

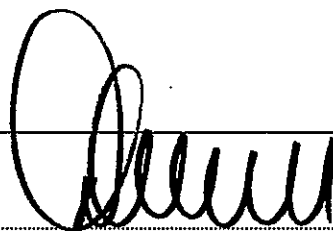
**Agreement No. CE 67/98
Yuen Long, Kam Tin, Ngau Tam Mei and Tin Shui Wai
Drainage Improvement, Stage 1, Phase 2B - Kam Tin
Secondary Drainage Channels KT14 & KT15**

Project Profile

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Issue By:



For and on Behalf of
Black & Veatch Hong Kong Limited


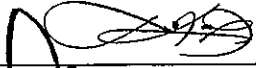

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*The Registered Recipient is responsible for destroying or marking as 'superseded' all superseded documents.

CONTENTS

	Page
EXECUTIVE SUMMARY	ES-1
1. BASIC INFORMATION	1
1.1 Project Titles	1
1.2 Purpose and Nature of the Projects	1
1.3 Purpose of this Project Profile	1
1.4 Name of Project Proponent	2
1.5 Location and Scale of Projects and History of the Site	2
1.6 Number and Types of Designated Projects under this Project Profile	7
1.7 Name and Telephone Number of Contact Person	7
2. OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME	7
2.1 Planning and Implementation	7
2.2 Project Programme	7
2.3 Project Interfaces	8
3. POSSIBLE IMPACTS ON THE ENVIRONMENT	9
4. MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT	14
4.1 Existing and Planned Sensitive Receivers	14
4.2 Major Elements of the Surrounding Environment and Existing and/or Past Landuses on site which might affect the Area in which the Project is located	14
5. ENVIRONMENTAL PROTECTION MEASURES	14
5.1 Measures to Minimize Environmental Impacts	14
5.2 Potential Severity, Distribution and Duration of Key Environmental Impacts	25
5.3 Environmental Monitoring and Audit Requirements	27
5.4 Public Consultation to Date	27
6. USE OF PREVIOUS APPROVED EIA REPORTS	30
END OF TEXT	30

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CONTENTS

(Cont'd)

ATTACHMENTS

- Attachment 1 – Details of Noise Calculations
- Attachment 2 – Water and Sediment Quality Monitoring Results
- Attachment 3 – Ecological Assessment
- Attachment 4 – Environmental Monitoring and Audit Manual
- Attachment 5 – Mitigation Measures Implementation Schedule

LIST OF FIGURES

- Figure 1.1 Location of the Designated Projects KT14 and KT15
- Figure 1.2 Yuen Kong San Tsuen Channel KT14 Proposed Layout Plan (Sheet 1 of 2)
- Figure 1.2 Yuen Kong San Tsuen Channel KT14 Proposed Layout Plan (Sheet 2 of 2)
- Figure 1.3 Kam Tsin Wai Channel KT15 Proposed Layout Plan
- Figure 3.1 Water and Sediment Sampling Locations at Existing Watercourses to be Channelized for KT15
- Figure 3.2 Ecological Monitoring Area KT14
- Figure 3.3 Ecological Monitoring Area KT15
- Figure 4.1 Locations of Representative Noise, Air and Visual Sensitive Receivers at KT14
- Figure 4.2 Locations of Representative Noise, Air and Visual Sensitive Receivers at KT14

CONTENTS

(Cont'd)

LIST OF FIGURES

Figure 4.3	Locations of Representative Noise, Air and Visual Sensitive Receivers at KT15
Figure 4.4	Habitat Map for KT14 and KT15
Figure 4.5	Water Quality Sensitive Receivers of Proposed Works KT14 and KT15.
Figure 5.1	Locations of Ecological Mitigation Measures at KT14
Figure 5.2	Locations of Ecological Mitigation Measures at KT15
Figure 5.3	Typical Sections of Drainage Channel Linings for KT14 and KT15
Figure 5.4	Locations of Proposed Temporary Noise Barriers at KT14
Figure 5.5	Locations of Proposed Temporary Noise Barriers at KT14
Figure 5.6	Locations of Proposed Temporary Noise Barriers at KT15
Figure 5.7	Indicative Cross Section View of Construction Site and Proposed Temporary Noise Barriers (KT15)

LIST OF TABLES

Table 2.1	Other Projects in the Study Area
Table 3.1	Potential Environmental Impacts: Construction Phase
Table 3.2	Potential Environmental Impacts: Operational Phase
Table 5.1	Summary of Specific Mitigation Measures (Construction Phase)
Table 5.2	Practicable Recommendations for Future Maintenance of the Channels
Table 5.3	Summary of Continuous Public Involvement
Table 5.4	Summary of the Comments and Recommendations Received during the Public Consultation

EXECUTIVE SUMMARY

The proposed works entitled “Yuen Long, Kam Tin, Ngau Tam Mei and Tin Shui Wai Drainage Improvement, Stage 1, Phase 2B - Kam Tin - Secondary Drainage Channels KT14 & KT15” are Designated Projects (DPs) as specified under Category I1, (b) vii), Schedule 2, Part 1 of the Environmental Impact Assessment Ordinance, as both KT14 and KT15 discharge within 300 m of the boundary of a Conservation Area (CA). The CA in question is located between the Tsing Long Highway and the West Rail alignment. These DPs have been identified to be essential under Territorial Land Drainage and Flood Control Strategy Study - Phase II (TELADFLOCOSS 2) for the prevention of flooding in the Pat Heung area.

Key environmental issues identified during the construction phase for KT14 (958 m in total length) are ecology and noise. In terms of ecology, there is a loss of 1.34 ha of agricultural land / fallow land / low lying grasslands. These are seasonal wetlands but they are already very fragmented and do not have high ecological value. There are no species of conservation interest found, and there is no evidence of breeding areas for any species. In terms of construction noise, the use of quiet equipment and temporary noise barriers will be sufficient for the remediation of temporary noise impacts. A channel design with no side weep holes has been adopted to prevent the drainage of adjacent wetland and thereby minimize any impacts on ecology during operation phase. There are unlikely to be any residual adverse environmental impacts from the operation of KT14.

Key environmental issues identified during construction phase for KT15 are ecology, management of excavated contaminated sediments and noise. In terms of ecology, there is a loss of a natural stream section, some grassland, part of an orchard, and a very small fishpond (0.1 ha). The stream at KT15 (796 m in length) is very polluted, with contaminated sediments from pig waste discharge lodged on its bed. The area is very disturbed by urban encroachment, and the introduction of West Rail and the improvement works on Kam Sheung Road will further increase the level of disturbance. There are no species of conservation interest found, and there are no breeding areas for any species. The significance of ecological impact is considered low. In terms of construction noise, the use of quiet equipment and temporary noise barriers will be sufficient for the remediation of temporary noise impacts. A channel design with no side weep holes has been adopted to prevent the drainage of adjacent wetland and thereby minimize any impacts on ecology during operation phase. Excavated contaminated sediments will have to be tested and suitably disposed at sites identified according to the procedures specified under the Environment, Transport and Works Bureau Technical Circular (Works) (ETWBTC (W)) No. 34/2002. There are unlikely to be any residual adverse environmental impacts from the operation of KT15.

Overall the identified potential impacts during the construction and the operation of KT14 and KT15 can be avoided or fully mitigated by the proposed measures described in this Project Profile.

1. BASIC INFORMATION

1.1 Project Titles

- 1.1.1 Yuen Long, Kam Tin, Ngau Tam Mei and Tin Shui Wai Drainage Improvement, Stage 1, Phase 2B - Kam Tin - Secondary Drainage Channels KT14 & KT15.

1.2 Purpose and Nature of the Projects

- 1.2.1 In accordance with the findings of the Yuen Long, Kam Tin, Ngau Tam Mei and Tin Shui Wai Drainage Master Plan (YLDMP), the proposed Projects are aimed at relieving the present drainage problems that have repeatedly led to severe flooding in the areas.
- 1.2.2 Construction activities for the Projects involve the forming of two groups of secondary drainage channels. In particular, works would include site clearance, excavation to formation levels of the channels, bank formation, dredging, widening, realignment and lining of channels, re-provisioning of vehicular and pedestrian crossings, drainage and utility diversion works, and other ancillary works.
- 1.2.3 This Project Profile (PP) covers two Designated Projects - the proposed Secondary Channels grouped under KT14 and KT15 respectively. Figure 1.1 shows the location of the proposed drainage improvement works in the Northwest New Territories.
- 1.2.4 The downstream ends of both KT14 and KT15 will be connected to the primary channels constructed by Kowloon-Canton Railway Corporation (KCRC) - West Rail (MDC 97CD) (already completed by others).
- 1.2.5 Figures 1.2 and 1.3 show the typical sections of the drainage channels with various bank slopes and different channel lining designs for KT14 and KT15 respectively.

1.3 Purpose of this Project Profile

- 1.3.1 This Project Profile is submitted to seek approval from the authorities to apply directly for an Environmental Permit for the Designated Projects (DPs), in accordance with S.5(1)(b) of the *Environmental Impact Assessment Ordinance* (EIAO)(Cap 499). The predicted impacts from the implementation of the proposed Designated Projects KT14 and KT15 are not expected to be adverse and sufficient information is provided in this Project Profile on mitigation measures to meet the

requirements under the Technical Memorandum on Environmental Impact Assessment Process (TMEIAP).

1.4 Name of Project Proponent

- 1.4.1 Project Management Division of Drainage Services Department of the Government of the Hong Kong Special Administrative Region.

