site Clearance (地盤平整)																								
Piling (打樁)																								
Channel Construction & Excavation (河道挖掘及建設)															Ch. 301-600	Ch. 0-300								
Backfilling* (工地回填*)																Ch. 301-600	Ch. 0-300							
Footbridge Reprovisioning (重建行人橋)																								

\* Backfilling, channel lining and access road paving will be carried out at this stage.

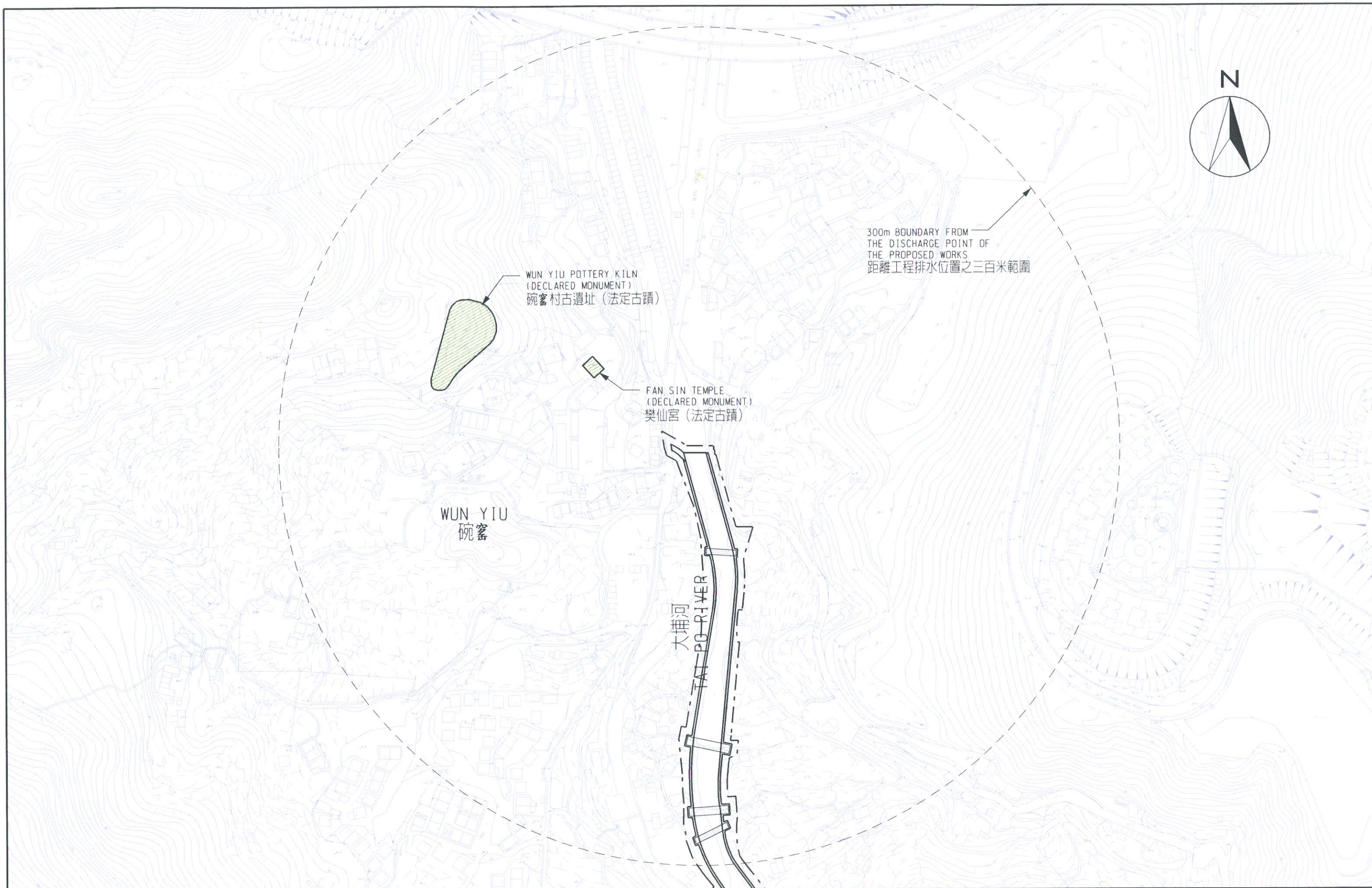
\* 回填，鋪設河底及路面都在這個階段進行

+ Only Bank A will be improved for section from Ch.000 - 150

+ 只有河堤'A'才會在Ch.000 - 150 段進行工程

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	PRELIMINARY CONSTRUCTION PROGRAMME 初步施工時間表				CHECK	FWYW	DRAWN	AHCM
					JOB No.	A01602-003	DRAWING No.	2.1





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LOCATION OF  
TWO SITES OF CULTURAL HERITAGE  
兩個文化遺產的位置

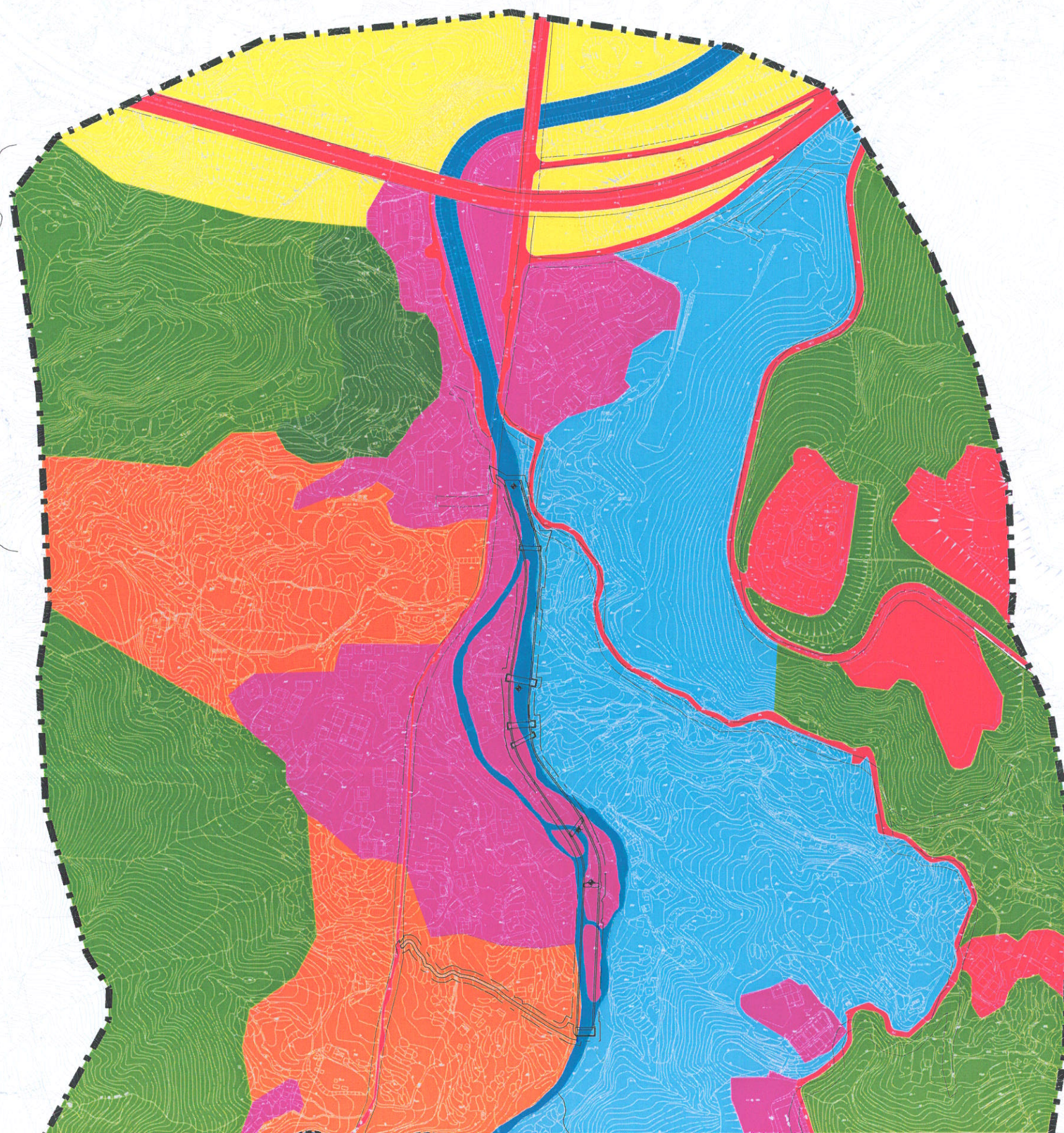
SCALE	A3 1:2500	DATE	MAY 2005
CHECK		DRAWN	GON
JOB No.	A01602(003)	DRAWING No.	3.1
		REV	





LEGEND:  
圖例:

- COUNTRY PARK  
郊野公園
- BOUNDARY LINE  
研究界線
- DEVELOPED AREA  
已發展地區
- VILLAGE  
鄉村
- SECONDARY WOODLAND  
次生林
- PLANTATION  
植林
- RIVER / STREAM  
河流 / 溪澗
- CULTIVATED LAND  
耕地
- FUNG SHUI WOODLAND  
風水林
- SHRUB LAND  
灌木林
- \* Sus Scrofa  
野豬
- CIVET SCAT  
果子狸糞便
- ∞ Pseudobagrus Trilineatus  
條紋擬鱔
- ⊗ Paramesotriton Hongkongensis  
香港瘰螈
- ◊ Ptyas Korros  
灰鼠蛇
- ◼ Ptyas Muscosus  
滑鼠蛇



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協議編號 CE 50/2001 (DS) 沙田及大埔雨水排放系統改善工程 - 設計和建造

HABITAT MAP FOR STUDY AREA (SHEET 1 OF 2)

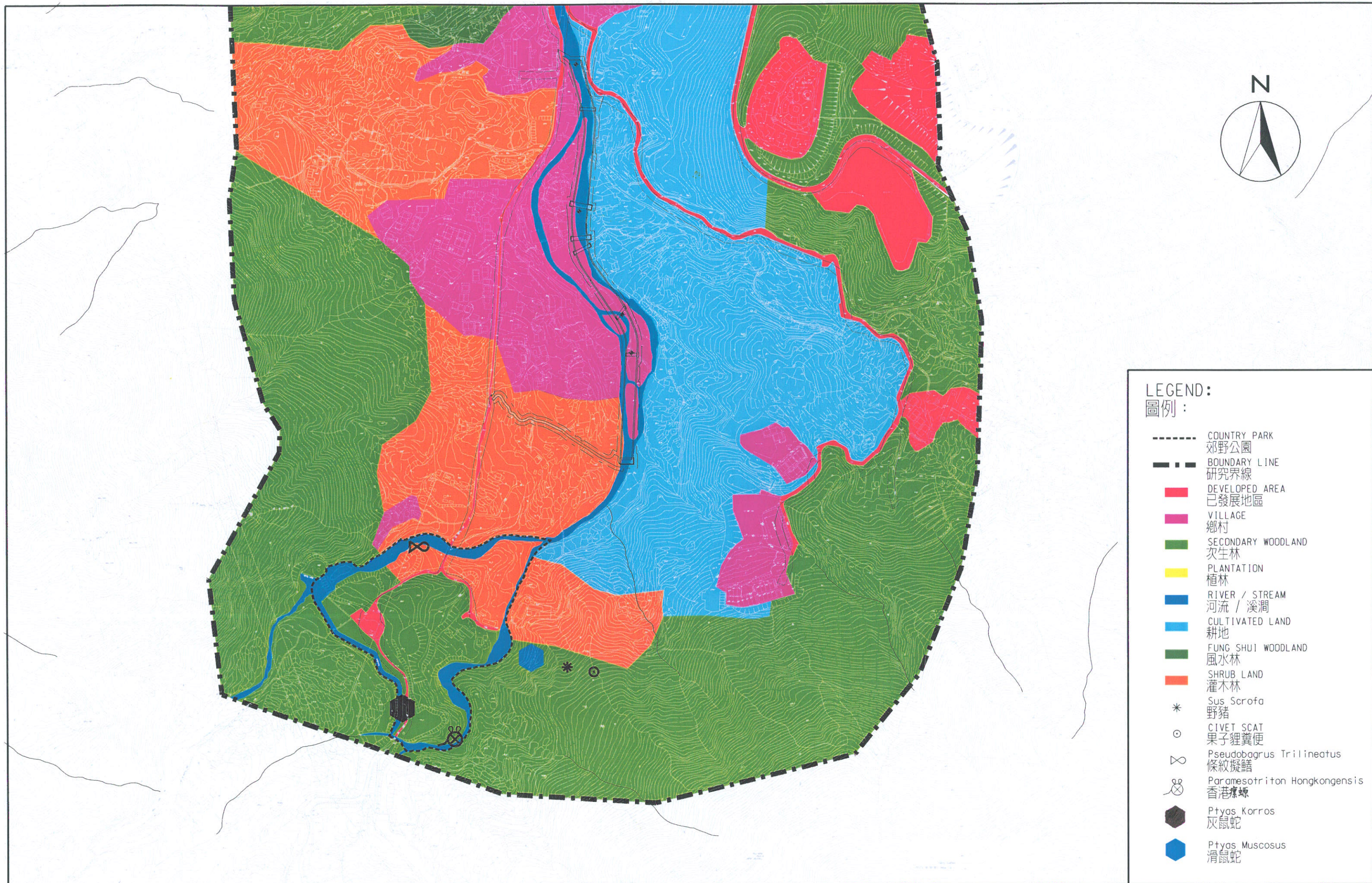
研究區生境圖(頁一)

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SCALE	1:5000 (A3)	DATE	JUN 2005
CHECK	FWYW	DRAWN	LDF
JOB NO.	A01602-003	DRAWING NO.	3.2
		REV	-