1.5 Location and Scale of Projects and History of the Site

KT14

- 1.5.1 The location of KT14 is at Yuen Kong San Tsuen and Tin Sam Tsuen areas in Pat Heung. The areas currently comprise abandoned dry agricultural land, and low lying grassland/fallow fields. A small part of the alignments is inside a paved area and construction site/ bare ground. There is no history of contaminating land use in the areas. The abandoned agricultural area is considered to be a seasonal marsh and is a breeding ground for common amphibian species. This is a new channel to be constructed on land where there is currently no stream or other drainage channel, and comprises four discrete sections with the following dimensions:

Section A	– 2.5 m width and 2.8 m height, 145 m
Section B	– 2.5 m width and 1.6 m height, 339 m
Section C	– 2.5 m width and 1.6 m height, 474 m
Drain along Kam Sheung Road – 900 mm nominal size U-channel	
Bank raising along the existing toe channel of Pat Heung Road	

- 1.5.2 The proposed layout of KT14 is shown in Figure 1.2 (2 sheets).

KT15

- 1.5.3 KT15 is to be formed by channelising an existing stream that passes through the Shek Wu Tong, Tin Sam San Tsuen and Kam Tsin Wai areas in Pat Heung. These are areas of mainly modified low-lying grassland with village houses and farms around the stream. There is no history of contaminating land use in the areas.
- 1.5.4 The length of KT15 is about 796 m. The proposed layout of KT15 is shown in Figure 1.3. The dimensions of the new KT15 channel are summarized as follows:

Chainage 0 – 11	3 x 3 m (W) x 2 m (H) box culvert
Chainage 11 – 200	Channel width 9.9 m, depth 1.6 m, with 0.8 m wide verge on both sides
Chainage 200 – 450	Channel width 9.9 m, depth 1.6 m, with 0.8 m wide verge on both sides, and 3.5 m wide maintenance access road to the south
Chainage 450 – 550	Channel width 6.7 m, depth 1.6 m, with 0.8 m wide verge on both sides, and 3.5 m wide maintenance access road to the north
Chainage 550 – 686	Channel width 9.9 m, depth 1.6 m, with 0.8 m wide verge on both sides, and 3.5 m wide maintenance access road to the north
Chainage 686 - 796	Channel width 3.5 m, depth 1.6 m, with 0.8 m wide verge on both sides

Justifications and Benefits of the Designated Projects

1.5.5 In accordance with the findings of the YLDMP, the proposed Project is expected to contribute to the relief of the present drainage problems that have repeatedly led to severe flooding in the study area. With the implementation of the Project, the defence of the well being and properties of local residents against flood risks can be much enhanced. In particular, the YLDMP identified that secondary channels in Tin Shui Wai, Kam Tin and Ngau Tam Mei areas are required:

- (i) to drain areas where the existing secondary drainage is insufficient;
- (ii) to solve known flooding problems;
- (iii) to deal with catchwater overflows; or
- (iv) to provide infrastructure for future development where applicable.

1.5.6 The justification of Secondary Channels KT14 and KT15, the subject of this PP Report, and other works elements of the Project was addressed in the Preliminary Project Feasibility Study (PPFS) Report [0023/REP/7/Issue 5 – March 1998] as well as the Environmental Review Report [0023/ER/Issue 2 – February 1998] for this Project. Both reports were endorsed in April 1998.

1.5.7 In summary, the justification of the Project (Here it refers to the Stage 1 and Stage 2 works on the whole) and the consequence of not proceeding are given in the following sections:

a) Justification for Project :

The Yuen Long, Kam Tin, Ngau Tam Mei & Tin Shui Wai catchments are served by existing drainage systems. However, rapid urbanisation in the areas has resulted in a higher runoff ratio and the existing systems are insufficient to provide the required protection standard so that frequent flooding occurs in the area during heavy rainfall. Extensive training of the primary channels is being

undertaken as recommended in the Territorial Land Drainage and Flood Control Strategy Study – Phase II (TELADFLOCOSS 2) which was issued in August 1993. Also as recommended in TELADFLOCOSS 2, the Land Drainage Division of Drainage Services Department commissioned the YLDMP Study to investigate and recommend measures to resolve secondary and local stormwater drainage problems in the study area. However during the course of the YLDMP Study it was also necessary to model the primary channels as the drainage system had to be considered as a whole. The following drainage problems were revealed in the YLDMP:

- i) part of the primary drainage channels in Tin Shui Wai proved unable to provide the required flood protection standard stipulated in the Stormwater Drainage Manual which was published after the TELADFLOCOSS 2 study;
- ii) Some of the areas were noted to be flood-prone because of insufficient or under-sized secondary/local channels - this is particularly important for areas designated for development;
- iii) the Yuen Long town and Hung Shui Kiu urban drainage system is under-sized in places.

Mitigation measures were recommended in the YLDMP Study to solve these drainage problems. As the primary channels are in place in Yuen Long, Kam Tin and Ngau Tam Mei, it is now appropriate to upgrade the local and secondary drainage systems in the area to resolve the local flooding problems within the study area.

b) Consequences of Not Proceeding :

Two consequences of not proceeding with the project are identified as follows:

- i) Flooding will persist in the flood-prone areas in Yuen Long, Kam Tin, Ngau Tam Mei & Tin Shui Wai identified in the DMP Study.
- ii) Development of the study area will be hindered.

Local areas will still be vulnerable to flooding during heavy rainfall even after completion of training of the primary channels because of deficiencies in the secondary and local drainage systems. Moreover, urbanisation and changes of land use will increase runoff and thus the flooding risk. It is therefore clear that not proceeding with this project will leave residents exposed to increasing and unacceptable flooding risk and will hinder development of the NWNT.

c) Previous Studies (identifying need) and Policy Acceptance :

The fore-runner of this project was initiated under a previous consultancy study entitled “Territorial Land Drainage and Flood Control Strategy Study - Phase II” (TELADFLOCOSS 2) which was conducted for Drainage Services Department to address the flooding problems in the North-Western and Northern New Territories. TELADFLOCOSS 2 identified major deficiencies in the stormwater drainage systems in the study area and confirmed that primary channels should be trained to provide adequate flood protection and recommended further studies to investigate the local and secondary drainage systems. These recommendations were accepted by Government and included in the Policy Comments in the 1995 Policy Address.

Training of the primary channels in Tin Shui Wai is complete and training of the primary channels in Yuen Long, Kam Tin and Ngau Tam Mei are also complete. In 1996, the Land Drainage Division of Drainage Services Department commissioned the YLDMP Study to investigate and recommend measures to resolve secondary and local stormwater drainage problems in the study area.

Consideration of Alternative Alignments and Channel Lining Options

Alternative Alignment

1.5.8 The Secondary Channels KT14 & KT15 require excavation of new drainage channels (KT14) and channelization of an existing stream (KT15). Improved drainage may impact on the water supply for the adjacent seasonal marshes, and loss of stream habitat in the case of KT15. When planning these DPs, the benefits from optimising hydraulic performance of the proposed channel design, material and alignment, and those from continued water supply to the seasonal wetlands habitats were both recognised and considered.

1.5.9 The designs of the KT14 & KT15 are based on the concept of “no-intake” from the adjacent agricultural land and seasonal marshes. No weep holes will be installed in the sections that are bound by these seasonal wetland areas, so that the flood water upstream of the existing stream or alignment can be quickly bypassed downstream, while drainage the adjacent wetland will be minimized.

Channel Lining Options

1.5.10 Options for channel lining for banks and floor include natural bedding (gravel or mud), gabions, concrete or grasscrete. While the hydraulic performance of concrete and grasscrete lined channels are best for smooth flow and easy maintenance, they will remove the ecological values of the land on which they occupy. Also, the rate of transport of sediments downstream, whether clean or

- contaminated, will also increase, resulting in the increase of suspended solids (SS) and biological oxygen demand (BOD) in water.
- 1.5.11 Gabions and natural stream beds offer surfaces that will sustain a bottom community and are better for retaining sediments and establishment of vegetation on banks. This would also reduce the rate of sediment loss from the catchment, which will ultimately reach Deep Bay. Nevertheless they are more expensive to maintain as they are often displaced or damaged after heavy storms. Annual trimming of bank side vegetation and removal of excess sediments will be required to ensure sufficient hydraulic capacity is retained. Natural banks are especially prone to erosion and subject to scour. To ensure the stability of the banks that sit near the existing residential blocks, it is not viable to adopt natural stream bank and bed for this Project.
- 1.5.12 After consultation with relevant green groups in July 2004 and due consideration of the ecological value of the sections of stream to be channelized under KT15, a gabion base and banks design will be adopted, except at chainage CH+686 to CH+796, where a rectangular concrete channel with gabion floor and a 0.75 m high bricks (e.g. bat bricks) at the banks will be formed. Gabion floor will allow the establishment of vegetation and retain some sediments, retaining the functions of a natural stream habitats for aquatic fauna. The bricks aims to provide shelter for protection of small fishes and other aquatic organisms for stream enhancement. The concrete banks at CH+686 to CH+796 are designed to prevent draining of the adjacent seasonal wetlands. For KT14 there is no existing stream bed as entirely new channels are proposed to be created. Accordingly, the key ecological concern is to maintain the existing water table in adjoining areas of seasonal wetland. Where the new KT14 channels are formed through the areas of seasonal wetland shown on Figure 3.2, a rectangular concrete channel with no weep holes with gabion floor and the bricks in the lower level of the banks will be formed in order to prevent draining of the wetland areas. This is shown in Figure 3.3 for KT15 channel. Figure 5.3 shows the typical sections of channel linings for KT14 and KT15.

Environmental Study

- 1.5.13 An Environmental Study (ES) for the Designated Projects KT14 and KT15 of the drainage improvement scheme, and practicable mitigation measures proposed for minimising impacts were conducted under Agreement No. CE 67/98 - Yuen Long, Kam Tin, Ngau Tam Mei & Tin Shui Wai Drainage Improvement Stage 1. Assessment and findings of the ES pertaining to KT14 and KT15 are used in this Project Profiles for impacts evaluation and mitigation proposals.

1.6 Number and Types of Designated Projects under this Project Profile

- 1.6.1 There are two DPs described under this Project Profile (PP). The two DPs are defined under Category II, (b) vii), Schedule 2, Part 1 of the *Environmental Impact Assessment Ordinance*, as both KT14 and KT15 discharge within 300m of the boundary of a Conservation Area (CA). This Conservation Area (CA) is located to the west of the West Rail alignment and depot, and to the east of Tsing Long Highway under the Kam Tin South Outline Zoning Plan (ref. S/YL-KTS/8). Locations of the DPs in relation to the CA, Kam Tin Drainage Channel, KCRC West Rail Depot and West Rail alignment are best viewed from Figure 1.1.

1.7 Name and Telephone Number of Contact Person

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2. OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

2.1 Planning and Implementation

- 2.1.1 Planning and design of the Yuen Long, Kam Tin, Ngau Tam Mei & Tin Shui Wai Drainage Improvement Project will be undertaken by DSD / Project Management Division. Consultants have been engaged to undertake site investigations, environmental impact assessment, design and construction supervision of the projects. The construction of the secondary channels will be implemented under construction contracts.

2.2 Project Programme

- 2.2.1 KT14 and KT15 are scheduled to commence in mid 2006 for completion in mid 2009.

2.3 Project Interfaces

- 2.3.1 Relevant concurrent drainage projects in the vicinity of the Secondary Channels KT14 and KT15 that could have some form of cumulative environmental impacts with these DPs are shown in Table 2.1, which indicates the duration for each project and the likely overlapping period with this project. No projects over 1000 m from these DPs and those outside the Kam Tin River Catchment have been included here since there would be minimal cumulative air quality, noise and water quality impacts with those projects. Ecological parameters such as rarity will however be assessed over local, regional, territory wide and global context.
- 2.3.2 The main potential cumulative impacts from concurrent projects within the vicinity of KT14 and KT15 will be related to runoff into the same watercourse (i.e. Kam Tin River / Kam Tin Main Drainage Channel and Deep Bay), and potential noise and dust impacts where works are carried out within 500 m of each other. Noise attenuation and dust fall-out over the large intervening distances between the projects mean that is unlikely to be cumulative impacts.
- 2.3.3 The measures that are prepared in this PP will aim to minimise potential impacts to these environmental areas and this minimise overall cumulative impacts to the region.

Table 2.1
Other Projects in the Study Area

PWP No., Agreement No. or Project	Project Title	Tentative Start/ Completion	Overlapping Period (Months)	Distance from KT14	Distance from KT15
KT2	Yuen Long, Kam Tin, Ngau Tam Mei and Tin Shui Wai Drainage Improvements Stage 1	mid 2006 – mid 2009	Whole period	3.0 km	2.0 km
KT12	Yuen Long, Kam Tin, Ngau Tam Mei and Tin Shui Wai Drainage Improvements Stage 1	mid 2006 – mid 2009	Whole period	800 m	1.8 km
KT13	Yuen Long, Kam Tin, Ngau Tam Mei and Tin Shui Wai Drainage Improvements Stage 1	mid 2006 – mid 2009	Whole period	1 km	1.5 km
95CD	DC/98/04 Kam Tin North River Channel between Kam Tin San Tsuen and Wang Toi Shan (Contract D)	August 2003 – Feb 2008	20 months	2.0 km	1.2 km

2.3.4 From the available information listed in Table 2.1, cumulative impacts are not expected given the large distance separation between projects. Implementation of KT14 and KT15 have beneficial cumulative impact on water quality in Kam Tin River Catchment as contaminated sediments on existing stream bed are removed. Long term improvement of water quality depends on the continued implementation of Livestock Waste Control Regulation.

3. POSSIBLE IMPACTS ON THE ENVIRONMENT

3.1 Tables 3.1 and 3.2 summarise the potential environmental impacts that may occur due to the proposed KT14 and KT15 works during construction and operation phases of the projects respectively.

Table 3.1
Potential Environmental Impacts: Construction Phase

Environmental Issues	Description of Impacts	
	KT14	KT15
Dust and Odour	The channelisation works are likely to cause temporary potential fugitive dust impacts.	As the stream bed sediments of KT15 is likely to be grossly polluted, they are likely to be a source of odour. The channelisation works are likely to cause temporary potential fugitive dust impacts
Noise/Night Time Operations	Unmitigated construction noise levels at all representative noise sensitive receivers for KT14 and KT15 works exceed the daytime construction noise limits by 3 dB (KT14-3) to 17 dB (KT14-4) at different stages of construction works. Attachment 1 presents the construction noise assessment for KT14 and KT15 works. No restricted hours works (1900 to 0700 and general holidays) are required.	

Environmental Issues	Description of Impacts	
	KT14	KT15
Water Quality	<p>Attachment 2 gives the water quality and sediment monitoring results for the purpose of preparing this Project Profile (PP). Sampling locations for KT15 is shown in Figure 3.1.</p>	
	<ul style="list-style-type: none"> Inadvertent release of excavated soils and sediments to nearby water bodies can lead to increased turbidity and suspended solids level Inadvertent release of concrete containing site runoff to nearby water bodies can lead to increased pH and suspended solids levels, possibly increase of ammonia level Inadvertent release of lubricants and solvents to nearby water bodies can lead to depletion of oxygen and increase of organic chemicals Sewage generated from site staff can lead to depletion of oxygen, increase of nitrogen, phosphates, and suspended solids 	<ul style="list-style-type: none"> Inadvertent release of excavated soils and sediments to nearby water bodies can lead to increased turbidity and suspended solids level Inadvertent release of concrete containing site runoff to nearby water bodies can lead to increased pH and suspended solids levels, possibly increase of ammonia level Inadvertent release of lubricants and solvents to nearby water bodies can lead to depletion of oxygen and increase of organic chemicals Sewage generated from site staff can lead to depletion of oxygen, increase of nitrogen, phosphates, and suspended solids Additional oxygen demand into stream from disturbed sediments on existing stream bed can lead to depletion of oxygen and increase of suspended solids level

Environmental Issues	Description of Impacts	
	KT14	KT15
Generation of Waste	<p>The waste from the construction of KT14 is mainly soil, vegetation with a small amount of concrete. Some of the soil may be reusable.</p> <p>The total estimated quantity of C&D material generated = 14,970m³</p> <p>The estimated quantity of C&D material to be re-used on-site = 1,590m³</p> <p>The estimated quantity of C&D material for disposal to a Public Filling Area = 11,210m³</p> <p>The estimated quantity of C&D waste delivered to Landfill = 25m³</p> <p>The remaining unsuitable material that may require disposal to Landfill = 2,145m³</p>	<p>The waste arising from the construction of KT15 includes vegetation, some concrete and the pig waste at the bottom of the existing stream.</p> <p>The total estimated quantity of C&D material generated = 24,610m³</p> <p>The estimated quantity of C&D material to be re-used on-site = 2,620m³</p> <p>The estimated quantity of C&D material for disposal to a Public Filling Area = 18,450m³</p> <p>The estimated quantity of C&D waste delivered to Landfill = 40m³</p> <p>The remaining unsuitable material (including some potentially contaminated sediment subject to further classification during detailed design stage) = 3,500m³</p>
Dangerous Goods and Hazardous waste	There will be no storage of any dangerous goods or hazardous waste under this Project.	
Contaminated Sediments	N/A	Initial assessment of the sediment quality of KT15 revealed that the sediments are classified as Category H according to ETWB TCW No. 34/2002. Further assessment on the contamination is necessary as required in ETWB TCW No. 34/2002. A Sediment Quality Report (SQR) shall be compiled and the feasibility and disposal options for the sediments shall be approved by EPD.
Hydrology	N/A	Temporary diversion of flow in KT15 will be required which will alter the hydraulic regime and water supply to the seasonal wetland.

Environmental Issues	Description of Impacts	
	KT14	KT15
Visual Impacts	Excavation, removal of vegetation, stream diversion works are likely to cause temporary visual and landscape impacts during the construction stage. Detailed tree survey would be undertaken during the detailed design stage.	
Ecological Impacts	<p>Figures 3.2 and 3.3 show the ecological sampling locations for KT14 and KT15. Attachment 3 shows the data collected for the purpose of providing background information.</p> <p>Attachment 3 presents data collected on floral and faunal species identified around the proposed works areas of KT14 and KT15.</p>	
	<p>Potential loss of some agricultural lands and low-lying grasslands, and increase in fragmentation to the continued agricultural lands/fallow fields/ low lying grasslands. The potential loss of 1.34 ha of agricultural lands/fallow fields/low-lying grasslands is considered to have low impact. Nevertheless, the proposed works will increase the fragmentation to the habitats, and thus the overall impact level is of low to moderate significance. The impact of draining the wet cultivated lands/ fallow fields/low lying grasslands from the channelisation works is of moderate significance, since the quality of the wetland habitat will be degraded. Given the large buffer distance and the high level of disturbance from the surrounding environment, there will be no direct/indirect impact on the Conservation Area from the proposed project.</p>	<p>Potential impacts include the disturbance, destruction and loss of a natural stream section, several patches of grasslands, part of an orchard, and a small abandoned fishpond (~0.1ha). There will be an increase in fragmented grasslands, which are east of Kam Sheung Road. Since the Study Area is already subject to high level of disturbance from the surrounding urban environment, which includes the West Rail works, Kam Sheung Road, and the residential areas, etc. the ecological impact is not unacceptable. Without mitigation, however, a higher level of impact can occur, namely the potential for draining of the wet fallow fields/low lying grasslands upstream. Given the large buffer distance and the high level of disturbance from the surrounding environment, there will be no direct/indirect impact on the Conservation Area from the proposed project.</p>
Historical and Cultural Impacts	<p>The nearest listed archaeological site near the proposed KT14 and KT15 works is Shui Lau Tin Archaeological Site, which is approximately 1.5 km away.</p> <p>The nearest historical village Kat Hing Wai and the other listed historic buildings are all located north of Kam Sheung Road, at a minimum distance of 1.5 km from the proposed works under KT14 and KT15.</p> <p>There will be no direct impacts on the archaeological or cultural resources under the proposed works.</p>	
Land Contamination	There is no previous contaminating land use history at the sites for KT14 and KT15.	