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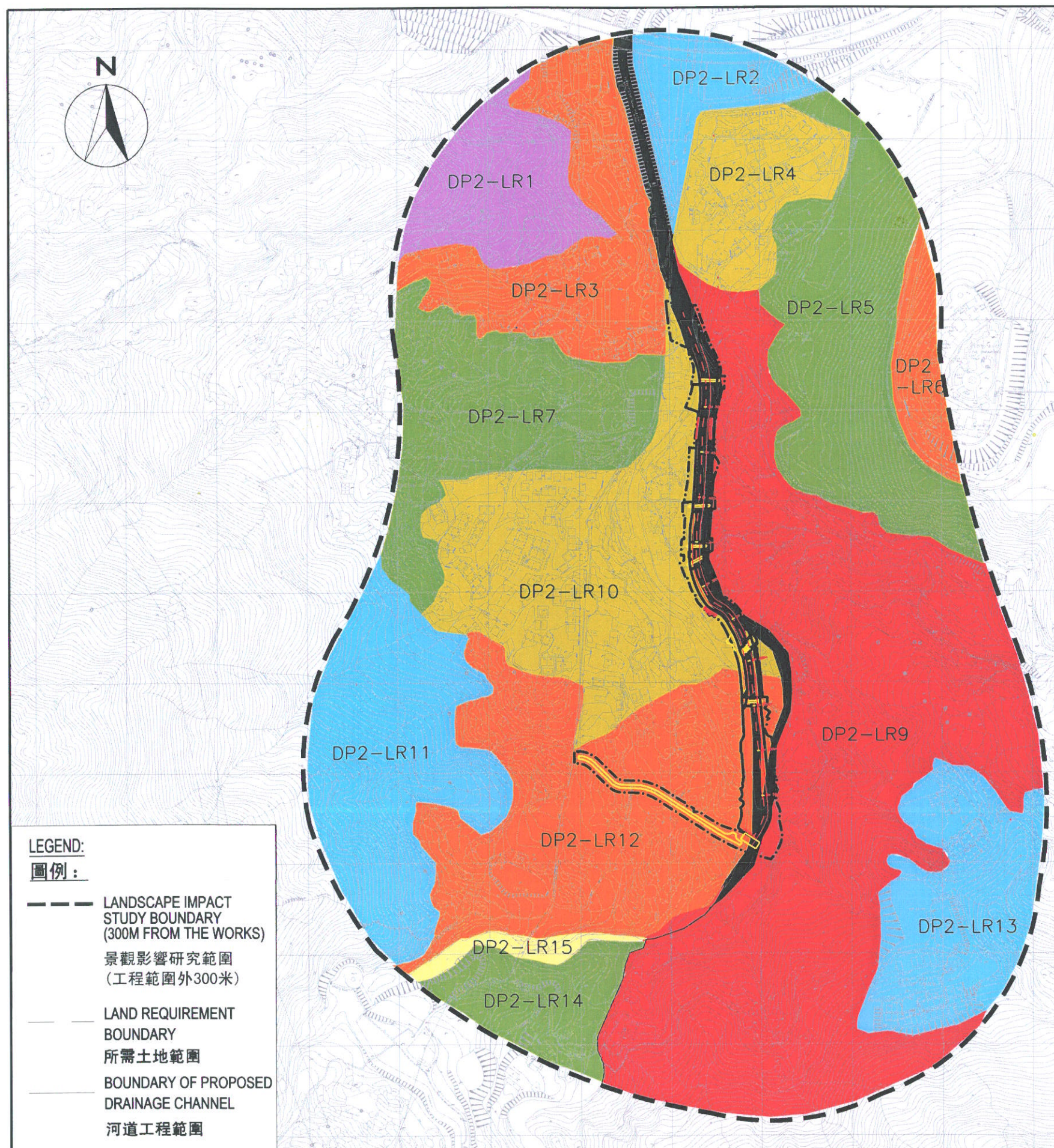
協議編號CE 50/2001 (DS) 沙田及大埔雨水排放系統改善工程 - 設計和建造

HABITAT MAP FOR STUDY AREA (SHEET 2 OF 2)

研究區生境圖(頁二)

SCALE	1:5000 (A3)	DATE	JUN 2005
CHECK	FWYW	DRAWN	LDF
JOB NO.	A01602-003	DRAWING NO.	3.2
		REV	-





**DP2-LR1 – Natural Woodland near Ha Wun Yiu Village (下碗窰附近的天然林地):** ~ 400 trees e.g. *Aquilaria sinensis* and *Sterculia lanceolata*. Nurseries scattered around with fruit tree species e.g. *Mangifera indica*, *Dimocarpus longan*, etc. 這裏有約 400 棵樹，包括牙香樹和假蘋婆。此外，亦有苗圃分布於區內，種植芒果、龍眼等果樹。

**DP2-LR2 – Amenity Area and Slope at the Intersection of Tolo Highway and Tai Wan Road (位於吐露港公路和達運路交界的市容美化區和山坡):** ~ 100 trees identified with typical species e.g. *Cinnamomum camphora* and *Leucaena leucocephala*. 這裏有約 100 棵樹。常見的種類有樟樹和銀合歡等。

**DP2-LR3 – Trees in Ha Wun Yiu Village (下碗窰村的樹木):** ~ 200 trees around the Village with many fruit tree species e.g. *Mangifera indica* & *Dimocarpus longan*, etc. 這條村的四周種植了約 200 株樹，其中有果樹芒果、龍眼等。

**DP2-LR4 – Trees in Lai Chi Shan Village (荔枝山村的樹木):** ~ 200 trees with species e.g. *Litchi chinensis* and *Citrus grandis*. 大約有 200 株樹，其中的種類包括荔枝和黃皮。

**DP2-LR5 – Shrubland at the east of the Paramount Residence (盈峰翠邸東面的灌木地):** ~200 trees scattering on the slope, e.g. *Acacia confusa*. 約有 200 株樹木零星散布山坡上，如台灣相思。

**DP2-LR6 – Trees and Vegetation around the Paramount Residence (盈峰翠邸四周的樹木和植物):** ~ 150 trees with both ornamental and fast-growing species, e.g., *Acacia confusa* and *Leucaena leucocephala*. 約有 150 株裝飾用和快速生長的樹木品種，例如台灣相思和銀合歡。

**DP2-LR7 – Trees and Agricultural Field at Sheung Wun Yiu (上碗窰的樹木和田地):** ~ 300 trees e.g. *Dimocarpus longan* and *Macaranga tanarius*. 約 300 棵樹木，包括龍眼和血桐。

**DP2-LR8 – Natural River of Upper Tai Po River (上大埔河的天然河流):** ~ 200 trees and boulders at both sides of the natural Upper Tai Po River e.g. *Acacia confusa* and *Ficus hispida*. 上大埔河兩側有礫石和約 200 棵樹，例如台灣相思和對葉榕。

**DP2-LR9 – Trees and Agricultural Field in Pun Shan Chau (半山洲的樹木和田地):** Apart from crops, tree species e.g. *Mangifera indica*, *Clausena lansium*, *Citrus grandis* are common. 這個地區除了農作物外，芒果、黃皮和柚子等樹木亦很常見。

**DP2-LR10 – Trees in San Uk Kai Village (新屋家村的樹木):** Both ornamental and fruit trees are common e.g. *Dimocarpus longan*, *Michelia alba* and *Juniperus chinensis*. 裝飾樹和果樹在新屋家村內都很常見，例如龍眼、白蘭和圓柏。

**DP2-LR11 – Woodland at the east of San Uk Kai Village (新屋家村東面的林地):** over 1200 trees (mostly mature), with common species e.g. *Macaranga tanarius* and *Clausena lansium*. 在新屋家村東面發現超過 1200 株樹，其中大部份都是已成長的樹木。這一帶的常見品種有朴樹和芒果等。

**DP2-LR12 – Trees and Agricultural Field at San Uk Kai (新屋家的樹木和農田):** Agricultural fields (mostly abandoned) are found at south of San Uk Kai. About 1500 trees (mostly mature) scattered in the field. Common species e.g. *Celtis sinensis* and fruit trees e.g. *Mangifera indica*. 在新屋家南面有些農田，但大都已經荒廢。大約有 1500 棵大都已經成長的樹散布在田間，其中有常見的品種，例如朴樹，以及一些果樹，例如芒果。

**DP2-LR13 – Trees at the Housing Area of Pun Shan Chau (半山洲房屋區的樹木):** ~ 200 trees scattered around the region with common species e.g. *Dimocarpus longan* and ornamental trees e.g. *Juniperus chinensis*. 約有 200 棵樹木散布在這個地區內，其中常見的品種，例如：龍眼。除了果樹外，亦有裝飾性的樹木，例如圓柏。

**DP2-LR14 – Woodland and Shrubland in Tai Mo Shan Country Park (大帽山郊野公園的林地和灌木地):** ~ 800 trees e.g. *Cinnamomum camphora*, *Acacia confusa* and *Celtis sinensis* are identified. 約有 800 棵樹，例如，樟樹、台灣相思和朴樹。

**DP2-LR15 – Natural River at the edge of Tai Mo Shan Country Park Area (大帽山郊野公園區邊緣的天然河流):** Natural boulders and trees are located at both sides of the natural river near San Uk Kai. Common species of trees e.g. *Macaranga tanarius*. 在新屋家附近有一條天然河流，兩側都有天然的礫石和樹木。沿河有 80 棵樹，其中有像血桐等常見品種。

#### LEGEND:

#### 圖例:

- LANDSCAPE IMPACT STUDY BOUNDARY (300M FROM THE WORKS)  
景觀影響研究範圍 (工程範圍外300米)
- LAND REQUIREMENT BOUNDARY  
所需土地範圍
- BOUNDARY OF PROPOSED DRAINAGE CHANNEL  
河道工程範圍

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### LANDSCAPE RESOURCE 景觀資源

SCALE	1:5000 (A3)	DATE	JUN 2005
CHECK	FWYW	DRAWN	AHCM
JOB No.	A01602-003	DRAWING No.	3.3
		REV	—





DP2-LCA3

DP2-LCA2

DP2-LCA1

**LEGEND:**

**圖例:**

- LANDSCAPE IMPACT STUDY BOUNDARY (300M FROM THE WORKS)  
景觀影響研究範圍 (工程範圍外300米)
- LAND REQUIREMENT BOUNDARY  
所需土地範圍
- BOUNDARY OF PROPOSED DRAINAGE CHANNEL  
河道工程範圍

**DP2-LCA1 – Wun Yiu Settled Valley (碗窑山谷):** It is situated to the south of Tai Po Town between Tai Mo Shan Country Park to the west and Tai Po Kau Nature Reserve to the east. Key landscape features include broad valley topography and large streams, remnant agricultural land, small villages and woodland on valley sides. 碗窑山谷景觀特色區位於大埔市鎮南面，介乎西面的大帽山郊野公園和東面的大埔滘自然護理區之間。這個景觀特色區的主要景觀特徵，是廣闊的山谷地形和大河溪、殘留農地、小村落和谷邊林地。

**DP2-LCA2 – Tai Po Kau Residential Urban Fringe (大埔滘城市邊緣住宅):** It is situated to the south of Tai Po Town between the Tolo Harbour Section of Tolo Highway to the north and the uplands of Tai Po Kau Nature Reserve to the south. Key landscape features are the elongated residential housing patches, with woodlands and streams in the surrounding environment. 大埔滘城市邊緣住宅景觀特色區位於大埔市鎮南面，介乎北面的吐露港公路吐露港段，以及南面的大埔滘自然護理區之間。這個景觀特色區的主要景觀特徵，是狹長的住宅樓宇小區，以及小區四周的林地和溪流。

**DP2-LCA3 – Lin Au Uplands (蓮澳高地):** This upland landscape consists of steep, rolling hillsides, which forms the lower part of Tai Mo Shan Peak. The landscape is largely undeveloped. Key landscape features are scrub woodland, steep upland topography and woodland plantation. 這個景觀特色區是由陡峭而起伏不平的山坡組成，亦是大帽山山峰的山腳部份。這裏大都未經開發。這個景觀特色區的特徵是灌木林地、陡峭的高地地形和種植林地。

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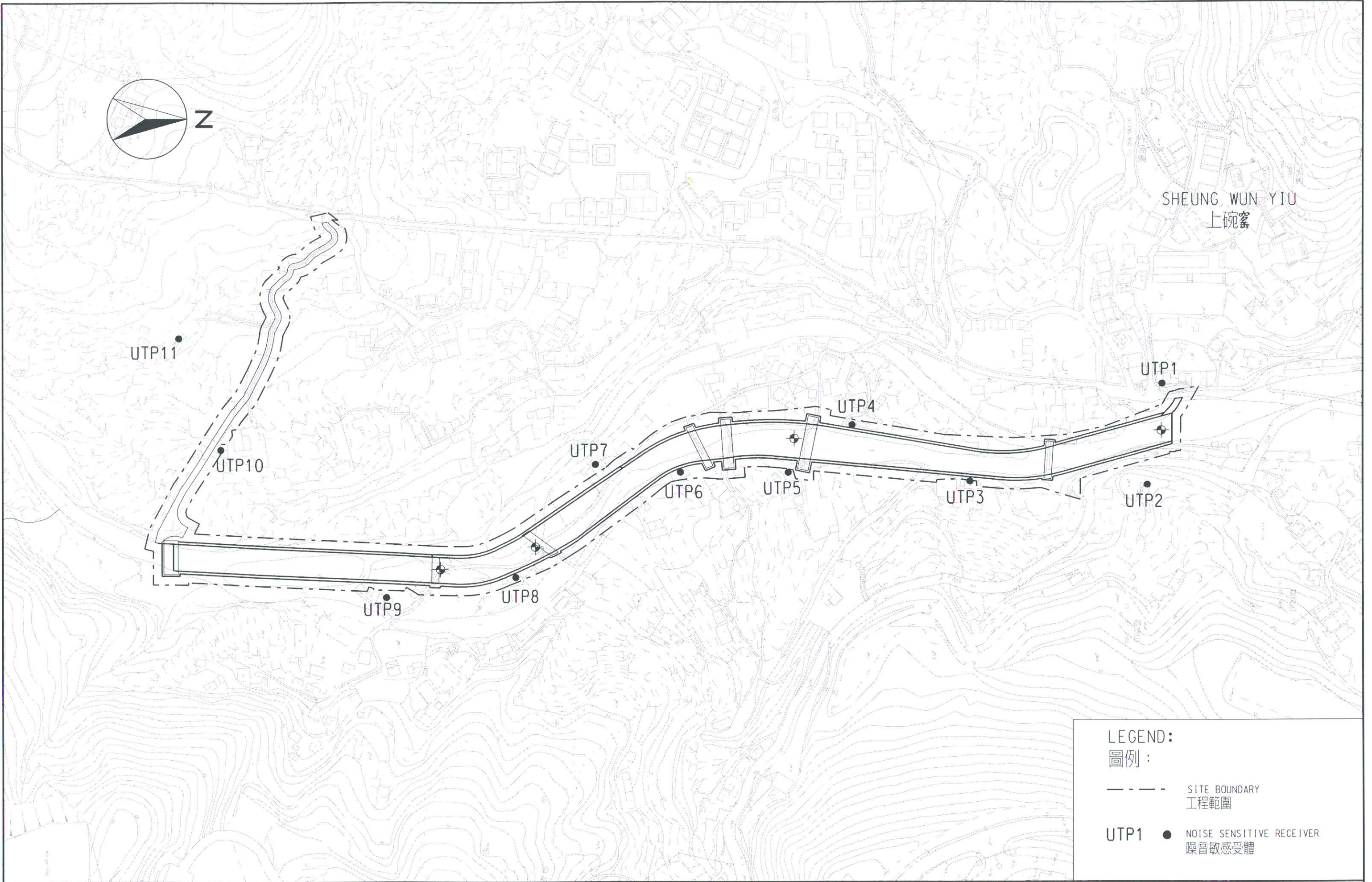
LANDSCAPE CHARACTER AREA  
景觀特色區