Table 3.2
Potential Environmental Impacts: Operational Phase

Environmental impacts/issues	Description of Impacts	
	KT14	KT15
Odour	N/A	Emission of odour from organic mud deposited on streambed is likely to be reduced because of the proposed Project. Nonetheless, recommendation for handling odourous material as stipulated for construction stage shall be implemented. It is expected only a very small quantity of sediment will be generated during routine maintenance of the channels.
Noise	No operation noise will arise from this Project as there are no pumping stations or other electrical mechanical equipment being installed. The maintenance access along KT14 and KT15 will not be open for public use.	
Water Quality	Periodic removal of sediments from completed channels will be carried out in dry season when the channel is dry, using small backhoes. No dredging will be carried out during operation phase. No impacts to water quality from the operation of the completed channel are envisaged.	
Generation of Waste	Maintenance of the channels will result in small quantity of sediments and vegetation being removed which will require proper disposal.	
Ecological Impacts	No operation phase ecological impacts are predicted.	
Dangerous Goods and Hazardous Waste	There will not be any storage of dangerous goods or hazardous substances due to the implementation of this Project.	
Hydrology	The construction of KT14 and KT15 could permanently change the hydrology of the Study Area and the impacts associated with these changes should be prevented in the context of ensuring the water supply to the seasonal wetland and preventing ground settlement. With the implementation of channel design with no weep holes for the sections bounded by the seasonal wetland areas, no impacts are expected.	
Visual Impacts	The visual and landscape impact associated with the implementation of the KT14 and KT15 include the introduction of a channel through a previously undeveloped rural landscape.	
Historical and Cultural Impacts	There is no operation phase historical and cultural impacts.	

4. MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

4.1 Existing and Planned Sensitive Receivers

4.1.1 The locations of potential noise, air quality and visual sensitive receivers within 300m of the proposed KT14 and KT15 works are shown on Figures 4.1, 4.2 and 4.3. The existing ecological habitats within a 500 m distance from the proposed works for KT14 and KT15 are shown in Figure 4.4. Figure 4.5 presents the water bodies that would be potentially affected by the proposed works.

4.2 Major Elements of the Surrounding Environment and Existing and/or Past Landuses on Site which might affect the Area in which the Project is located

4.2.1 Highly contaminated sediments resulting from long term discharge of pig waste and expedient discharge of domestic effluent into the stream course for KT15 will have to be excavated and suitably handled and disposed. This imposes a constraint on the Project. There is no other existing or past land uses that may affect the project area.

5. ENVIRONMENTAL PROTECTION MEASURES

5.1 Measures to Minimise Environmental Impacts

5.1.1 As part of the efforts to minimise potential environmental impacts from the proposed Designated Projects, all regulations, technical memoranda, practice notes, and guidelines related to the following environmental and planning ordinances shall be observed:

- *Air Pollution Control Ordinance*
- *Animals and Plants (Protection of Endangered Species) Ordinance*
- *Dumping at Sea Ordinance*
- *Environmental Impact Assessment Ordinance*
- *Foreshore and Sea Bed Reclamation Ordinance*
- *Forestry and Countryside Ordinance*
- *Noise Control Ordinance*
- *Public Health and Municipal Services Ordinances*
- *Town Planning Ordinance*
- *Waste Disposal Ordinance*
- *Water Pollution Control Ordinance*
- *Waterworks Ordinance*
- *Wild Animals Protection Ordinance*

5.1.2 The Contractor shall be aware of, and comply with, the following environmental protection related legislation and guidelines:

- *A Guide to the Chemical Waste Control Scheme*
- *A Guide to the Registration of Chemical Waste Producers*
- *The Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*

- *Works Branch Technical Circulars (WBTC) No. 2/93 Public Dumps*
- *WBTC No. 2/93B Public Filling Facilities*
- *WBTC No. 16/96 Wet Soil in Public Dumps*
- *WBTC No. 4/98 & 4/98A Use of Public Fill in Reclamation and Earth Filling Projects*
- *WBTC No. 12/2000 Fill Management*
- *WBTC No. 19/2001 Metallic Site Hoarding and Signboard.*
- *Environment, Transport and Works Branch (ETWB) TCW No. 33/2002 Management of Construction and Demolition Material including Rock.*
- *ETWB TCW No. 34/2002 Management of Dredged/Excavated Sediment*
- *ETWB TCW No. 15/2003 Waste Management on Construction Sites*
- *ETWB TCW No. 31/2004 Trip-ticket System for Disposal of Construction and Demolition Material*
- *ProPECC Note PN 1/94 - Construction Site Drainage*
- *WBTC No. 14/2002 - Management and Maintenance of Natural Vegetation and Landscape Works, and Tree Preservation*

5.1.3 Specific mitigation measures for minimising potential impacts from the construction of KT14 and KT15 are briefly summarised in Table 5.1. Practicable recommendations to help future maintenance contractor on the future maintenance of the channels (during operation) without causing environmental nuisance are summarized in Table 5.2. Full details of these measures are provided in the Implementation Schedule (Attachment 5).

Table 5.1
Summary of Specific Mitigation Measures (Construction Phase)

Environmental Impact	Specific Mitigation Measures
Ecology	
Drainage of the adjacent seasonal wetland result in loss of wetland habitats.	Channels with no side weep holes and with wide base slab to counter uplift designed to sustain groundwater levels will be constructed where the KT14 channel passes through the seasonal wetland areas shown on Figure 3.2. This will prevent draining the adjacent wetland. Design of the channels without side weep holes is detailed in Figures 5.1 and 5.3.
Loss of stream habitat	For KT14 channel, the base will have gabion mattress while the banks will have bricks (e.g. bat bricks) up to 0.75m high for stream enhancement. The proposed channel linings and banks for typical sections of KT15 channel will have gabion banks and base, except at CH+686 to CH+796 where the design is similar to KT14 (see Figures 5.2 and 5.3).
Temporary disturbance impacts to seasonal wetland habitats	During the construction phase, works or disturbances to areas of seasonal wetlands adjacent to the construction site boundary shown on Figures 3.2 and 3.3 are not allowed. In particular, any discharge of site effluent to the seasonal wetlands, upstream stockpiling or disposal of materials, and any dredging or construction activities at these areas are prohibited. No site runoff shall be discharged to these wetland areas.
Construction Noise	
Exceedance of predicted construction noise levels without implementing any mitigation measures.	The Contractor is required to adopt Levels 1 and 2 site-specific direct technical measures as specified below during the construction phase. <i>Level 1 Mitigation Measures</i> <ul style="list-style-type: none"> The use of equipment with sound power level lower than that stipulated in the Technical Memorandum on Noise from Construction Works Other Than Percussive Piling is recommended as the first level mitigation (Level 1 mitigation) for all construction works under this Project.

Environmental Impact	Specific Mitigation Measures
	<p><i>Level 2 Mitigation Measures</i></p> <p>In addition to the use of quiet plant, purpose-built site noise barriers shall be used as hoarding where construction works would be undertaken close (about 30m or less) to the NSRs. Temporary noise barrier of minimum 3m height should be erected along the site boundary of the construction work closest to the NSRs (see Figures 5.4 - 5.6). Notwithstanding the required minimum height these barriers shall be constructed in a way such that no construction works and PME can be visible from the NSRs nearby. The minimum height is estimated assuming the construction equipment/activities will be located on the channel bed 2 m below the surrounding ground level.</p> <p>Stationary equipment shall be placed on the channel bed during construction works.</p> <p>For the construction works which are predicted to exceed 75dB(A) (Leq 30min) at nearby NSR and whose line of sight cannot be blocked by the temporary noise barrier (i.e. further away from the hoarding), movable (mobile) noise barrier of more than 3 m high should be provided. A typical example is shown in Figure 5.7.</p> <p>Temporary noise barriers or screens shall be constructed of material with a minimum surface density of 10 kg/m². Generators and compressors, should be completely screened by construction barriers giving a total noise reduction of 10 dB(A) or more.</p>
<p>Construction Dust and Odour</p> <p>Likely increase of fugitive dust during construction works.</p>	<p>The Contractor shall prevent dust nuisance arising from the construction activities. The Contractor is required to follow all the requirements for dust control stipulated in the Air Pollution Control (Construction Dust) Regulation.</p> <p>Dust suppression measures shall include:</p> <ul style="list-style-type: none"> (i) The Contractor shall frequently clean and water the site to minimise fugitive dust emissions.

Environmental Impact	Specific Mitigation Measures
Likely odourous excavated material.	<p>(ii) Effective water sprays shall be used during the delivery and handling of aggregate, and other similar materials, when dust is likely to be created and to dampen all stored materials during dry and windy weather.</p> <p>(iii) Watering of exposed surfaces shall be exercised at least three times a day.</p> <p>(iv) Areas within the site where there is a regular movement of vehicles must be regularly watered at minimum three times a day.</p> <p>(v) The Contractor shall restrict all motorised vehicles within the site, excluding those on public roads, to a maximum speed of 15 km per hour and confine haulage and delivery vehicles to designated roadways inside the site.</p> <p>(vi) Any stockpiles of construction materials that are likely to generate fugitive dust shall be covered with tarpaulins, including the materials on lorries or trucks.</p> <p>(vii) Wheel washing facilities shall be installed and used by all vehicles leaving the site. No earth, mud, debris, dust and the like shall be deposited on public roads. Water in the wheel cleaning facility shall be changed at frequent intervals and sediments shall be removed regularly. The Contractor shall submit details of proposals for the wheel cleaning facility. Such wheel washing facilities shall be usable prior to any earthworks excavating activity on the site. The Contractor shall also provide a hard-surfaced road between any washing facility and the public road.</p> <p>(viii) Any materials dropped on paved roads will need to be cleaned up immediately to prevent dust nuisance.</p> <p>Odour mitigation measure:</p> <p>(ix) Any odourous excavated material shall not be stockpiled on site, and shall be removed from site on the same day (or within 1 day). The material shall be stored in impermeable skips and must be properly covered at all times. Such material shall be properly covered when delivery to the dumping locations. Any temporary storage areas shall be placed remote from the air sensitive receives.</p>