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SCALE	A3 1:5000	DATE	JUN 2005
CHECK	FWYW	DRAWN	AHCM
JOB No.	A01602-003	DRAWING No.	3.4
		REV	—





LEGEND:

圖例:

--- SITE BOUNDARY  
工程範圍

UTP1 ● NOISE SENSITIVE RECEIVER  
噪音敏感受體

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協議編號CE 50/2001 (DS) 沙田及大埔雨水排放系統改善工程 - 設計和建造

LOCATIONS OF REPRESENTATIVE NOISE SENSITIVE RECEIVERS  
具代表性之噪音敏感受體位置圖

SCALE	A3 1:2000	DATE	JUN. 2005
CHECK	FWYW	DRAWN	XJH
JOB No.	A01602(003)	DRAWING No.	3.5
		REV	





SHEUNG WUN YIU  
上碗窰

AUTP11

AUTP10

AUTP7

AUTP6

AUTP5

AUTP4

AUTP3

AUTP2

AUTP9

AUTP8

LEGEND:

圖例:

--- SITE BOUNDARY  
工程範圍

AUTP1 ● AIR SENSITIVE RECEIVER  
空氣敏感受體

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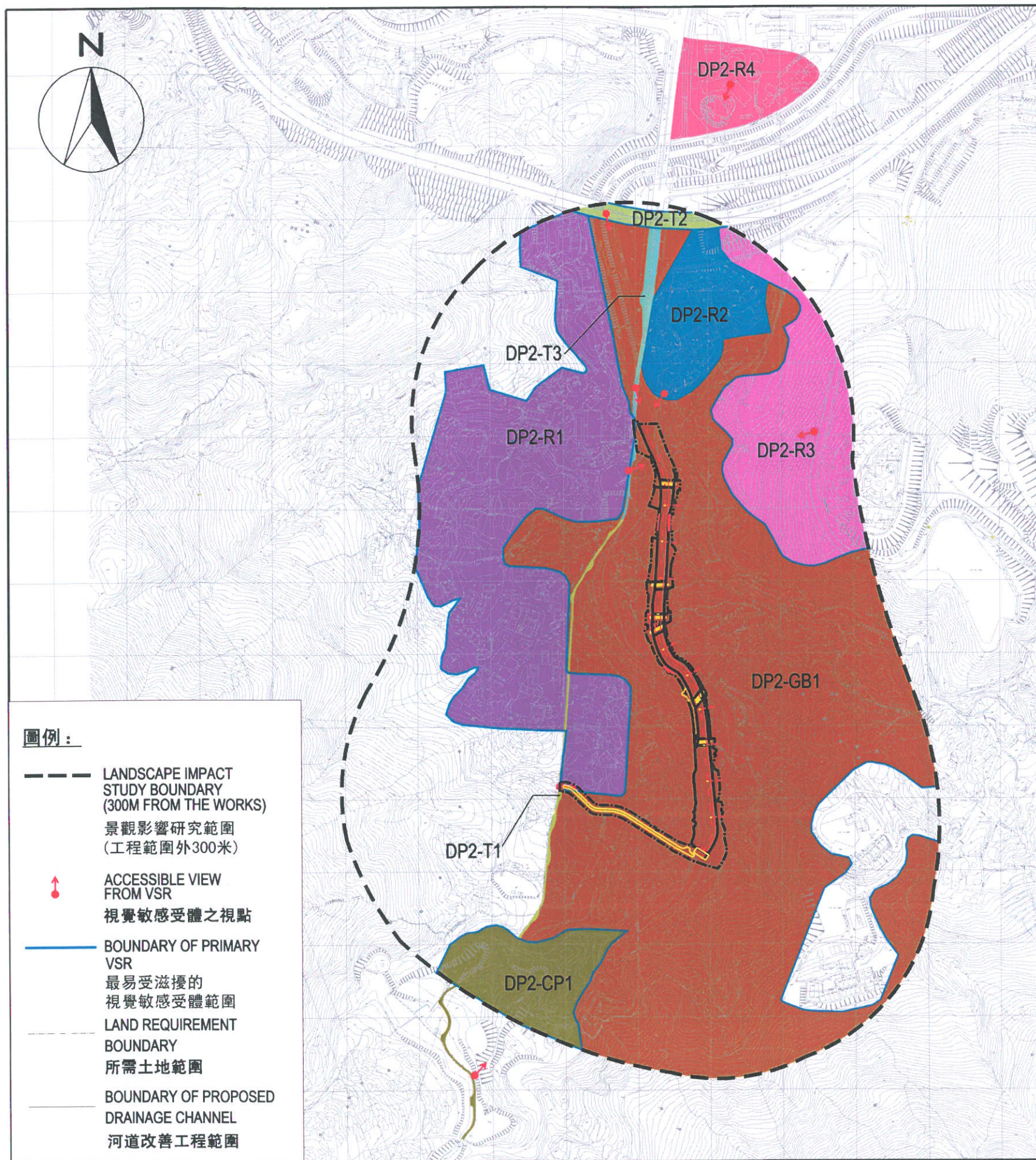
協議編號CE 50/2001 (DS) 沙田及大埔雨水排放系統改善工程 - 設計和建造

LOCATIONS OF REPRESENTATIVE AIR SENSITIVE RECEIVERS

具代表性之空氣敏感受體位置圖

SCALE	A3 1:2000	DATE	JUN. 2005
CHECK	FWYW	DRAWN	XJH
JOB No.	A01602(003)	DRAWING No.	3.6
		REV	





**圖例：**

- LANDSCAPE IMPACT STUDY BOUNDARY (300M FROM THE WORKS)  
景觀影響研究範圍 (工程範圍外300米)
- ↑ ACCESSIBLE VIEW FROM VSR  
視覺敏感受體之視點
- BOUNDARY OF PRIMARY VSR  
最易受滋擾的視覺敏感受體範圍
- LAND REQUIREMENT BOUNDARY  
所需土地範圍
- BOUNDARY OF PROPOSED DRAINAGE CHANNEL  
河道改善工程範圍

**DP2-R1 – Residents of Wun Yiu Village (碗窑村居民):** They would have at most a full view and minimum 1m distance to the source of the impact of gabion channel both in construction and operation phase. 無論是施工或運作階段，他們最多可以看見影響來源（即石籠所形成的河道）的全景，而與該處的最短距離為 1 米。

**DP2-R2 – Residents of Lai Chi Village (荔枝村居民):** They would have at most a partial view and minimum 20m distance to the source of the construction impact of gabion channel both in construction and operation phases. (無論是施工或運作階段，他們最多可以看見影響來源（即石籠所形成的河道）的一部份，而與該處的最短距離為 20 米。)

**DP2-R3 – Residents of the Paramount (盈峰翠邸居民):** They would have at most a glimpse view and minimum 100m distance to the source of the construction impact of gabion channel both in construction and operation phases. 無論是施工或運作階段，他們最多可以看見影響來源（即石籠所形成的河道）的極少部份，而與該處的最短距離為 100 米。

**DP2-R4 – Residents of Tak Nga Court (德雅苑居民):** They would have at most a glimpse view and minimum 400m distance to the source of the construction impact of gabion channel both in construction and operation phases. 無論是施工或運作階段，他們最多可以看見影響來源（即石籠所形成的河道）的極少部份，而與該處的最短距離為 400 米。

**DP2-T1 – Drivers / Pedestrians of Lane at San Uk Kai (新屋家小路的駕車者／行人)** They would have at most a full view next to the source of the construction impact of gabion channel in construction phase and a partial view with minimum 250m in operation phase. 在施工階段，他們最多會在影響來源（即石籠所形成的河道）旁邊看見它的全景；而在運作階段則最少在距離 250 米處看見它的一部份。

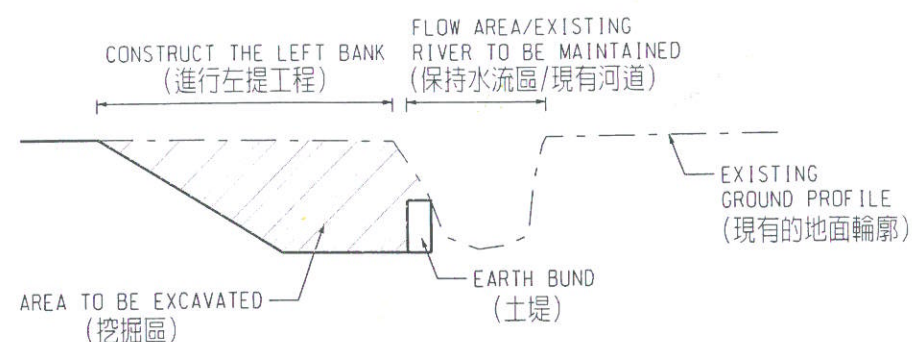
**DP2-T2 – Drivers / Pedestrians of Wun Yiu Section of Tolo Highway (吐露港公路碗窑段的駕車者／行人):** They would have at most a glimpse view and minimum 250m distance to the source of the construction impact of gabion channel both in construction and operation phases. 無論是施工或運作階段，他們最多可以看見影響來源（即石籠所形成的河道）的極少部份，而與該處的最短距離為 250 米。

**DP2-T3 – Drivers / Pedestrians of Tat Wan Road (達運道的駕車者／行人):** They would have at most a full view and minimum 5m distance to the source of the construction impact of gabion channel both in construction and operation phases. 無論是施工或運作階段，他們最多可以看見影響來源（即石籠所形成的河道）的全景，而與該處的最短距離為 5 米。

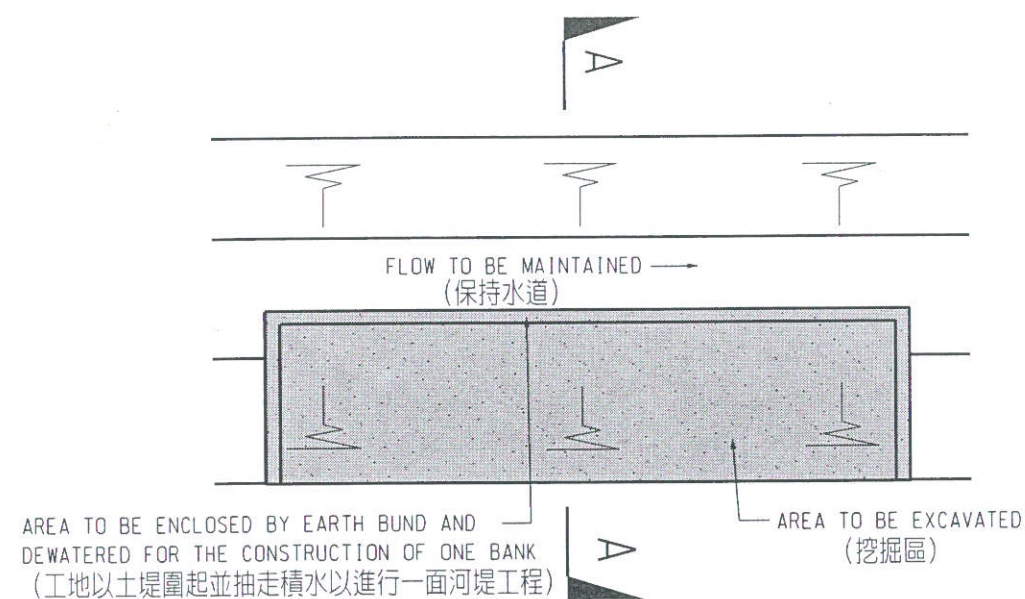
**DP2-GB1 – Residents/Engagers of Pun Shan Chau Agricultural Fields (半山洲農田的居民／佔用者):** They would have at most a full view and next to the source of the construction impact of gabion channel both in construction and operation phases. 無論是施工或運作階段，他們最多可以在旁邊看見影響來源（即石籠所形成的河道）的全景。

**DP2-CP1 – Walkers on Wilson Trail (衛奕信徑的行人):** They would have at most a partial view and minimum 300m distance to the source of the construction impact of gabion channel both in construction and operation phases. 無論是施工或運作階段，他們最多可以看見影響來源（即石籠所形成的河道）的一部份，而與該處的最短距離為 300 米。

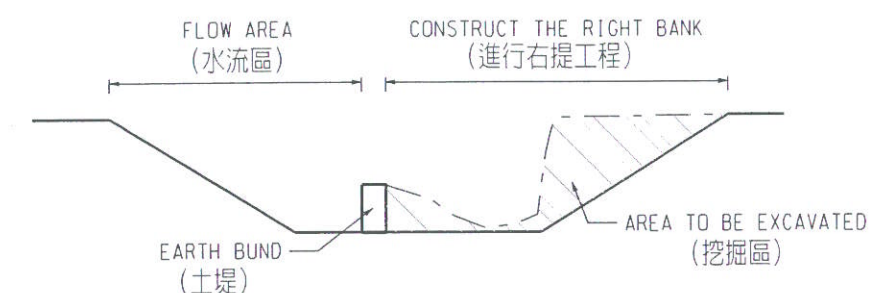




STAGE 1 - CONSTRUCT THE LEFT BANK  
(第一期 - 進行左堤工程)

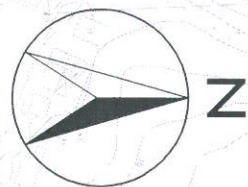


PLAN FOR STAGE 2  
(第二期的平面圖)

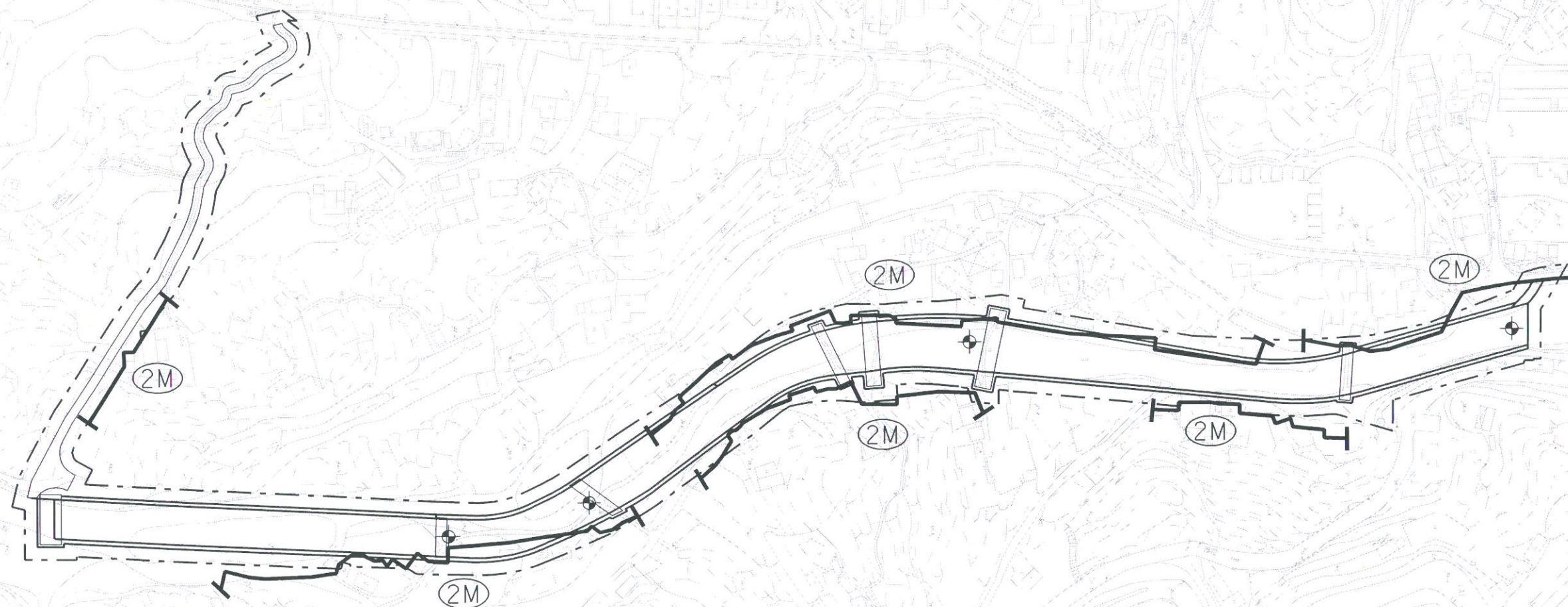


STAGE 2 - CONSTRUCT THE RIGHT BANK  
(SECTION A - A)  
(第二期 - 進行右堤工程(橫切面 A - A))





SHEUNG WUN YIU  
上碗窰



LEGEND:  
圖例:

--- SITE BOUNDARY  
工程範圍

(2M) PROPOSED 2M HIGH VERTICAL BARRIER  
擬建之兩米高直立式隔音屏障

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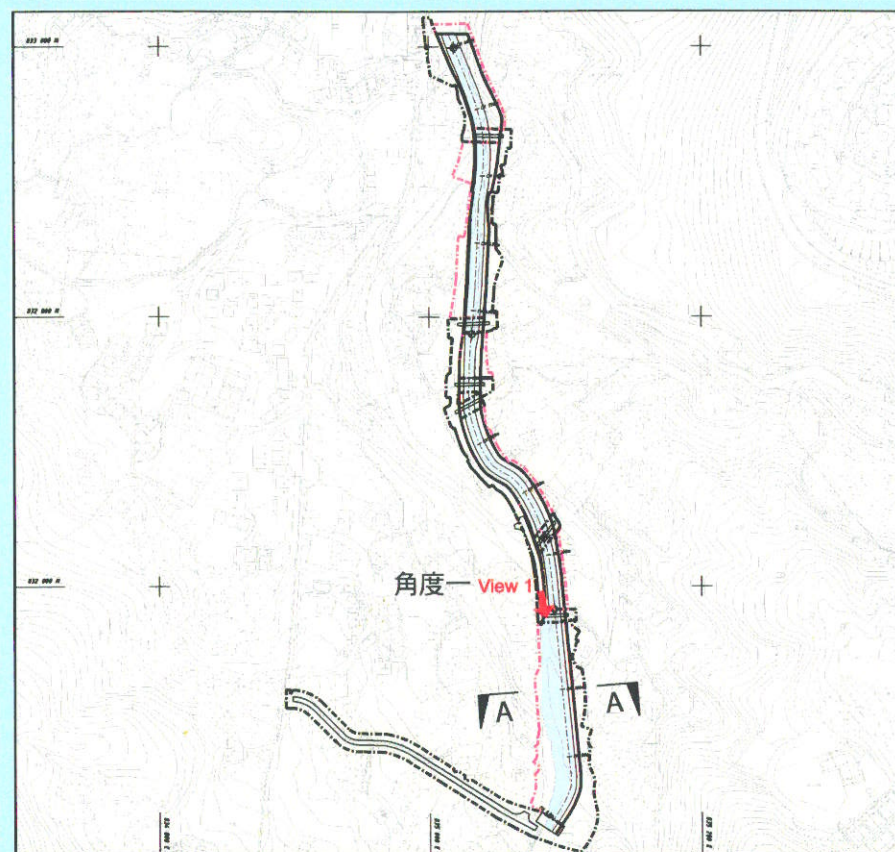
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協議編號CE 50/2001 (DS) 沙田及大埔雨水排放系統改善工程 - 設計和建造