BVHKL

Environmental Impact	Specific Mitigation Measures
	area.
<p>Waste Management</p> <p>Construction waste arising from the Secondary Channels KT14 & KT15 projects will include:</p> <ul style="list-style-type: none"> Excavated sediments, some of which is potentially contaminated. A small quantity of chemical waste such as lubricants and paints domestic waste from activities of site staff sewage inert material, such as rock, and non-inert materials such as wood, metals, and plastics arising from site clearance activities <p>The waste from the construction of KT14 is mainly soil, vegetation with a small amount of concrete. Some of the soil may be reusable.</p> <p>The waste arising from the construction of KT15 includes vegetation, some concrete and the pig waste at the bottom of the existing stream.</p> <p>If not managed and minimised these are potential causes of pollution.</p>	<p><i>Waste Management Plan</i></p> <p>Upon appointment, the main contractor of each construction contract should submit a Waste Management Plan (WMP) to the Engineer for approval. The WMP shall describe the arrangements for avoidance, reuse, recovery and recycling, storage, collection, treatment and disposal of different categories of waste to be generated from the construction activities and shall take into account the recommended mitigation measures in this Project Profile report. Such a management plan shall incorporate site specific factors, such as the designation of areas for segregation and temporary storage of reusable and recyclable materials. The following mitigation measures will be included in the WMP.</p> <ul style="list-style-type: none"> (i) Trip-ticket system - In order to monitor the disposal of C&D and solid wastes at public filling facilities and landfills, and control fly-tipping, a trip-ticket system shall be included. (ii) Records of wastes - A recording system for the amount of wastes generated, recycled and disposed (including the disposal sites) shall be proposed. (iii) Training - Training should be provided to workers about the concepts of site cleanliness and appropriate waste management procedure, including waste reduction, reuse and recycling. <p><u>Site Clearance Waste/Demolition Waste</u></p> <p>All construction wastes shall be sorted on site into inert and non-inert components. Non-inert materials (wood, glass, metals, and plastics) shall be recycled or reused and disposed to landfill as a last resort. Inert materials (soil, rubble, sand, rock, brick and concrete) shall be separated and reused on site prior to final disposal at public filling facilities. According to CEDD, the designated public filling facility for disposal of public fill will be the Public Filling Facility at Tuen Mun Area 38. According to the Facilities Management Group of EPD, the final disposal site for construction and demolition waste will be the North East New Territories (NENT) Landfill.</p>

Environmental Impact	Specific Mitigation Measures
	<p><u>Excavated Material</u></p> <p>Any excavated material from the stream shall not be stockpiled, and shall be removed from site on the same day (or within 1 day). The material shall be stored in covered impermeable skips while awaiting removal from site.</p> <p>The excavated sediments shall be managed in accordance with ETWB TCW No. 34/2002 and WBTC No. 12/2000. Characterisation and quantification shall be carried out during detailed design stage to determine the sediment quality and the quantity of contaminated sediment. If the material is found to be uncontaminated, it should be drained and reused on site. Measures to control dust pollution and runoff from stockpiles are given respectively in this Project Profile.</p> <p>Any leachate from skips shall be treated to meet discharge standard for Government sewers before being collected along with toilet waste by licensed contractor.</p> <p><i>Contaminated Sediment</i></p> <p>Contaminated sediments will be managed according to WBTC No. 12/2000 and ETWB TC (W) No. 34/2002. In order to reduce flooding risks the proposed drainage works of Secondary Channel KT15 may require removal of contaminated sediments from the stream, depending on the findings of the Sediment Quality Report to be prepared during detailed design stage. Liaison with Marine Fill Committee (MFC) to locate suitable sediment disposal space will be carried out at detailed design stage.</p> <p><i>Reducing the Use of Non-Reusable Materials on Site</i></p> <p>Hoarding, shutters, form works and false works made of reusable materials such as steel or plastic / concrete panels shall be used as a preferred alternative to non-reusable materials such as wood and timber, with reference to WBTC No. 19/2001 - Metallic Site Hoarding and Signboards.</p> <p><i>Chemical Waste</i></p> <p>Any Contractor generating waste oil, lubricants, paints or other chemicals as a result of his activities should register as a chemical waste producer. Storage, handling, transport and disposal of chemical waste should be arranged in accordance with the <i>Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes</i> published by EPD. Chemical waste should be</p>

Environmental Impact	Specific Mitigation Measures
	<p>collected by licensed collectors.</p> <p>The Contractor shall provide a storage area with hard standing, impermeable surface for storing chemicals on site to prevent inadvertent release of waste oil or other chemicals into nearby water bodies. Oil and fuel bunkers should be bunded and/or enclosed on three sides to prevent discharge due to accidental spillages or breaches of tanks. Bunded area should be of sufficient capacity to accommodate 110% of the volume of the largest container or 20% of the total volume of waste, whichever is largest. For construction plant that is likely to leak oil, absorbent inert material e.g. sand, shall be placed beneath it. This material should be replaced on a regular basis and the contaminated material disposed as chemical wastes. Storage areas should have adequate ventilation and be covered to prevent rain entering.</p> <p>Grease traps shall be installed for site drains. These traps shall be cleared at least one a week. A licensed contractor shall regularly clear the traps and dispose waste oils. No chemicals should be allowed to discharge into water courses, either by direct discharge, or as contaminants carried in surface water runoff from the construction site.</p> <p>Training on safety codes and relevant manuals related to the chemicals stored on site should be obligatory for the personnel who handle the chemicals on site.</p> <p>Domestic garbage generated by site staff shall be stored at dry locations in covered, impermeable skips. It should be collected daily and disposed to the nearest Refuse Collection Point or arranged for collection by licensed contractors. The Engineer is responsible for checking that no chemical waste, sewage, excavated material or sorted reusable material is disposed as domestic garbage.</p>
<p>Landscape and Visual Impact</p> <p>Potential loss of trees and vegetation.</p>	<p>A survey of existing trees shall be completed in accordance with WBTC No. 14/2002, Management and Maintenance of Natural Vegetation and Landscape Works, and Tree Preservation during detailed design stage. The results of the survey shall form consideration in the detail design for the proposed Secondary Channels KT14 & KT15, in order that any significant trees shall be protected during both the design and construction periods. Parameters assessed in the survey shall include species, health, form, transplant-ability and amenity value (assessed according to form, size, age, condition and situation of the tree). All surveyed trees should be checked with species listed under the "Animals and Plants (Protection of Endangered Species) Ordinance (Cap. 187)" and "Forestry and Countryside Ordinance (CAP. 96)" to ensure that no endangered species are affected. Where tree felling</p>

Environmental Impact	Specific Mitigation Measures
	is unavoidable, compensatory planting proposal shall be prepared and submitted to EPD, LCSD and LandsD for approval.

Table 5.2
Practicable Recommendations for Future Maintenance of the Channels

Environmental Impact	Recommendations
<p>In general, it is expected that an annual routine maintenance of removing excess silt, and trimming of some vegetation will be sufficient. Ad hoc maintenance such as emergency repair, clearance of debris or obstructions and removal of refuse, etc. will be carried out only when necessary.</p> <p>Maintenance process will remove small quantity of accumulated sediments and vegetation from the future channels which will require proper disposal.</p> <p>Emission of odour from organic sediment deposited on streambed is likely to be reduced because of the proposed Project.</p> <p>Adverse environmental impacts arising from such minor maintenance works are therefore not expected.</p> <p>Nonetheless, the following recommendations should be considered in planning future maintenance works.</p>	<p>Before proceeding with any desilting or maintenance works, except for emergency works, the maintenance engineer should check to ascertain if any of the proposed works will be located in or near an environmentally sensitive and/or ecologically important watercourses. In case of doubt, advice from EPD and AFCD or other relevant departments should be sought.</p> <p>Depending on the extent of the maintenance works, AFCD and EPD should be notified and/or consulted as appropriate on the proposed method and mitigation measures for executing the works. Their comments on necessary mitigation measures should be considered and incorporated.</p> <p>The following considerations should be included in planning for the maintenance works:</p> <ul style="list-style-type: none"> (a) Desilting or maintenance works should be carried out within the dry season when flow in the watercourse is low. (b) Phasing of the works should be considered to better control and minimize any impacts caused, and to provide refuges for aquatic animals. Works should be carried out along half width of the watercourse section by section (in small section). A free passage along the watercourse is necessary to avoid forming stagnant water in any phase of the works and to maintain the integrity of aquatic communities. (c) Containment structures (such as sand bags barrier) should be provided for the active desilting works area to facilitate a dry or at least confined working area within the watercourses. (d) Temporary access to the works site should be carefully planned and located to minimize disturbance caused to the watercourse, adjacent

Environmental Impact	Recommendations
	<p>vegetation and nearby sensitive receivers by construction plants.</p> <p>(e) The use of lesser or smaller construction plants should be considered to reduce disturbance to the riverbed where fish habitats are located and to the nearby sensitive receivers. Quiet construction plants should be used.</p> <p>(f) The use of concrete or the like should be avoided or minimized.</p> <p>(g) In the event odourous materials are encountered, the odourous material should not be stockpiled on site, and should be removed from site on the same day (or within 1 day). The material should be stored in impermeable skips and must be properly covered at all times. Such material should be properly covered when delivery to the dumping locations. Any temporary storage areas should be located away from the air sensitive receivers.</p> <p>(h) The locations for the disposal of the removed materials should be identified and agreement sought with the relevant departments before commencement of the maintenance works. Temporary stockpile of these materials should be located away from watercourses and properly covered to prevent inadvertent wash away into the watercourses during storm conditions.</p>