PROPOSED LOCATIONS OF TEMPORARY NOISE BARRIERS  
臨時隔音屏障建議位置圖

SCALE	A3 1:2000	DATE	JUN. 2005
CHECK	FWYW	DRAWN	XJH
JOB NO.	A01602(003)	DRAWING No.	5.1
		REV	



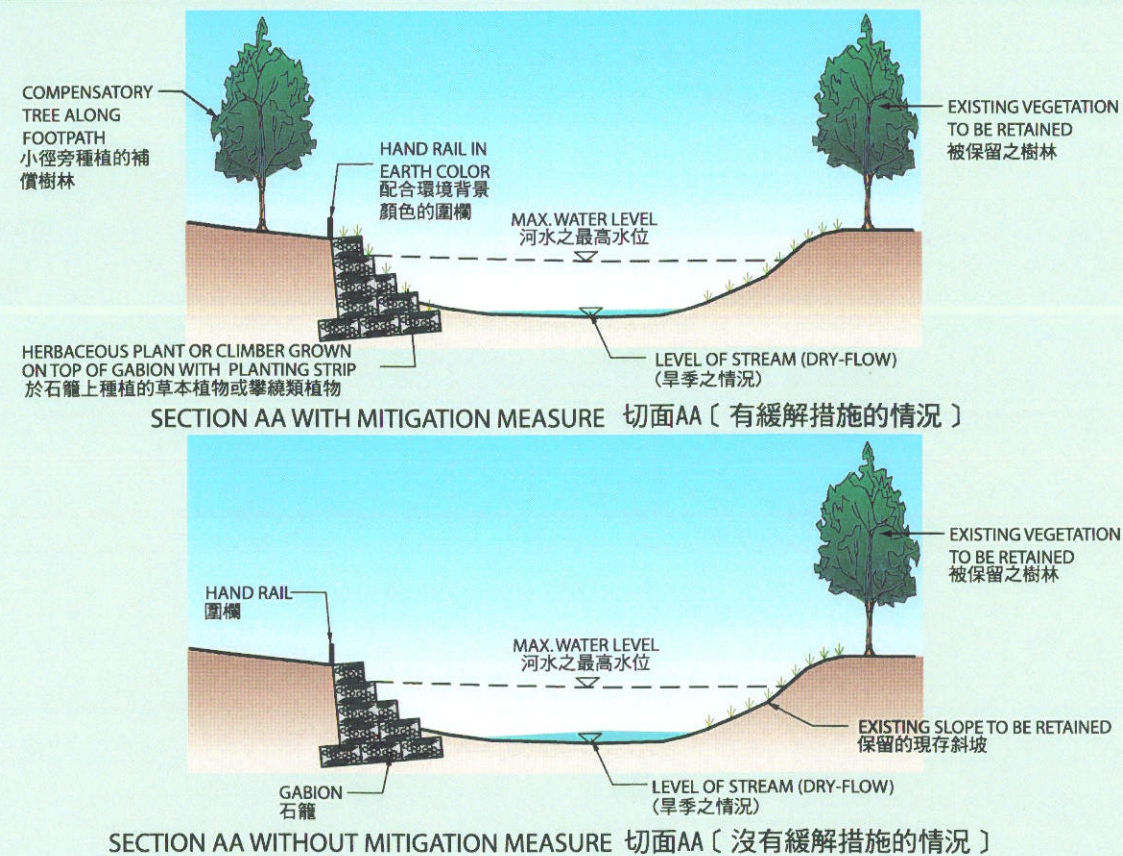
## General Layout Plan 平面設計圖



## Existing View 現有景觀



## Typical Sections 典型切面圖

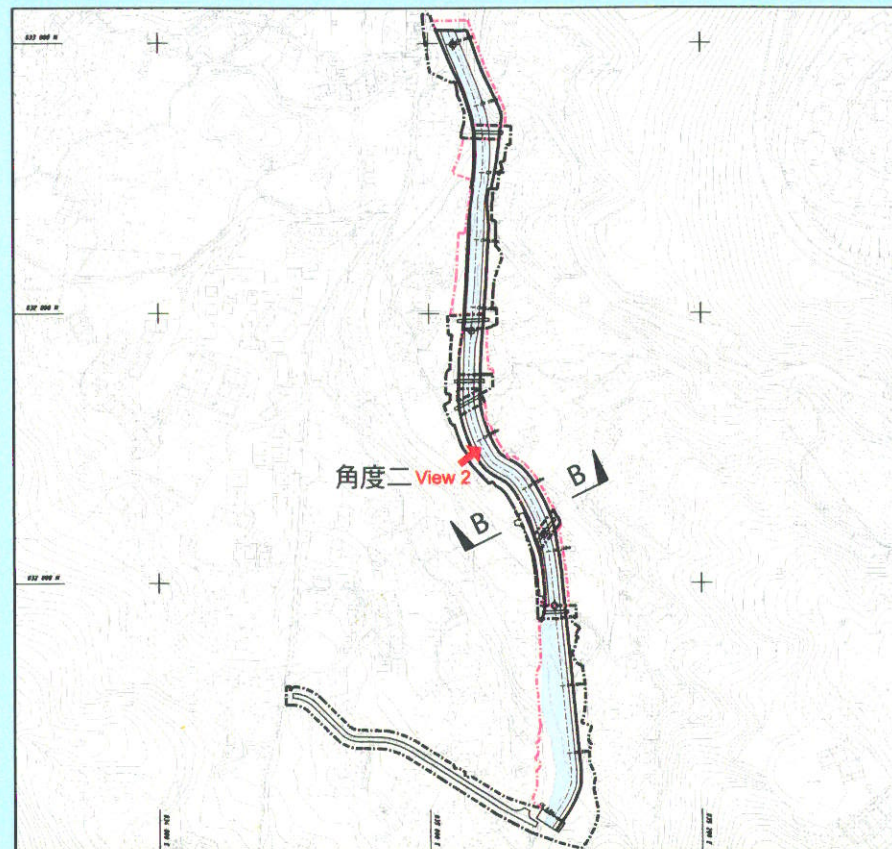


## Photomontage without mitigated measure 沒有緩解措施的景觀





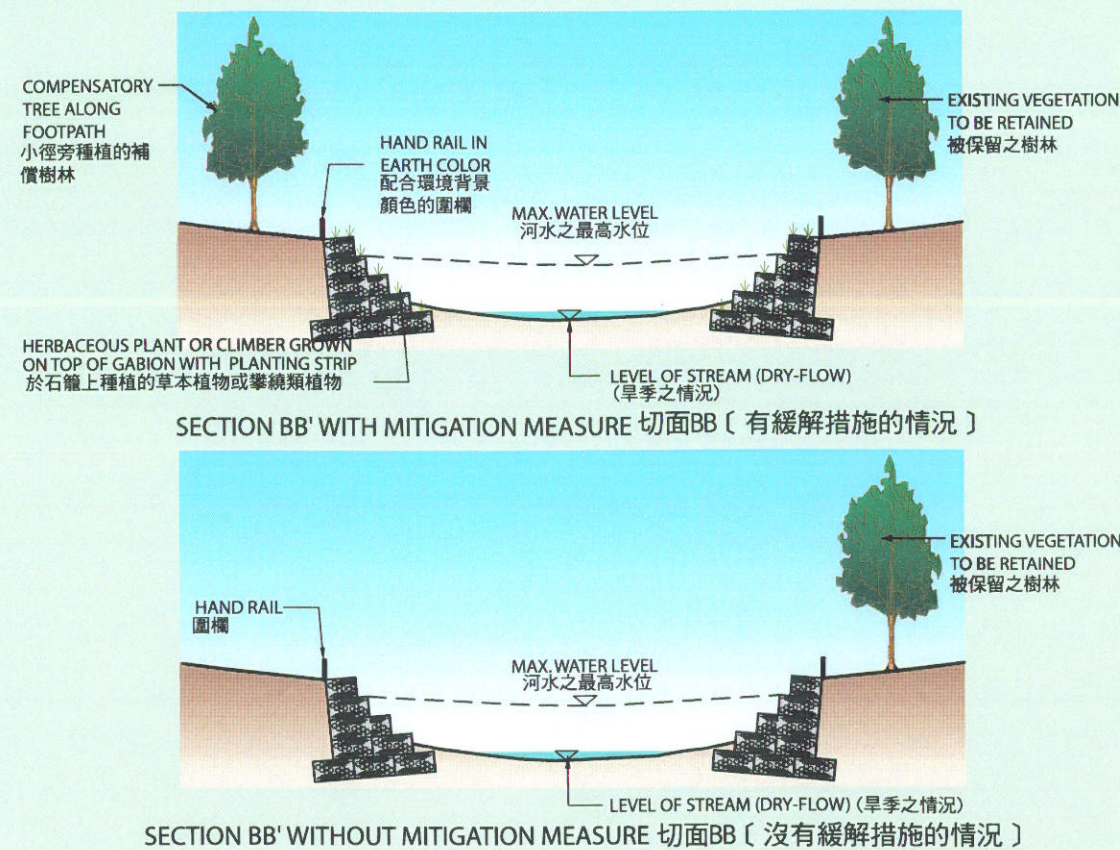
## General Layout Plan 平面設計圖



## Existing View 現有景觀



## Typical Sections 典型切面圖

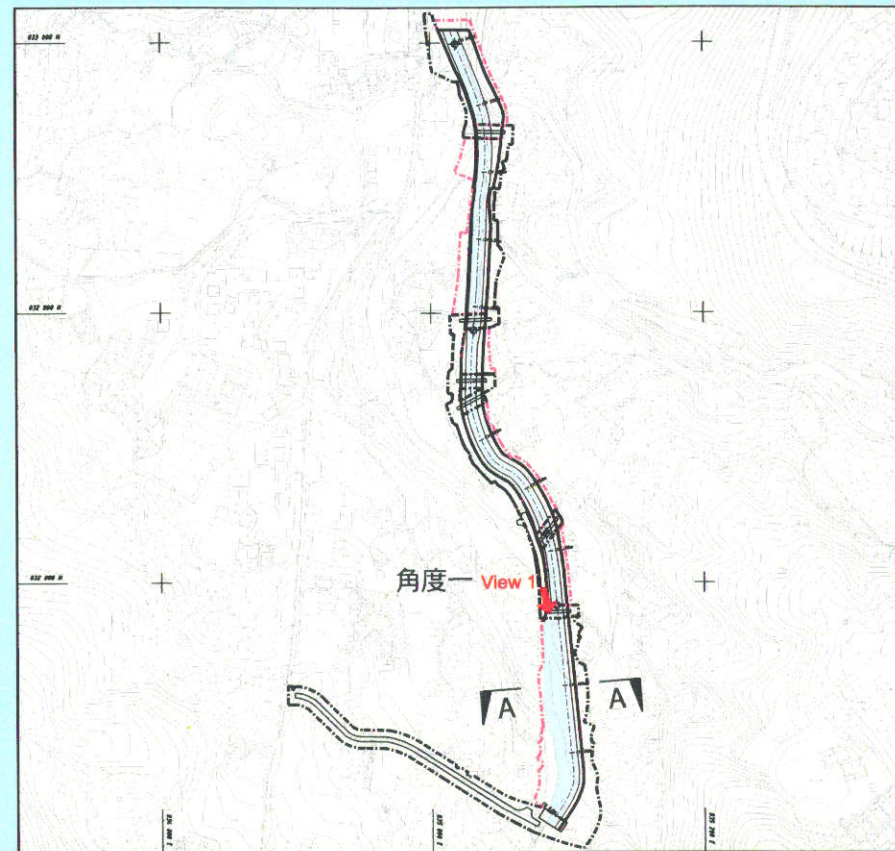


## Photomontage without mitigated measure 沒有緩解措施的景觀





## General Layout Plan 平面設計圖



## Mitigated View at Day 1 Operation 實行緩解措施〔即時景觀〕

Compensatory Planting along the Footpath  
種植在行人路旁的補償植物

Railing in "Earth" Color  
配合環境背景顏色的圍欄

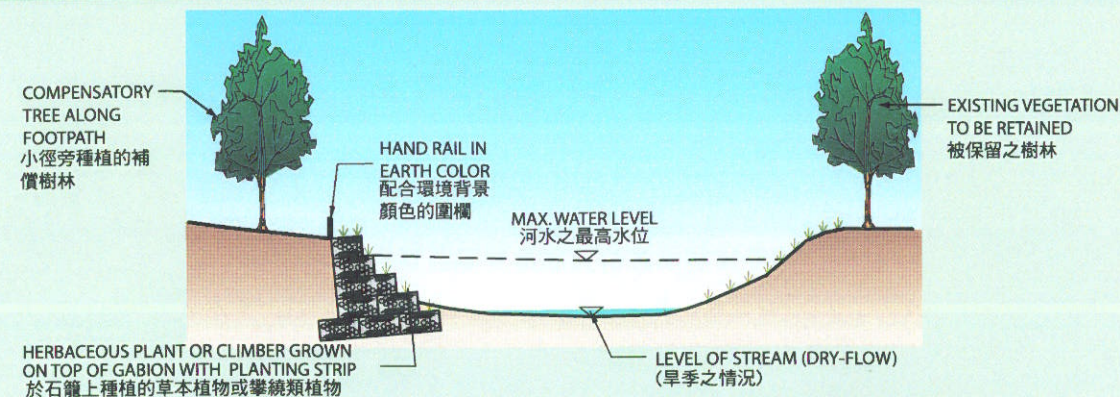
Herbaceous Plant or Climber grown on Top of Gabion  
於石籠上種植的草本植物或攀繞類植物

Natural Colonization of Vegetation on Natural Substrate of the Channel  
於河道天然物質上生長的植物

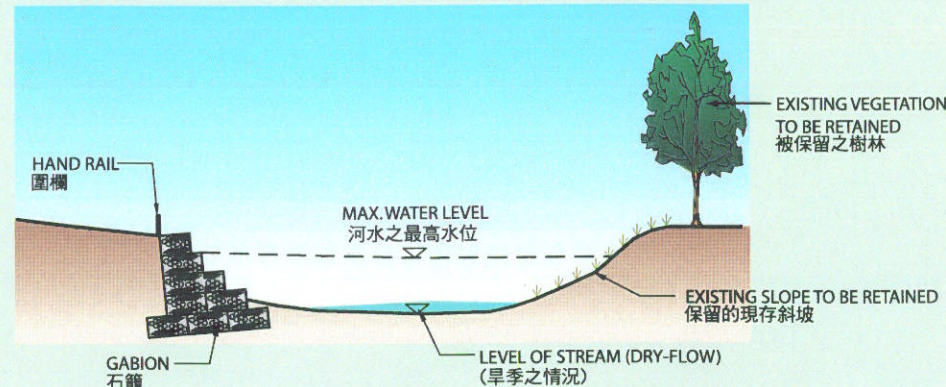


Improved Channel with Natural Substrate & Boulder (During Dry Flow Season)  
改善後佈滿天然物質和卵石的河道 (旱季之情況)

## Typical Sections 典型切面圖



SECTION AA' WITH MITIGATION MEASURE 切面AA〔有緩解措施的情況〕



SECTION AA' WITHOUT MITIGATION MEASURE 切面AA〔沒有緩解措施的情況〕

## Mitigated View at Year 10 Operation 實行緩解措施〔十年後之景觀〕

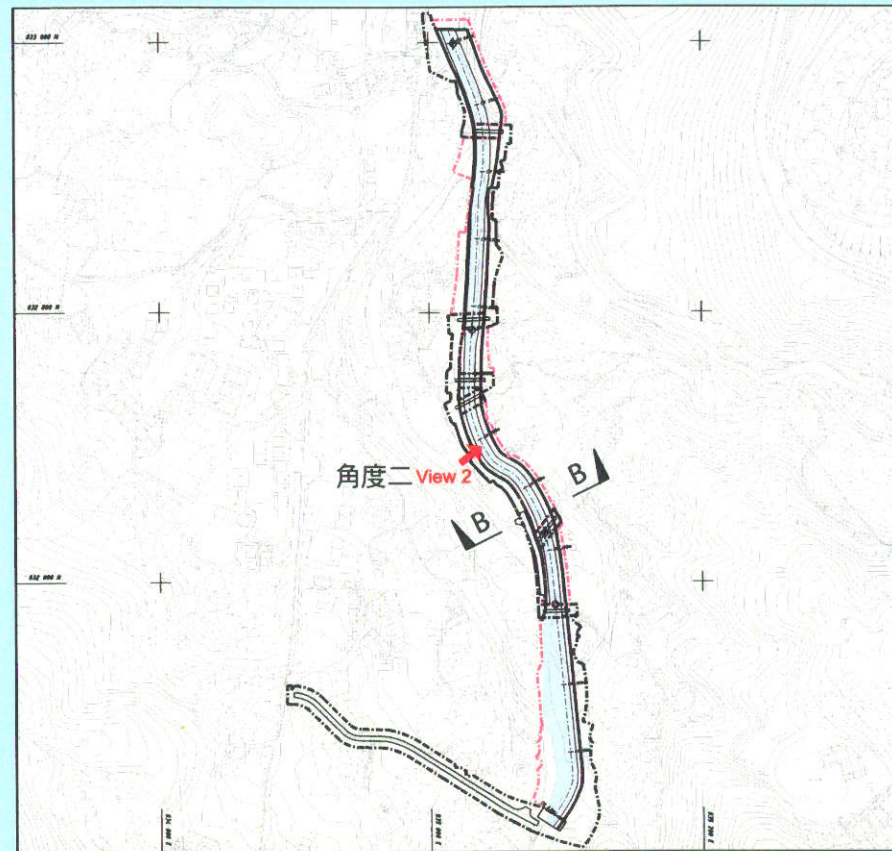
Well Grown Compensation Planting along Footpath  
行人路旁已成長的補償植物

Gabion with Herbaceous or Climber Fully Grown  
種滿草本植物或攀繞類植物的石籠





## General Layout Plan 平面設計圖



## Mitigated View at Day 1 Operation 實行緩解措施〔即時景觀〕

Compensatory Planting along the Footpath  
種植在行人路旁的補償植物

Railing in "Earth" Color  
與環境背景顏色協調的圍欄

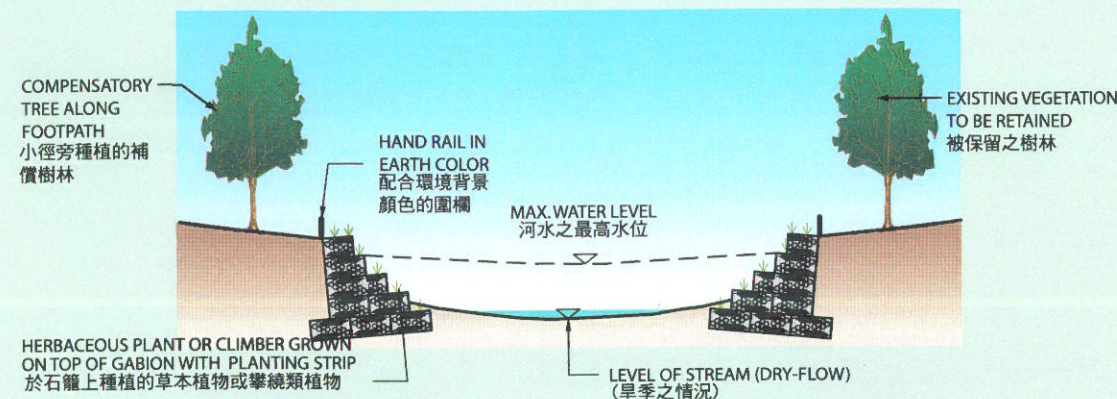
Natural Colonization of Vegetation on Natural Substrate of the Channel  
於河道天然物質上生長的植物



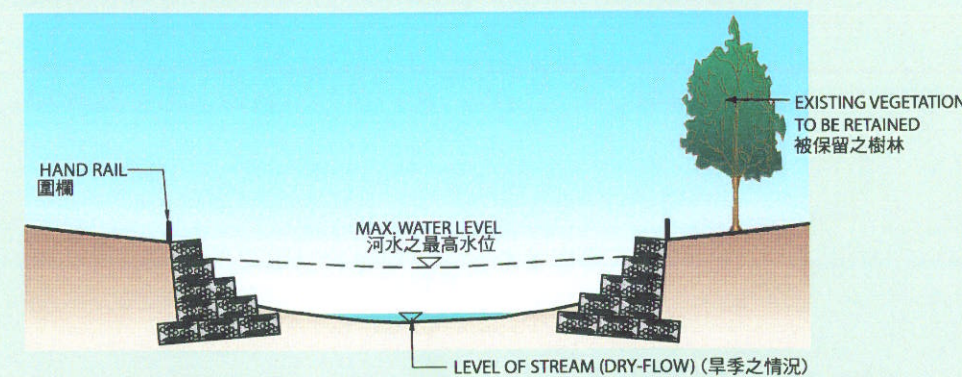
Herbaceous Plant or Climber grown on Top of Gabion with Planting Strip  
於石籠上種植的草本植物或攀繞類植物

Improved Channel with Natural Substrate & Boulder (During Dry Flow Season)  
改善後佈滿天然物質和卵石的河道〔旱季之情況〕

## Typical Sections 典型切面圖



SECTION BB WITH MITIGATION MEASURE 切面BB〔有緩解措施的情況〕



SECTION BB WITHOUT MITIGATION MEASURE 切面BB〔沒有緩解措施的情況〕

## Mitigated View at Year 10 Operation 實行緩解措施〔十年後之景觀〕

Well Grown Compensation Planting along Footpath  
行人路旁已成長的補償植物

Gabion with Herbaceous or Climber Fully Grown  
種滿草本植物或攀繞類植物的石籠





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**Appendix 3.1   Representative Photographs of  
Habitats Recorded in the Study  
Area**

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Upper Tai Po River



Cultivated Land



Secondary / Fung Shui Woodland





Plantation



Developed/Village Area



Shrubland



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<b>Appendix 3.2    Plant Species Recorded in the Study Area</b>
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Appendix 3.2 - Plant Species Recorded in the Study Area  
附件 3.2 研究區內所記錄到的植物品種

Botanic Name	植物學名	Form	習性	Status	分佈
<i>Abrus mollis</i>	毛相思子	woody climber	木質攀援植物	restricted	分佈局限
<i>Acacia confusa</i>	台灣相思	tree	喬木	exotic, common	外來種, 常見
<i>Acronychia pedunculata</i>	降真香	tree	喬木	common	常見
<i>Adiantum capillus-veneris</i>	鐵線蕨	herb	草本植物	common	常見
<i>Ageratum conyzoides</i>	勝紅菊	herb	草本植物	exotic, common	外來種, 常見
<i>Aglaia odorata</i>	米仔蘭	shrub	灌木	common	常見
<i>Alangium chinense</i>	八角楓	tree	喬木	common	常見
<i>Alchornea trewioides</i>	紅背山麻桿	shrub	灌木	common	常見
<i>Allamanda nerifolia</i>	硬枝黃蟬	shrub	灌木	widely cultivated	廣泛種植
<i>Alocasia macrorrhiza</i>	海芋	herb	草本植物	common	常見
<i>Altermanthera philoxeroides</i>	空心草, 空心蓮子草	herb	草本植物	exotic, common	外來種, 常見
<i>Altermanthera sessilis</i>	蝦鉗菜	herb	草本植物	common	常見
<i>Amaranthus viridis</i>	野苋	herb	草本植物	exotic, common	外來種, 常見
<i>Ampelopsis brevipedunculata</i>	牯嶺蛇葡萄	climber	攀援植物	common	常見
<i>Amygdalus persica</i>	桃	tree	喬木	widely cultivated	廣泛種植
<i>Antirhea chinensis</i>	毛茶	tree	喬木	very common	很常見
<i>Aporosa dioica</i>	銀柴	shrub	灌木	common	常見
<i>Aquilaria sinensis</i>	牙香樹	tree	喬木	common, protected in China	常見, 中國保護品種
<i>Ardisia quinquegona</i>	羅傘樹	tree	喬木	very common	很常見
<i>Artocarpus heterophyllus</i>	大樹菠蘿	tree	喬木	common	常見
<i>Averrhoa carambola</i>	楊桃	tree	喬木	introduced, common	引入種, 常見
<i>Bambusa spp.</i>	竹	grass	草本植物	common	常見
<i>Bidens alba</i>	白花鬼針草	herb	草本植物	exotic, common	外來種, 常見
<i>Bidens bipinnata</i>	婆婆針	herb	草本植物	common	常見
<i>Bischofia trifoliata</i>	秋楓	tree	喬木	common	常見
<i>Blechnum orientale</i>	烏毛蕨	fern	草本植物	very common	很常見
<i>Boehmeria nivea</i>	芋麻	shrub	灌木	restricted	分佈局限
<i>Bougainvillea glabra</i>	勒杜鵑	climber	攀援植物	exotic, common	外來種, 常見
<i>Breynia fruticosa</i>	黑面神	shrub	灌木	very common	很常見
<i>Bridelia tomentosa</i>	土蜜樹	tree	喬木	common	常見
<i>Calonyction aculeatum</i>	月光花	climber	攀援植物	exotic, restricted	外來種, 分佈局限
<i>Canthium dicoccum</i>	魚骨木	tree	喬木	common	常見
<i>Carex sp.</i>	藁草屬	herb	草本植物	common	常見
<i>Camona microphylla</i>	福建茶	shrub	灌木	exotic, cultivated	外來種, 種植
<i>Catharanthus roseus</i>	長春花	herb	草本植物	exotic, common	外來種, 常見
<i>Celtis sinensis</i>	朴樹	tree	喬木	very common	很常見
<i>Chenopodium album</i>	藜	herb	草本植物	exotic, restricted	外來種, 分佈局限
<i>Choerospondias axillaris</i>	酸棗	tree	喬木	common	常見
<i>Chrysopogon aciculatus</i>	竹節草	herb	草本植物	very common	很常見
<i>Cinnamomum camphora</i>	樟樹	tree	喬木	very common	很常見
<i>Citrus grandis</i>	柚子	tree	喬木	widely planted	廣泛種植
<i>Citrus reticulata</i>	桔, 柑	tree	喬木	common	常見
<i>Clausena lansium</i>	黃皮	tree	喬木	common	常見
<i>Clerodendrum cyrtophyllum</i>	大青	shrub	灌木	common	常見
<i>Colocasia esculenta</i>	芋	herb	草本植物	widely cultivated	廣泛種植
<i>Commelina nudiflora</i>	裸花水竹葉	herb	草本植物	common	常見
<i>Conyza canadensis</i>	小白酒草	herb	草本植物	very common	很常見
<i>Cunninghamia lanceolata</i>	杉木	tree	喬木	widely cultivated	廣泛種植
<i>Cuscuta chinensis</i>	莠絲子	climber	攀援植物	common	常見
<i>Cyclosorus acuminatus</i>	漸尖毛蕨	herb	草本植物	very common	很常見
<i>Cyclosorus parasiticus</i>	華南毛蕨	fern	草本植物	very common	很常見
<i>Cyperus rotundus</i>	香附子	herb	草本植物	very common	很常見
<i>Desmos cochinchinensis</i>	假鷹爪	woody climber	木質攀援植物	common	常見
<i>Dicranopteris linearis</i>	鐵芒莠	fern	草本植物	very common	很常見
<i>Dicranopteris petata</i>	芒莠	fern	草本植物	very common	很常見
<i>Digitaria sanguinalis</i>	馬唐	herb	草本植物	very common	很常見
<i>Dimocarpus longan</i>	龍眼	tree	喬木	widely planted	廣泛種植
<i>Dischidia chinensis</i>	瓜子金	climber	攀援植物	restricted	分佈局限
<i>Elaeocarpus sylvestris</i>	山杜英	tree	喬木	very common	很常見
<i>Eleusine indica</i>	牛筋草	herb	草本植物	exotic, common	外來種, 常見
<i>Emilia sonchifolia</i>	一點紅	herb	草本植物	exotic, common	外來種, 常見
<i>Eriobotrya japonica</i>	枇杷	tree	喬木	cultivated	種植
<i>Eucalyptus citriodora</i>	檸檬桉	tree	喬木	exotic, common	外來種, 常見
<i>Eupatorium catarium</i>	假臭草	herb	草本植物	exotic, common	外來種, 常見
<i>Euphorbia hirta</i>	飛揚草	herb	草本植物	exotic, common	外來種, 常見
<i>Ficus hirta</i>	粗葉榕	tree	喬木	common	常見
<i>Ficus hispida</i>	對葉榕	tree	喬木	common	常見
<i>Ficus microcarpa</i>	細葉榕	tree	喬木	common	常見
<i>Ficus simplicissima</i>	裂掌榕	shrub	灌木	common	常見
<i>Ficus superba</i>	筆管榕	tree	喬木	common	常見
<i>Ficus tinctoria</i>	斜葉榕	tree	喬木	restricted	分佈局限
<i>Ficus variegata</i>	青果榕	tree	喬木	common	常見
<i>Fortunella margarita</i>	金橘	shrub	灌木	cultivated	種植
<i>Garcinia oblongifolia</i>	黃牙果	tree	喬木	very common	很常見
<i>Glochidion eriocarpum</i>	毛果算盤子	shrub	灌木	very common	很常見
<i>Hedychium coronarium</i>	薑花	herb	草本植物	common	常見



# Appendix 3.2 - Plant Species Recorded in the Study Area

## 附件 3.2 研究區內所記錄到的植物品種

Botanic Name	植物學名	Form	習性	Status	分佈
<i>Hedyotis hedyotide</i>	牛白藤	climber	攀援植物	very common	很常見
<i>Hibiscus rosa-sinensis</i>	大紅花	shrub	灌木	widely planted	廣泛種植
<i>Ilex asprella</i>	梅葉冬青	shrub	灌木	very common	很常見
<i>Ilex rotunda</i>	鐵冬青	tree	喬木	common	常見
<i>Ipomoea batatas</i>	番薯	climber	攀援植物	widely cultivated	廣泛種植
<i>Juniperus chinensis</i> var. <i>kaizuca</i>	圓柏	tree	喬木	cultivated	種植
<i>Kyllinga monocephala</i>	單穗水蜈蚣	herb	草本植物	very common	很常見
<i>Lantana camara</i>	馬纓丹	shrub	灌木	exotic, common	外來種, 常見
<i>Leucaena leucocephala</i>	銀合歡	tree	喬木	introduced, common	引入種, 常見
<i>Ligustrum sinense</i>	山指甲	tree	喬木	common	常見
<i>Liriope spicata</i>	麥冬	herb	草本植物	very common	很常見
<i>Litchi chinensis</i>	荔枝	tree	喬木	restricted but widely planted	分佈局限, 廣泛種植
<i>Litsea cubeba</i>	山蒼樹	tree	喬木	common	常見
<i>Litsea glutinosa</i>	潺槁樹	tree	喬木	very common	很常見
<i>Litsea monopetala</i>	假柿樹	tree	喬木	restricted	分佈局限
<i>Litsea rotundifolia</i>	豺皮樟	tree	喬木	very common	很常見
<i>Livistona chinensis</i>	蒲葵	tree	喬木	cultivated	種植
<i>Lophatherum gracile</i>	淡竹葉	herb	草本植物	very common	很常見
<i>Lophostemon confertus</i>	紅膠木	tree	喬木	exotic, common	外來種, 常見
<i>Lygodium dichotomum</i>	掌葉海金沙	climber	攀援植物	common	常見
<i>Lygodium scandens</i>	小葉海金沙	climber	攀援植物	common	常見
<i>Macaranga tanarius</i>	血桐	tree	喬木	very common	很常見
<i>Machilus breviflora</i>	短序潤楠	tree	喬木	very common	很常見
<i>Machilus chekiangensis</i>	浙江潤楠	tree	喬木	very common	很常見
<i>Maesa perflaris</i>	鯽魚膽	shrub	灌木	common	常見
<i>Mallotus paniculatus</i>	白楸	tree	喬木	very common	很常見
<i>Mangifera indica</i>	芒果	tree	喬木	introduced, common	引入種, 常見
<i>Maranta arundinacea</i>	竹芋	herb	草本植物	widely cultivated	廣泛種植
<i>Michelia alba</i>	白蘭	tree	喬木	widely planted	廣泛種植
<i>Microcos paniculata</i>	布渣葉	tree	喬木	common	常見
<i>Microstegium ciliatum</i>	剛莠竹	herb	草本植物	very common	很常見
<i>Mikania micrantha</i>	薇甘菊	climber	攀援植物	exotic, common	外來種, 常見
<i>Mimosa pudica</i>	含羞草	herb	草本植物	exotic, common	外來種, 常見
<i>Miscanthus floridulus</i>	五節芒	herb	草本植物	common	常見
<i>Murraya paniculata</i>	九里香	tree	喬木	exotic, common	外來種, 常見
<i>Musa x paradisiaca</i> (musa paradisiacavar. <i>Sapientum</i> )	甘蔗	tree	喬木	exotic, common	外來種, 常見
<i>Mussaenda pubescens</i>	玉葉金花	shrub	灌木	very common	很常見
<i>Osmanthus fragrans</i>	桂花	tree	喬木	cultivated	種植
<i>Oxalis corymbosa</i>	酢醬草	herb	草本植物	exotic, common	外來種, 常見
<i>Paederia scandens</i>	雞矢藤	climber	攀援植物	very common	很常見
<i>Panicum paludosum</i>	水生黍	herb	草本植物	common	常見
<i>Paspalum conjugatum</i>	兩耳草	herb	草本植物	exotic, common	外來種, 常見
<i>Pennisetum purpureum</i>	象草	herb	草本植物	very common	很常見
<i>Phyllanthus cochinchinensis</i>	越南葉下珠	herb	草本植物	very common	很常見
<i>Phyllanthus emblica</i>	油甘子	tree	喬木	very common	很常見
<i>Polygonum chinense</i>	火炭母	herb	草本植物	very common	很常見
<i>Polygonum hydropiper</i>	水蓼	herb	草本植物	common	常見
<i>Pronephrium</i> sp.	新月蕨屬	herb	草本植物	common	常見
<i>Psychotria rubra</i>	山大刀	shrub	灌木	common	常見
<i>Pteris semipinnata</i>	半邊旗	fern	草本植物	very common	很常見
<i>Pueraria lobata</i>	野葛	climber	攀援植物	very common	很常見
<i>Pyrrosia adnascens</i>	貼生石草	fern	草本植物	common	常見
<i>Rhodomyrtus tomentosa</i>	崗欏	shrub	灌木	very common	很常見
<i>Rhus chinensis</i>	鹽膚木	tree	喬木	common	常見
<i>Rhus hypoleuca</i>	白背漆	tree	喬木	common	常見
<i>Rhus succedanea</i>	野漆	tree	喬木	very common	很常見
<i>Sapium sebiferum</i>	烏桕	tree	喬木	common	常見
<i>Sarcandra glabra</i>	草珊瑚	shrub	灌木	very common	很常見
<i>Schefflera octophylla</i>	鴨腳木	tree	喬木	very common	很常見
<i>Sida acuta</i>	黃花稔	shrub	灌木	common	常見
<i>Solanum nigrum</i>	龍葵	herb	草本植物	exotic, common	外來種, 常見
<i>Solanum torvum</i>	水茄	herb	草本植物	exotic, common	外來種, 常見
<i>Sterculia lanceolata</i>	假蒟蒻	tree	喬木	very common	很常見
<i>Syzygium jambos</i>	蒲桃	tree	喬木	introduced, common	引入種, 常見
<i>Tetracera asiatica</i>	錫葉藤	woody climber	木質攀援植物	very common	很常見
<i>Tetradium glabrifolium</i>	棟葉吳茱萸	tree	喬木	common	常見
<i>Thuja orientalis</i>	側柏	tree	喬木	widely cultivated	廣泛種植
<i>Vernonia cinerea</i>	夜香牛	herb	草本植物	very common	很常見
<i>Wedelia chinensis</i>	蛇蟠菊	herb	草本植物	common	常見