5.2 Potential Severity, Distribution and Duration of Key Environmental Impacts

KT14 Channel

- 5.2.1 The key environmental issues associated with the construction of KT14 are ecology and noise impact. These impacts occur between mid 2006 to mid 2009. They are confined to the works area for KT14, but also some indirect impacts in terms of draining to the seasonal wetland upstream of the southernmost channel proposed under KT14.
- 5.2.2 The main ecological impact at KT14 is the loss of 1.34 ha of agricultural land / fallow land / low-lying grasslands. These are seasonal wetlands, already fragmented and do not have very high ecological value. KT14 will further increase the fragmentation. No species of conservation interest are found and there are no breeding areas for any species in the affected areas. The significance of the loss is therefore low. Use of quiet equipment and installation of temporary noise barriers will be sufficient for the remediation of temporary noise impacts.
- 5.2.3 Magnitude of potential waste impact from KT14 is not large as the estimated amount of surplus construction and demolition material (including construction and demolition waste) is no more than 13,380 m³. Most of which can be disposed of to public filling facilities. Potential visual and landscape quality, water quality, odor and fugitive dust impacts can be prevented by suitable site management measures. The site has no cultural resources or contaminating land use history.
- 5.2.4 Some potential operation phase impacts exist in terms of ecology and hydrology in case the wetland near KT14 is drained. Measures have now been incorporated into the channel lining design to prevent loss of water supply to this nearby wetland. Concern of accelerated sediment loss to Deep Bay after channelization has been addressed by adopting a gabion mattress lining to allow vegetation to grow and retain some sediments. A 0.75 m high bricks (e.g. bat bricks) will be provided at the bank for stream enhancement. Overall, the environmental impacts due to the development and operation of KT14 are low and they can be adequately remediated by adopting the proposed mitigation measures, monitoring and audit requirements in this Project Profile.

KT15 Channel

- 5.2.5 The key environmental issues associated with the construction of KT15 are potential ecological impacts, management of contaminated sediments and construction noise impact. These impacts occur between mid 2006 to mid 2009, but indirect ecological impact could continue in the long term without due consideration of drainage pattern and water supply to the nearby wetlands. All potential impacts are confined to the work areas under KT15, with some potential indirect impacts to the seasonal wetland upstream of KT15. Contaminated sediments are present on existing streambed and require disposal to landfill (subject to landfill's disposal criteria) is counted as off site impact.
- 5.2.6 The main ecological impact at KT15 is the loss of a natural stream section, patches of grassland, part of an orchard, and a very small fishpond (< 0.1 ha). The area is currently very disturbed by urban encroachment, and the introduction of West Rail, improvement of Kam Sheung Road will increase the level of disturbance with or without KT15. No species of conservation interest are found and no breeding areas for any species are evident in the affected areas. The significance of the ecological impact is low. Use of quiet equipment and installation of temporary noise barriers will be sufficient for the remediation of temporary noise impacts.
- 5.2.7 As the stream in which KT15 is proposed is grossly polluted by pig waste, any excavated sediments are likely to be contaminated. Sediments test results indicated that these sediments have high level of zinc (230 mg/kg) and lead (140 mg/kg). The sediments would be re-sampled, tested and classified according to the procedures in ETWB TCW No. 34/2002 in the detailed design stage. The results in Attachment 2 are for reference only. With the continued implementation of Livestock Waste Control Regulation, the water and sediment quality of KT15 may gradually improve.
- 5.2.8 Magnitude of potential waste impact from KT15 is not large as the estimated amount of surplus construction and demolition material (including construction and demolition waste) is no more than 21,990 m³. Most of which can be disposed of to public filling facilities. Potential visual and landscape quality, water quality, odor and fugitive dust impacts can be prevented by suitable site management measures. The site has no cultural resources or contaminated land use history.
- 5.2.9 Some potential operation phase impacts exist in terms of ecology and hydrology in case the wetland at the upstream KT15 is drained. Measures have now been incorporated into the channel lining design to prevent loss of water supply to this nearby wetland. Concern of accelerated sediment loss to Deep Bay after channelization has been addressed by adopting a gabion lining to allow vegetation to grow and retain some sediments. Overall, the environmental impacts due to the development and operation of KT15 are low and they can be adequately

remediated by adopting the proposed mitigation measures, monitoring and audit requirements in this Project Profile.

5.3 Environmental Monitoring and Audit Requirements

5.3.1 An Environmental Monitoring and Audit (EM&A) programme for the Secondary Channels KT14 & KT15 is necessary to monitor the construction impacts of the proposed works and review and ascertain the effectiveness of the proposed mitigation measures. The details of the EM&A requirements in the form of an EM&A Manual for Secondary Channels KT14 & KT15 are provided in Attachment 4.

5.4 Public Consultation to Date

5.4.1 The process of Continuous Public Involvement (CPI) for the proposed Project through meetings and public consultation are summarized below in Table 5.3. A series of ad-hoc site visits / discussions with Village Representatives were also held.

Table 5.3
Summary of Continuous Public Involvement

Date	Concerned Parties
26 January 2002	▪ Pat Heung Rural Committee
13 March 2002	▪ Yuen Long District Council (Town Planning and Development Committee)
23 August 2002	▪ Yuen Kong Tsuen Village Representatives ▪ Pat Heung Rural Committee member
30 April 2004	▪ Kam Tin Rural Committee
25 June 2004	▪ Green Groups (WWF Hong Kong, Kadoorie Farm & Botanic Garden)
14 July 2004	▪ Yuen Long District Council (Town Planning and Development Committee)
17 July 2004	▪ Pat Heung Rural Committee
21 October 2004	▪ Yuen Kong Tsuen Village Representatives and villagers ▪ Yuen Kong San Tsuen Village Representatives and villagers
21 October 2004	▪ Kam Tsin Wai Village Representatives and villagers ▪ Ng Ka Tsuen Village Representatives and villagers ▪ Tin Sam Tsuen Village Representatives and villagers
28 October 2004	▪ Shek Wu Tong Village Representatives and villagers
14 July 2005	▪ Tin Sam Tsuen Village Representatives

5.4.2 During the course of the CPI, the channel designs were continuously reviewed according to the comments and recommendations from the local residents, village representatives, green groups, District Council and Rural Committees. Major comments and recommendations are summarized below.

Table 5.4
Summary of the Comments and Recommendations received during the Public Consultation

Concerned Parties	Major Comments / Recommendations	Responses / Outcomes
Pat Heung Rural Committee	<ul style="list-style-type: none"> Suggestion to amend KT14 alignment to provide more effective flood prevention. Early commencement of the project Arrangement of the remaining tributaries Connection of existing streams Opening of maintenance access for villager's use Any works on Shui Tsan Tin village. 	<ul style="list-style-type: none"> All the suggestions were incorporated into the channel design. After the consultation process, the Project needs to follow relevant statutory requirements. The earliest possible commencement of the Project would be mid 2006. Remaining existing tributaries would be preserved, appropriate design would be provided to maintain water flow. Connection to existing stream would be provided to ensure collection of water from the tributaries. Opening of the maintenance access for public usage would require further discussion with relevant government departments. Shui Tsan Tin village is outside the scope of this Project.
Yuen Long District Council (Town Planning and Development Committee)	<ul style="list-style-type: none"> To consult relevant village representatives on the proposed Project. 	<ul style="list-style-type: none"> Relevant village representatives were consulted and supported the Project.
Green Groups <ul style="list-style-type: none"> WWF Hong Kong Kadoorie Farm & Botanic Garden 	<p><u>KT14</u></p> <ul style="list-style-type: none"> Suggestion to replace the concrete lining in the channel bed with gabion lining / mattress. Suggestion to place bricks / rocks in the base of the channel to provide shelters for protection of small fish and other organisms for stream enhancement. 	<ul style="list-style-type: none"> All the suggestions were incorporated into the channel design.

Concerned Parties	Major Comments / Recommendations	Responses / Outcomes
	<p><u>KT15</u></p> <ul style="list-style-type: none"> Suggestion to replace the concrete lining in the channel bed with gabion lining / mattress. 	
<p>Village representatives and local villagers of:</p> <ul style="list-style-type: none"> Yuen Kong Tsuen Yuen Kong San Tsuen Kam Tsin Wai Ng Ka Tsuen Tin Sam Tsuen Shek Wu Tong 	<ul style="list-style-type: none"> Provide information on the affected lots. Whether small house application will be affected outside the site boundary. Whether certain sections of the channel works could be completed earlier to reduce the flooding risk. To inform the village representative prior to the gazettal of the Project. To retain existing footbridges and drainage facilities. Whether nearby graves and fung shui trees will be affected. Request to provide connection points to proposed drainage channel for future connection. Request to extend the inlet of the proposed drainage channel to facilitate the collection of water. 	<ul style="list-style-type: none"> The extent of the affected lots cannot be provided for the time being, this will be presented in the gazette, Yuen Long District Office will contact the affected property owner in due course. Small house application is handled by Yuen Long District Office, under normal circumstances, DSD will not disapprove small house application outside the site boundary. DSD will stipulate in the contract for certain sections of the work to be completed within 1 year. All notices under the Road (Works, Use and Compensation) Ordinance (Cap. 370) will be placed prominently in the relevant village notice board. In accordance with typical design requirements, all existing facilities affected as a result of the project will be reinstated, temporary facilities will be provided during the construction stage to reduce inconvenience to the villagers. According to the design, all the graves and fung shui trees will not be affected by the Project. Connection point will be provided at every 100m of the proposed channel for future connection. The inlet of the proposed drainage channel has been extended.

5.4.3 In July 2005, the public consultation was completed and the channel design details were finalized. Overall, there are no objections to the final design and the relevant village representatives and Rural Committees supported the proposed Project.

6. USE OF PREVIOUS APPROVED EIA REPORTS

- 6.1 No previous EIA report has been approved or submitted for the subject development.