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**Appendix 3.3   Fauna Recorded within the  
Study Area**

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### Appendix 3.3- Fauna Recorded Within the Study Area

#### 附件 3.3 - 研究區內所記錄到的動物

##### Avifauna (鳥類)

Common Name	中文名	Scientific Name	Status in Hong Kong* (分佈*)
Chinese Pond Heron	池鷺	<i>Ardeola bacchus</i>	1
Little Egret	小白鷺	<i>Egretta garzetta</i>	1
Black Kite	黑鳶	<i>Milvus lineatus</i>	1
Crested Goshawk	鳳頭鷹	<i>Accipiter trivirgatus</i>	3
White-breasted Waterhen	白胸苦惡鳥	<i>Amaurornis phoenicurus</i>	1
Common Sandpiper	磯鶯	<i>Actitis hypoleucos</i>	1
Wood Sandpiper	林鶯	<i>Tringa glareola</i>	2
Domestic pigeon	鴿	<i>Columba sp.</i>	1
Spotted Dove	珠頸斑鳩	<i>Streptopelia chinensis</i>	1
Large Hawk Cuckoo	鷹鵂	<i>Cuculus sparveroides</i>	2
Common Koel	噪鵂	<i>Eudynamys scolopacea</i>	1
Great Coucal	褐翅鴉鵂	<i>Centropus sinensis</i>	1
Common Kingfisher	普通翠鳥	<i>Alcedo atthis</i>	1
Tree Sparrow	樹麻雀	<i>Passer montanus</i>	1
White Wagtail	白鶺鴒	<i>Motacilla alba</i>	1
Chinese Bulbul	白頭鶇	<i>Pycnonotus sinensis</i>	1
Crested bulbul	紅耳鶇	<i>Pycnonotus jocosus</i>	1
Maggie Robin	鸚鵡	<i>Copsychus saularis</i>	1
Daurian redstart	北紅尾鶇	<i>Phoenicurus aureus</i>	2
Plain Prinia	褐頭鷦鶯	<i>Prinia inornata</i>	2
Common Tailorbird	火尾縫葉鶯	<i>Orthotomus sutorius</i>	1
Black faced Laughing Thrush	黑臉噪(眉)鳥	<i>Garrulax perspicillatus</i>	1
Fork-tailed Sunbird	叉尾太陽鳥	<i>Aethopyga christinae</i>	2
Japanese White Eye	暗綠繡眼鳥	<i>Zosterops japonica(simplex)</i>	1
Rufous-backed Shrike	棕背伯勞	<i>Lanius schach</i>	1
Black Drongo	黑卷尾	<i>Dicrurus macrocercus</i>	1
Maggie	喜鵲	<i>Pica pica</i>	1
Jungle Crow	大嘴烏鴉	<i>Corvus macrorhynchos</i>	1
Silky Starling	絲光椋鳥	<i>Sturnus sericeus</i>	2
Black-necked Starling	黑領椋鳥	<i>Sturnus nigricollis</i>	1
Crested Myna	八哥	<i>Acridotheres cristatellus</i>	1
Spotted Munia	斑文鳥	<i>Lonchura punctulata</i>	2

\* 1 - Widespread & Common, 2 - Local but not Uncommon, 3 - Very Local or Rare.

\* 1 - 廣泛分佈及常見 2 - 分佈於局部地區, 不算太難見 3 - 分佈於少數局部地區或罕見



# Herpetofauna & Mammals (兩棲爬蟲類及哺乳類)

Common Name	中文名	Scientific Name	Status	分佈
<b>Amphibians</b>				
Asian Common Toad	蟾蜍	<i>Bufo melanostictus</i>	Common and widespread	廣泛分佈及常見
Asiatic Painted Frog	花狹口蛙	<i>Kaloula pulchra pulchra</i>	Common and widespread	廣泛分佈及常見
Brown Tree Frog	斑腿泛樹蛙	<i>Polypedates leucomystax</i>	Common and widespread	廣泛分佈及常見
Gunther's Frog	沼蛙	<i>Rana guentheri</i>	Common and widespread	廣泛分佈及常見
Hong Kong Newt	香港黑鰻	<i>Paramesotriton hongkongensis</i>	Locally common, protected	本地常見, 受保護
Marbled Pigmy Frog	花姬蛙	<i>Microhyla pulchra</i>	Common and widespread	廣泛分佈及常見
Paddy Frog	澤蛙	<i>Rana limnocharis</i>	Common and widespread	廣泛分佈及常見
<b>Reptiles</b>				
Blue-tailed Skink	四綫石龍子	<i>Eumeces quadrilineatus</i>	Uncommon but widespread	廣泛分佈但不常見
Bowring's Gecko	原尾蜥虎	<i>Hemidactylus bowringi</i>	Common and widespread	廣泛分佈及常見
Chinese Gecko	壁虎	<i>Gekko chinensis</i>	Common and widespread	廣泛分佈及常見
Changeable Lizard	變色樹蜥	<i>Calotes versicolor</i>	Common and widespread	廣泛分佈及常見
Chinese Forest Skink	光蜥	<i>Ateuchosaurus chinensis</i>	Uncommon but widespread	廣泛分佈但不常見
Common Rat Snake	水律	<i>Ptyas mucosus</i>	Common and widespread	廣泛分佈及常見
Four clawed Gecko	截趾虎	<i>Gehyra mutilata</i>	Fairly common & widespread	廣泛分佈及頗常見
Garnot's Gecko	鋸尾蜥虎	<i>Hemidactylus garnoti</i>	Uncommon but widespread	廣泛分佈但不常見
Indo Chinese Rat Snake	過樹榕	<i>Ptyas korros</i>	Common and widespread	廣泛分佈及常見
Long Tailed Skink	長尾南蜥	<i>Mabuya longicaudata</i>	Fairly common & widespread	廣泛分佈及頗常見
<b>Mammals</b>				
Wild Boar	野豬	<i>Sus scrofa</i>	common	常見
Japanese Pipistrelle	普通伏翼	<i>Pipistrellus abramus</i>	common	常見

## Freshwater Fish (淡水魚類)

Scientific Name	中文名	Status	分佈
<i>Misgurnus anguillicaudatus</i>	泥鰍	common	常見
<i>Parazacco spilurus</i>	異鱸	locally common	本地常見
<i>Poecilia reticulata</i>	孔雀花(魚將)	common	常見
<i>Pseudobagrus trilineatus</i> *	條紋擬鱨	rare	稀有
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰍	common	常見
<i>Rhinogobius duospilus</i>	斑鱨植鰕虎	common	常見
<i>Sarotherodon massambicus</i>	-	exotic, common	外來種, 常見

## Odonates (蜻蛉目)

Scientific Name	中文名	常用名	Status	分佈
<b>Zygoptera</b>	<b>束翅亞目</b>			
<i>Agriocnemis femina</i>	杯斑小蠅	-	Common & widespread	廣泛分佈及常見
<i>Ceriatrion auranticum</i>	琉球橘黃蠅	-	Common & widespread	廣泛分佈及常見
<i>Copera ciliata</i>	白狹扇蠅	-	Common & widespread	廣泛分佈及常見
<i>Copera marginipes</i>	黃狹扇蠅	-	Common & widespread	廣泛分佈及常見
<i>Euphaea decorata</i>	方帶幽蠅	-	Common & widespread	廣泛分佈及常見
<i>Ischnura senegalensis</i>	褐斑異悲蠅	-	Common & widespread	廣泛分佈及常見
<i>Mnais mneme</i>	煙翅綠色蠅	-	Fairly common & widespread	廣泛分佈及頗常見
<i>Prodastineura autumnalis</i>	烏齒原蠅	-	Common & widespread	廣泛分佈及常見
<i>Rhinocypha perforata</i>	三斑鼻蠅	-	Common & widespread	廣泛分佈及常見
<b>Anisoptera</b>	<b>差翅亞目</b>			
<i>Acisoma panorpoides</i>	鉅腹蜻	-	Fairly common & widespread	頗 廣泛分佈及常見
<i>Crocothemis servilia servilia</i>	紅蜻	-	Common & widespread	廣泛分佈及常見
<i>Orthetrum glaucum</i>	黑尾灰蜻	-	Common & widespread	廣泛分佈及常見
<i>Pantala flavescens</i>	黃蜻	-	Common & widespread	廣泛分佈及常見
<i>Rhyothemis variegata arria</i>	斑麗翅蜻	-	Common & widespread	廣泛分佈及常見
<i>Sinistogomphus clavatus</i>	大團扇春蜓	-	Fairly common & widespread	廣泛分佈及頗常見
<i>Trithemis aurora</i>	曉褐蜻	-	Common & widespread	廣泛分佈及常見
<i>Zygonyx iris</i>	彩虹蜻	-	Common & widespread	廣泛分佈及常見

## Butterflies (蝴蝶)

Scientific Name	中文名	Common Name	Status	分佈
<i>Abisara echerius</i>	蛇目褐蛭蝶	Plum judy	Common & widespread	廣泛分佈及常見
<i>Acytolepis puspa</i>	鈕灰蝶	Common Hedge Blue	Common & widespread	廣泛分佈及常見
<i>Pieris canidia</i>	東方菜粉蝶	Common white	Common & widespread	廣泛分佈及常見
<i>Catopsilia pomona</i>	遷粉蝶	Lemon migrant	Fairly common & widespread	廣泛分佈及頗常見
<i>Danaus chrysippus</i>	金斑蝶	Plain Tiger	Locally common	本地常見
<i>Delias pasithoe</i>	報喜斑粉蝶	Common black jezebel	Common & widespread	廣泛分佈及常見
<i>Eurema hecabe</i>	寬邊黃粉蝶	Common Grass Yellow	Common & widespread	廣泛分佈及常見
<i>Euploea core</i>	幻紫斑蝶	Common Crow	Common & widespread	廣泛分佈及常見
<i>Faunis eumeus</i>	串珠環蝶	Common faun	Common & widespread	廣泛分佈及常見
<i>Graphium sarpedon</i>	青鳳蝶	Common Bluebottle	Common & widespread	廣泛分佈及常見
<i>Hebomoia glaucippe</i>	鶴頂粉蝶	Great Orange Tip	Common & widespread	廣泛分佈及常見
<i>Hypolimnas bolina</i>	幻紫斑蛱蝶	Great Eggfly	Common & widespread	廣泛分佈及常見
<i>Ideopsis similis</i>	擬旖斑蝶	Blue Glassy Tiger	Common & widespread	廣泛分佈及常見
<i>Lampides boeticus</i>	亮灰蝶	Pea Blue	Common & widespread	廣泛分佈及常見
<i>Lethe confusa</i>	白帶黛眼蝶	Common white banded brown	Common & widespread	廣泛分佈及常見
<i>Mycalesis mineus</i>	小眉眼蝶	Dark brand bush brown	Common & widespread	廣泛分佈及常見
<i>Papilio memnon</i>	美鳳蝶	Great mormon	Common & widespread	廣泛分佈及常見
<i>Papilio polytes</i>	玉帶鳳蝶	Common mormon	Common & widespread	廣泛分佈及常見
<i>Papilio protenor</i>	藍鳳蝶	Dark mormon	Common & widespread	廣泛分佈及常見
<i>Triumala limniace</i>	青斑蝶	Blue Tiger	Fairly common & widespread	廣泛分佈及頗常見
<i>Ypthima lisandra</i>	黎桑憂眼蝶	Straight six ring	Common & widespread	廣泛分佈及常見
<i>Zizeeria maha</i>	酢漿灰蝶	Pale Grass Blue	Common & widespread	廣泛分佈及常見

# Freshwater Macroinvertebrates (大型淡水無脊椎生物)

Faunal Group	組別	Scientific Name	中文名
Mollusk	軟體動物門	<i>Melanoides tuberculata</i>	福壽螺
		<i>Gyraulus</i> sp.	旋螺屬
		<i>Brotia hainanensis</i>	海南蜆螺
Crustacea	甲殼綱	<i>Macrobrachium hainanense</i>	海南沼蝦
		<i>Caridina contonensis</i>	廣東米蝦
		<i>Eriocheir sinensis</i>	中華絨螯蟹
Insecta	昆蟲綱		
Ephemeroptera	蜉蝣目	<i>Choroterpes</i> sp.	褐蜉屬
		<i>Baetis</i> spp.	四節蜉屬
		<i>Indobaetis</i> sp.	-
		<i>Electrogena</i> sp.	-
		<i>Caenis</i> sp.	細蜉屬
		<i>Pseudocloeon</i> sp.	-
Odonata	蜻蛉目	<i>Euphaea decorata</i>	方帶幽蝶
		<i>Zygonyx iris</i>	彩虹蜻
Trichoptera	毛翅目	<i>Cheumatopsyche</i> sp.	-
		<i>Anisocentropus</i> sp.	-
Hemiptera	半翅目	<i>Gerris</i> sp.	龜椿屬
Diptera	雙翅目	Orthocladiinae	-
		Tanipodinae	-
		<i>Simulium</i> sp.	-
Annalida	環節動物門	<i>Tubifex</i> sp.	紅蟲



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**Appendix 4.1****Proposed Construction Plant  
Inventory for Various  
Construction Activities –  
Unmitigated**

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#### Appendix 4.1

#### Proposed Construction Plant Inventory -Unmitigated

#### Drainage Channel Improvement to Upper Tai Po River

##### Site Clearance

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Excavator / Loader	CNP081	1	112	60%	0	110
Dump Truck	CNP067	1	117	30%	0	112
Total						114

##### Pilling

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Pilling, large diameter bored, reverse circulation drill	CNP166	1	100	100%	0	100
Total						100