END OF TEXT

ATTACHMENTS

Attachment 1

Details of Noise Calculations

Attachment 1

Equipment List and Associated Sound Power Level for Construction Activities (Unmitigated)

A1. Construction Equipment during Site Clearance

Type of PME	TM Code / BS Ref.	SWL - dB(A)	Barrier Correction	Corrected SWL	No. of Units	Total SWL - dB(A)
Excavator, tracked	081	112	0	112	1	115.2
Lorry	141	112	0	112	1	
Generator	102	100	0	100	1	
Water pump, submersible (electric)	283	85	0	85	5	

A2. Construction Equipment during Excavation of Channel

Type of PME	TM Code / BS Ref.	SWL - dB(A)	Barrier Correction	Corrected SWL	No. of Units	Total SWL - dB(A)
Excavator, tracked	081	112	0	112	1	115.2
Lorry	141	112	0	112	1	
Generator	102	100	0	100	1	
Water pump, submersible (electric)	283	85	0	85	5	

A3. Construction Equipment during Formwork

Type of PME	TM Code / BS Ref.	SWL - dB(A)	Barrier Correction	Corrected SWL	No. of Units	Total SWL - dB(A)
Bar bender and cutter (electric)	021	90	0	90	1	113.7
Generator	102	100	0	100	1	
Crane, mobile mounted (diesel)	048	112	0	112	1	
Saw, circular, wood	201	108	0	108	1	
Water pump, submersible (electric)	283	85	0	85	5	

A4. Construction Equipment during Concreting Works

Type of PME	TM Code / BS Ref.	SWL - dB(A)	Barrier Correction	Corrected SWL	No. of Units	Total SWL - dB(A)
Air Compressor, air flow $\leq 10\text{m}^3/\text{min}$.	001	100	0	100	1	116.9
Concrete Lorry Mixer	044	109	0	109	1	
Poker, vibratory, hand-held	170	113	0	113	2	

Notes:

PME = Powered Mechanical Equipment

SWL = Sound Power Level

TM = Technical Memorandum on Noise from Construction Work other than Percussive Piling

BS = BS 5228

Equipment List and Associated Sound Power Level for Construction Activities (Level 1 Mitigation : Use of Quiet Plant)

A1. Construction Equipment during Site Clearance

Type of PME	TM Code / BS Ref.	SWL - dB(A)	Barrier Correction	Corrected SWL	No. of Units	Total SWL - dB(A)
Excavator, tracked	C.8-33	102	0	102	1	105.6
Lorry	C.9-19	102	0	102	1	
Generator, super silenced	103	95	0	95	1	
Water pump, submersible (electric)	283	85	0	85	5	

A2. Construction Equipment during Excavation of Channel

Type of PME	TM Code / BS Ref.	SWL - dB(A)	Barrier Correction	Corrected SWL	No. of Units	Total SWL - dB(A)
Excavator, tracked	C.8-33	102	0	102	1	105.6
Lorry	C.9-19	102	0	102	1	
Generator, super silenced	103	95	0	95	1	
Water pump, submersible (electric)	283	85	0	85	5	

A3. Construction Equipment during Formwork

Type of PME	TM Code / BS Ref.	SWL - dB(A)	Barrier Correction	Corrected SWL	No. of Units	Total SWL - dB(A)
Bar bender and cutter (electric)	021	90	0	90	1	107.9
Generator, super silenced	103	95	0	95	1	
Crane, mobile mounted (diesel)	C.7-112	102	0	102	1	
Saw, circular, wood	C.7-78	106	0	106	1	
Water pump, submersible (electric)	283	85	0	85	5	

A4. Construction Equipment during Concreting Works

Type of PME	TM Code / BS Ref.	SWL - dB(A)	Barrier Correction	Corrected SWL	No. of Units	Total SWL - dB(A)
Air Compressor, air flow $\leq 10\text{m}^3/\text{min}$.	001	100	0	100	1	106.0
Concrete Lorry Mixer	C.6-23	100	0	100	1	
Poker, vibratory, hand-held	C.6-32	100	0	100	2	

Notes:

PME = Powered Mechanical Equipment

SWL = Sound Power Level

TM = Technical Memorandum on Noise from Construction Work other than Percussive Piling

BS = BS 5228

Equipment List and Associated Sound Power Level for Construction Activities (Level 2 - Mitigation : Quiet Plant + Temporary Noise Barrier)

A1. Construction Equipment during Site Clearance

Type of PME	TM Code / BS Ref.	SWL - dB(A)	Barrier Correction	Corrected SWL	No. of Units	Total SWL - dB(A)
Excavator, tracked	C.8-33	102	-5	97	1	100.2
Lorry	C.9-19	102	-5	97	1	
Generator, super silenced	103	95	-10	85	1	
Water pump, submersible (electric)	283	85	-10	75	5	

A2. Construction Equipment during Excavation of Channel

Type of PME	TM Code / BS Ref.	SWL - dB(A)	Barrier Correction	Corrected SWL	No. of Units	Total SWL - dB(A)
Excavator, tracked	C.8-33	102	-5	97	1	100.2
Lorry	C.9-19	102	-5	97	1	
Generator, super silenced	103	95	-10	85	1	
Water pump, submersible (electric)	283	85	-10	75	5	

A3. Construction Equipment during Formwork

Type of PME	TM Code / BS Ref.	SWL - dB(A)	Barrier Correction	Corrected SWL	No. of Units	Total SWL - dB(A)
Bar bender and cutter (electric)	021	90	-10	80	1	99.8
Generator, super silenced	103	95	-10	85	1	
Crane, mobile mounted (diesel)	C.7-112	102	-5	97	1	
Saw, circular, wood	C.7-78	106	-10	96	1	
Water pump, submersible (electric)	283	85	-10	75	5	

A4. Construction Equipment during Concreting Works

Type of PME	TM Code / BS Ref.	SWL - dB(A)	Barrier Correction	Corrected SWL	No. of Units	Total SWL - dB(A)
Air Compressor, air flow $\leq 10\text{m}^3/\text{min}$.	001	100	-10	90	1	100.2
Concrete Lorry Mixer	C.6-23	100	-5	95	1	
Poker, vibratory, hand-held	C.6-32	100	-5	95	2	

Notes:

PME = Powered Mechanical Equipment

SWL = Sound Power Level

TM = Technical Memorandum on Noise from Construction Work other than Percussive Piling

BS = BS 5228

Haul Road Noise Calculation

Assumption:

Equation based on BS 5228

$$L_{aeq} = L_{wa} - 33 + 10 \log Q - 10 \log V - 10 \log d + 3$$

where:

L_{wa} = sound power level of truck, Q = no. of trips per hour, V = average vehicle speed, d = distance from haul road

construction period : mid 2006 – mid 2009 (approx. 30 months)

390 assume working day for haul road noise assessment (15 months during site clearance and excavation works)

10 assume working hours per working day

6 capacity of truck (m³)

112 sound power level (L_{wa} in dB(A))

20 average vehicle speed (km/hr)

3 façade correction added (dB(A))

RNSR	Secondary Channel	Materials for each Channel Segment* (m ³)	No. of Trips per Hour	Distance from Haul Road (m)	Haul Road Noise Level (dB(A))
KT14-1	KT14	4,990	0.4	20	52
KT14-2	KT14	4,990	0.4	10	55
KT14-3	KT14	4,990	0.4	35	50
KT14-4	KT14	4,990	0.4	10	55
KT15-1	KT15	12,305	1	20	56
KT15-2	KT15	12,305	1	25	55

*** Assumptions:**

Total materials for KT14 = 14,970 m³, splitted to 3 channel segment = approx. 4,990 m³ per channel segment.

Total materials for KT15 = 24,610 m³, splitted to 2 channel segment = approx. 12,305 m³ per channel segment.

Table of Predicted (unmitigated and mitigated) Construction Noise Levels at Representative NSRs

RNSR ID	Works Involved	Distance of RNSR from Notional Point, m	Unmitigated Sound Power Level, dB(A)	Predicted Noise Level (unmitigated), dB(A)	Haul Road Noise Level, dB(A)	Total Predicted Noise Level (unmitigated), dB(A)	Mitigated 1 Sound Power Level, dB(A)	Predicted Noise Level (Mitigated 1), dB(A)	Haul Road Noise Level, dB(A)	Total Predicted Noise Level (Mitigated 1), dB(A)	Mitigated 2 Sound Power Level, dB(A)	Predicted Noise Level (Mitigated 2), dB(A)	Haul Road Noise Level, dB(A)	Total Predicted Noise Level (Mitigated 2), dB(A)
KT14-1	A1	20	115.2	84	52	84	105.6	75	52	75	N/A	N/A	N/A	N/A
	A2	20	115.2	84	52	84	105.6	75	52	75	N/A	N/A	N/A	N/A
	A3	20	113.7	83	0	83	107.9	77	0	77	99.8	69	0	69
	A4	20	116.9	86	0	86	106.0	75	0	75	N/A	N/A	0	N/A
KT14-2	A1	10	115.2	90	55	90	105.6	81	55	81	100.2	75	55	75
	A2	10	115.2	90	55	90	105.6	81	55	81	100.2	75	55	75
	A3	10	113.7	89	0	89	107.9	83	0	83	99.8	75	0	75
	A4	10	116.9	92	0	92	106.0	81	0	81	100.2	75	0	75
KT14-3	A1	35	115.2	79	50	79	105.6	70	50	70	N/A	N/A	N/A	N/A
	A2	35	115.2	79	50	79	105.6	70	50	70	N/A	N/A	N/A	N/A
	A3	35	113.7	78	0	78	107.9	72	0	72	N/A	N/A	0	N/A
	A4	35	116.9	81	0	81	106.0	70	0	70	N/A	N/A	0	N/A
KT14-4	A1	10	115.2	90	55	90	105.6	81	55	81	100.2	75	55	75
	A2	10	115.2	90	55	90	105.6	81	55	81	100.2	75	55	75
	A3	10	113.7	89	0	89	107.9	83	0	83	99.8	75	0	75
	A4	10	116.9	92	0	92	106.0	81	0	81	100.2	75	0	75
KT15-1	A1	20	115.2	84	56	84	105.6	75	56	75	N/A	N/A	N/A	N/A
	A2	20	115.2	84	56	84	105.6	75	56	75	N/A	N/A	N/A	N/A
	A3	20	113.7	83	0	83	107.9	77	0	77	99.8	69	0	69
	A4	20	116.9	86	0	86	106.0	75	0	75	N/A	N/A	0	N/A
KT15-2	A1	25	115.2	82	55	82	105.6	73	55	73	N/A	N/A	N/A	N/A
	A2	25	115.2	82	55	82	105.6	73	55	73	N/A	N/A	N/A	N/A
	A3	25	113.7	81	0	81	107.9	75	0	75	N/A	N/A	0	N/A
	A4	25	116.9	84	0	84	106.0	73	0	73	N/A	N/A	0	N/A

Notes:

A1 : Site Clearance

A2 : Excavation of Channel

A3 : Formwork

A4 : Concreting Works

Level 1 Mitigation : Use of Quiet Equipment.