##### Channel Construction & Excavation

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)	Total SWL dB(A)
Excavator / Loader	CNP081	1	112	60%	0	110	
Submersible Pump	CNP283	2	85	100%	0	88	88
Generator	CNP101	1	108	100%	0	108	108
Dump Truck	CNP067	1	117	30%	0		112
Total						112	113

Max: 113

##### Backfilling

Backfilling / Channel Lining / Access Road Paving / Upgrading of Existing Footpath to Maintenance Access

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Crane	CNP048	1	112	70%	0				110
Excavator / Loader	CNP081	1	112	70%	0	110			
Vibratory Roller	CNP186	1	108	50%	0		105		
Vibratory Poker	CNP170	1	113	70%	0			111	
Dump Truck	CNP067	1	117	30%	0			112	112
Concrete Lorry Mixer	CNP045	1	109	50%	0			106	106
Air Compressor	CNP002	1	102	50%	0			99	
Total						110	105	115	115

Max SWL 115

##### Footbridge Reprovisioning

Powered Mechanical Equipment (PME)	TM Ref./ other Ref.	No.of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Concrete Lorry Mixer	CNP044	1	109	50%	0			106
Excavator / Loader	CNP081	1	112	70%	0	110		
Vibratory Roller	CNP186	1	108	50%	0		105	
Vibratory Poker	CNP170	1	113	70%	0			111
Bar Bender / Cutter	CNP021	1	90	70%	0			88
Dump Truck	CNP067	1	117	30%	0			112
Total						110	105	115

Max SWL 115

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<b>Appendix 4.2</b>	<b>Sample Calculation of Construction Noise Levels at Representative Noise Sensitive Receivers – Unmitigated</b>
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Appendix 4.2		Sample Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver - Unmitigated																											
Drainage Channel Improvement to Upper Tai Po River																													
NSR: UTP2		SWL	Dist	SPL	Duration*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Construction Task																													
Ch. 150 - 600m Bank B'																													
Site Clearance		114	25	81	0-2	81	81																						
Pilling		100	98	55	2-3			55																					
Channel Construction & Excavation	Section 1:Ch. 301-600	113	265	60	3-9				60	60	60																		
	Section 2:Ch. 150-300	113	25	80								80	80	80															
Backfilling**	Section 1:Ch. 301-600	115	265	62	6-16							62	62	62															
	Section 2:Ch. 150-300	115	25	82								82	82	82															
Upgrading of Existing Footpath to Maintenance Access		115	40	78								78	78	78	78														
Ch. 0 - 600m Bank A'																													
Site Clearance		114	20	83	11-13							83	83																
Pilling		100	96	55	13-14							55																	
Channel Construction & Excavation	Section 1:Ch. 301-600	113	260	60	14-20															60	60	60							
	Section 2:Ch. 0-300	113	20	82																			82	82	82				
Backfilling**	Section 1:Ch. 301-600	115	260	62	17-23																		62	62	62				
	Section 2:Ch. 0-300	115	20	84																						84	84	84	
Footbridge Reprovisioning		115	50	76	20-24																					76	76	76	
Overall Noise Level						81	81	55	60	60	60	80	80	80	82	82	82	86	84	78	78	78	60	82	82	85	85	85	76
* Duration in month																													
** Backfilling = Backfilling, Channel Lining & Access Road Paving																													



Appendix 4.2																														
Sample Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver - Unmitigated																														
Drainage Channel Improvement to Upper Tai Po River																														
NSR: UTP10																														
Construction Task		SWL	Dist	SPL	Duration*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Ch. 150 - 600m Bank B'																														
Site Clearance		114	145	66	0-2	66	66																							
Piling		100	216	48	2-3			48																						
Channel Construction & Excavation		113	145	65	3-9				65	65	65																			
	Section 1:Ch. 301-600	113	285	59																										
	Section 2:Ch. 150-300	113	285	59								59	59	59																
Backfilling**		115	145	67	6-16							67	67	67																
	Section 1:Ch. 301-600	115	285	61											61	61	61													
	Section 2:Ch. 150-300	115	285	61														96	96	96	96									
Upgrading of Existing Footpath to Maintenance Access		115	5	96																										
Ch. 0 - 600m Bank A'																														
Site Clearance		114	70	72	11-13													72	72											
Piling		100	>300	-	13-14														-											
Channel Construction & Excavation		113	70	71	14-20															71	71	71								
	Section 1:Ch. 301-600	113	285	59																			59	59	59					
	Section 2:Ch. 0-300	113	285	59																										
Backfilling**		115	70	73	17-23																		73	73	73					
	Section 1:Ch. 301-600	115	285	61																										
	Section 2:Ch. 0-300	115	285	61																										
Footbridge Reprovisioning		115	135	68	20-24																									
Overall Noise Level						66	66	48	65	65	65	68	68	68	61	61	72	96	96	96	96	71	74	74	74	68	68	68	68	
* Duration in month																														
** Backfilling = Backfilling, Channel Lining & Access Road Paving																														



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**Appendix 4.3****Significance of Landscape  
Impacts in Construction and  
Operational Phases**

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### Appendix 4.3 Significance of Landscape Impacts in Construction and Operational Phases

Identity No.	Landscape Resource / Landscape Character	Sensitivity to Change (Low, Medium, High)		Magnitude of Change before Mitigation* (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation* (Insubstantial, Slight, Moderate, Substantial)		Residual Impact Significance Threshold AFTER Mitigation* (Insubstantial, Slight, Moderate, Substantial)		
		Construction	Operation	Construction	Operation	Construction	Operation	Operation		
								DAY 1	YEAR 10	
Landscape Resources										
DP2-LR3	Trees in Ha Wun Yiu Village	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	Insubstantial	Insubstantial	Insubstantial
DP2-LR8	Natural river of Upper Tai Po River	High	High	Large	Large	Substantial	Substantial	Substantial	Moderate	Moderate
DP2-LR9	Trees and Agricultural Field in Pun Shan Chau	Medium	Medium	Small	Small	Moderate	Moderate	Moderate	Slight	Insubstantial
DP2-LR10	Trees in San Uk Kai Village	Medium	Medium	Large	Large	Moderate	Moderate	Moderate	Slight	Insubstantial
DP2-LR12	Trees and Agricultural Field at San Uk Kai	Medium	Medium	Large	Large	Moderate	Moderate	Moderate	Slight	Insubstantial
Landscape Character Areas										
DP2-LCA1	Wun Yiu Settled Valley	Medium	Medium	Large	Intermediate	Substantial	Moderate	Moderate	Slight	Insubstantial

Note: \* Mitigation refers to the implementation of mitigation measures as recommended in Section 5.58.



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<b>Appendix 4.4</b>	<b>Significance of Visual Impacts in Construction and Operational Phases</b>
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#### Appendix 4.4 Significance of Visual Impacts in Construction and Operational Phases

Type and ID No. of VSR	Key Visually Sensitive Receiver (VSR)	Degree of Visibility of Source(s) of Visual Impact (Full, Partial, Glimpse) & Distance Between VSR & Nearest Source(s) of Impact		Receptor Sensitivity (Low, Medium, High)		Magnitude of Impact (Negligible, Small, Intermediate, Large)		Impact Significance Threshold BEFORE Mitigation* (Insubstantial, Slight, Moderate, Substantial)	Residual Impact Significance Threshold AFTER Mitigation* (Insubstantial, Slight, Moderate, Substantial)		
		CONST	OPER	CONST	OPER	CONST	OPER		CONST	DAY 1	YEAR 10
DP2-R1	Residents of Wun Yiu Village	Full – 1m	Full – 1m	High	High	Large	Intermediate	Substantial	Moderate	Slight	Insubstantial
DP2-R2	Residents of Lai Chi Village	Partial – 20m	Partial – 20m	Medium	Medium	Small	Small	Moderate	Moderate	Slight	Insubstantial
DP2-R3	Residents of the Paramount	Glimpse – 100m	Glimpse – 100m	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	Insubstantial	Insubstantial
DP2-R4	Residents of Tak Nga Court	Glimpse – 400m	Glimpse – 400m	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	Insubstantial	Insubstantial
DP2-T1	Drivers / Pedestrians of Lane at San Uk Kai	Full – 0m	Partial – 250m	Medium	Low	Intermediate	Small	Moderate	Moderate	Slight	Insubstantial
DP2-T2	Drivers of the Wun Yiu Section of Tolo Highway	Glimpse – 250m	Glimpse – 250m	Low	Low	Small	Small	Insubstantial	Insubstantial	Insubstantial	Insubstantial
DP2-T3	Pedestrians of Tak Wan Road	Full – 5m	Full – 5m	High	High	Large	Intermediate	Substantial	Moderate	Slight	Insubstantial
DP2-GB1	Residents / Engagers of Pun Shan Chau	Full – 0m	Full – 0m	High	High	Large	Large	Substantial	Moderate	Moderate	Slight
DP2-CP1	Agricultural Fields Walkers on Wilson Trail	Partial – 300m	Partial – 300m	Low	Low	Intermediate	Small	Moderate	Moderate	Slight	Insubstantial

Note: \* Mitigation refers to the implementation of mitigation measures as recommended in Section 5.58.

CONST= Construction Phase

OPER= Operation Phase



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<b>Appendix 5.1</b>	<b>Proposed Construction Plant Inventory for Various Construction Activities – Mitigated</b>
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**Appendix 5.1**  
**Proposed Construction Plant Inventory -Mitigated**

**Drainage Channel Improvement to Upper Tai Po River**

**Use of Quiet Plant**

**Site Clearance**

Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No. of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Excavator / Loader	[1]	C3/97	1	105	60%	0	103
Dump Truck	[1]	C9/39	1	103	30%	0	98
Total							104

**Pilling**

Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No. of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)
Pilling, large diameter bored, reverse circulation drill		CNP166	1	100	100%	0	100
Total							100

**Channel Construction & Excavation**

Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No. of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)	Total SWL dB(A)
Excavator / Loader	[1]	C3/97	1	105	60%	0	103	
Submersible Pump		CNP283	2	85	100%	0	88	88
Generator	[1]	CNP103	1	95	100%	0	95	95
Dump Truck	[1]	C9/39	1	103	30%	0		98
Total							104	100
Max							104	

**Backfilling**

Backfilling / Channel Lining / Access Road Paving / Upgrading of Existing Footpath to Maintenance Access

Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No. of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Crane	[1]	C7/114	1	101	70%	0				99
Excavator / Loader	[1]	C3/97	1	105	70%	0	103			
Vibratory Roller	[1]	C3/116	1	106	50%	0		103		
Vibratory Poker	[1]	C6/32	1	100	70%	0			98	
Dump Truck	[1]	C9/39	1	103	30%	0			98	98
Concrete Lorry Mixer	[1]	C6/23	1	100	50%	0			97	97
Air Compressor		CNP002	1	102	50%	0			99	
Total							103	103	104	103
Max							104			

**Footbridge Reprovisioning**

Powered Mechanical Equipment (PME)		TM Ref./ other Ref.	No. of Items	SWL/Item dB(A)	On-time %	Barrier dB	Total SWL dB(A)	Total SWL dB(A)	Total SWL dB(A)
Concrete Lorry Mixer	[1]	C6/23	1	100	50%	0			97
Excavator / Loader	[1]	C3/97	1	105	70%	0	103		
Vibratory Roller	[1]	C3/116	1	106	50%	0		103	
Vibratory Poker	[1]	C6/32	1	100	70%	0			98
Bar Bender / Cutter		CNP021	1	90	70%	0			88
Dump Truck	[1]	C9/39	1	103	30%	0			98
Total							103	103	103
Max							103		

Note: [1] Use of Quiet PME



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<b>Appendix 5.2</b>	<b>Sample Calculation of Construction Noise Levels at Representative Noise Sensitive Receivers – Mitigated</b>
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Appendix 5.2																												
Sample Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver - Mitigated																												
Drainage Channel Improvement to Upper Tai Po River																												
NSR: UTP2																												
Construction Task																												
	SWL	Dist	SPL	Duration*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Ch. 150 - 600m Bank B*																												
Site Clearance	104	25	71	0-2	71	71																						
Pilling	100	98	55	2-3			55																					
Channel Construction & Excavation																												
Section 1:Ch. 301-600	104	265	50	3-9																								
Section 2:Ch. 150-300	104	25	71																									
Section 1:Ch. 301-600	104	265	51	6-16																								
Section 2:Ch. 150-300	104	25	71																									
Backfilling**																												
											</																	



Appendix 5.2																														
Sample Calculation of Construction Noise Levels at Representative Noise Sensitive Receiver - Mitigated																														
Drainage Channel Improvement to Upper Tai Po River																														
NSR: UTP10																														
Construction Task		SWL	Dist	Bar#	SPL	Duration*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Ch. 150 - 600m Bank B'																														
Site Clearance		104	145	10	46	0-2	46	46																						
Pilling		100	216	10	38	2-3			38																					
Channel Construction & Excavation		104	145	10	45	3-9				45	45	45																		
Section 1:Ch. 301-600		104	285	10	39								39	39	39															
Section 2:Ch. 150-300		104	145	10	46	6-16							46	46	46															
Backfilling**		104	145	10	46											40	40	40												
Section 2:Ch. 150-300		104	285	10	40													75	75	75	75									
Upgrading of Existing Footpath to Maintenance Access		104	5	10	75																									
Ch. 0 - 600m Bank A'																		52	52											
Site Clearance		104	70	10	52	11-13																								
Pilling		100	>300	10	-	13-14														-										
Channel Construction & Excavation		104	70	10	52	14-20															52	52	52							
Section 1:Ch. 301-600		104	285	10	39																			39	39	39				
Section 2:Ch. 0-300		104	70	10	52	17-23																		52	52	52				
Backfilling**		104	70	10	52																							40	40	40
Section 1:Ch. 301-600		104	285	10	40																							46	46	46
Section 2:Ch. 0-300		103	135	10	46	20-24																						46	46	46
Footbridge Reprovisioning																														
Overall Noise Level							46	46	38	45	45	45	47	47	47	40	40	52	75	75	75	75	52	52	52	52	47	47	47	47
# 10dB(A) noise reduction was assumed with the use of temporary barrier																														
* Duration in month																														
** Backfilling = Backfilling, Channel Lining & Access Road Paving																														