Level 2 Mitigation : Use of Quiet Equipment + Erection of Acoustic Noise Barrier / Hoarding, assume 5 dB(A) & 10 dB(A) reduction for mobile plant & stationary plant respectively.

Haul road noise applied to site clearance and excavation of channel only.

Mitigation measures on haul road traffic not considered in the calculations to simulate worst case scenario.

N/A : not applicable or not required

3 dB(A) façade correction has been included in the Predicted Noise Level

Daytime construction noise criterion for residential premises : 75 dB(A)

Please refer to Figures 4.1 - 4.3 for location of RNSR.

Attachment 2

Water and Sediment Quality Monitoring Results

ATTACHMENT 2

Water and Sediment Quality Monitoring Results

1. Site visits took place over a number of days between February and July 2000 and followed-up visits were convened in March 2002 and December 2004. Observations are detailed in Table ATT2-1 below. There were very few visible differences between observations in 2000 and 2004.

Table ATT2-1
Field Observations at Watercourses in the Study Area

Stream Number	Stream Description	Water Quality Observations
KT14	In most places there are no visible streams in the dry season. The future channel will cut across mainly agricultural land.	No current channel
KT15	The stream passes through pig farms and agricultural areas at the upper (eastern) end and past a container/works area after passing under Kam Sheung Road, before passing a chicken farm. The stream is channelized in places.	Water quality at the upper end was bad becoming very bad lower down in 2000. The water appeared almost solid with pig effluent and emitted a very strong odour. By 2004 the water quality had visibly improved and in some places the bottom of the stream was visible. There is some vegetation in the channel. The bottom sediments appear to be giving off gas, particularly in the middle section.

2. Sampling was carried out in mid 2000 under this Study to assess the water and sediment quality of KT15 in the Study area. Sampling locations are shown in Figure 3.1. The number of locations sampled was determined based on visual observations on water quality variation. Where there was little observed changes in water quality between the upstream and downstream sections of a stream, fewer sampling locations were used and samples were taken at the downstream end.
3. Table ATT2-2 shows the water quality collected from sampling locations KT15A, B and C. Results indicated that water quality at KT15 was particularly bad with low levels of Dissolved Oxygen and high Total Organic Carbon (TOC) levels. High concentration of zinc was found.

Table ATT2-2
Summary of Water Quality of KT15A, B & C (July 2000)

Contaminants	Unit	KT15A	KT15B	KT15C
Cadmium	µg/L	<5	<5	<5
Chromium	µg/L	<10	<10	<10
Copper	µg/L	10	10	<10
Nickel	µg/L	<10	<10	<10
Lead	µg/L	<10	<10	<10
Zinc	µg/L	1600	310	420
Mercury	µg/L	<5	<5	<5
pH @ 30°C		6.8	6.7	6.9
Dissolved Oxygen	mg/L	5.0	3.0	3.0
Total cyanide	mg/L	<0.05	<0.05	<0.05
Total organic carbon	mg/L	4.0	6.6	14
Sulphide	mg/L	<0.1	<0.1	<0.1
Organochloride Pesticides	µg/L	<0.1	<0.1	<0.1
LMW PAHs	µg/L	<1	<1	<1
HMW PAHs	µg/L	<2	<2	<2
TPH	µg/L	<500	<500	<500

4. Sediment sampling was conducted initially in mid 2000 and again in December 2004 (in accordance with ETWB TCW No. 34/2002). Table ATT2-3 shows the latest sediment quality collected from sampling locations KT15A, B and C in December 2004. Results showed high concentration of lead and zinc in the sediment.

Table ATT2-3
Summary of Sediment Quality of KT15 at Sampling Locations KT15A, B & C (December 2004)

Contaminants	Unit	KT15A	KT15B	KT15C
Cadmium (Cd)	mg/kg	<0.1	0.4	0.3
Chromium (Cr)	mg/kg	18	11	14
Copper (Cu)	mg/kg	7.3	9.8	7.4
Nickel (Ni)	mg/kg	2.5	4.4	3.7
Lead (Pb)	mg/kg	57	140	73
Zinc (Zn)	mg/kg	35	230	200
Mercury (Hg)	mg/kg	0.09	0.148	0.066
Arsenic (As)	mg/kg	7.2	2.2	3.9
Silver (Ag)	mg/kg	0.3	<0.1	0.2

Contaminants	Unit	KT15A	KT15B	KT15C
LMW PAHs	µg/kg	<55	<55	<55
HMW PAHs	µg/kg	<170	<170	240
PCBs	µg/kg	<2	<2	<2
TBT	µg TBT/L	<0.015	<0.015	<0.015

Notes:

1. The **bold** figure is the contaminant level exceeding the Lower Chemical Exceedance Level (LCEL).
2. The **bold and underlined** figure is the contaminant level exceeding the Upper Chemical Exceedance Level (UCEL).

Attachment 3

Ecological Assessment

ATTACHMENT 3

Summary of the Ecological Assessments for KT14 and KT15

Introduction

1. The summary of the ecological assessment conducted for secondary drainage channels KT 14 and KT15 are presented below. Details are presented in the attachment.

Baseline Ecological Conditions

KT14

2. There is no natural stream at KT14.
3. Habitats within the 300m-radius from the proposed alignments for KT14 are dominated by urban/industrial area and low lying grassland / fallow land. There are also significant areas of construction sites / bare ground and agricultural land. Of these habitats, that of most ecological interest is the low lying grassland and fallow land, much of which is seasonally wet. However, it is highly fragmented by urban areas. Agricultural areas, many of which are given over to the cultivation of the wetland crop *Ipomoea aquatica*, are also of ecological interest. Other habitats of potential ecological importance are areas of marsh, fishpond and woodland. However, the areas of all of these habitats are very small.

KT15

4. KT15 is a highly disturbed site and is generally heavily to grossly polluted with organic waste discharges from farm livestock in the upper portion of the stream.
5. The main habitats within a 300-m radius of KT15 are urban/industrial areas, low-lying grassland and fallow land and agricultural land. There are also significant areas occupied by construction sites / bare ground. Most ecological interest lies in the low lying grassland and fallow land, much of which is seasonally wet. This grassland is moderate in size and is adjacent to two areas of active agricultural land with which it has some linkages, especially in respect of use by wetland-dependent birds such as Chinese Pond Heron *Ardeola bacchus* and Cattle Egret *Bubulcus ibis*. Wetland floral species found in the grasslands within the Project Area include *Solanum nigrum*, *Ricinus communis*, *Polygonum perfoliatum*, *Panicum paludosum*, *Amaranthus viridis*, *Polygonum hydropiper*, *Cyperus kyllingia*, *Commelina nudiflora*, *Eclipta prostrata*, *Eleusine indica*, *Soliva anthemifolia*, *Colocasia esculenta*, *Microstegium ciliatum*, *Alocasia macrorrhiza*, and *Pennisetum*

purpureum. Other habitats of potential ecological interest include a small area of marsh, an abandoned fishpond and the existing streamcourse itself.

6. Three species protected under *Forestry Regulation* were found within the Study Area of KT15: *Michelia alba* and *Michelia figo* inside an orchard west of West Rail, a *Camellia japonica* at a pond bund north of Shek Wu Tong. Because of their remote location from the works area (over 100 m from the proposed alignment of isolated by some urban environment), no adverse impact to these species was expected.

Key Findings of Ecological Surveys

7. No species of conservation concern were recorded at KT14 and KT15. The key findings of the ecological surveys are tabulated below.

	Key Findings of Ecological Surveys
Birds	Only a few, common and widespread wetland dependent bird species (Chinese Pond Heron, Little Egret, Cattle Egret, White-breasted Waterhen, White-throated Kingfisher) were recorded during the surveys.
Amphibians and Reptiles	There is no natural stream at KT14. Significantly, no obligate stream species (amphibian or reptile) were recorded during surveys of KT15, undoubtedly as a consequence of severe pollution and other anthropogenic disturbance at most sites. Sightings of herpetofauna within the channels themselves were rare and involved only one frog species (Asiatic Painted Frog in drainage channel at KT14). With the exception of Checkered Keelback (two individuals of which were seen at KT14) none of the reptile species encountered is particularly associated with wetland habitats.
Dragonflies	Dragonfly records were generally of little consequence, being primarily comprised of extremely tolerant and widespread lowland lentic species. The absence of several typical lowland stream species (such as <i>Rhinocypha perforata</i> and several species of Gomphidae) at KT15 is undoubtedly a consequence of pollution and other anthropogenic impacts.
Butterflies	Butterflies were more diverse at KT14 (which is a larger Study Area with a greater area of vegetated land) than at KT15. However, all species recorded are common or very common in Hong Kong, with the exception of the uncommon Three-spot Grass Yellow and Banana Skipper. One individual of the Three-Spot Grass Yellow and three Banana Skippers were observed. Neither of these species was considered to be a species of conservation concern.
Mammals	No species of mammals were noted in the survey.
Aquatic Invertebrates	There is no natural stream at KT14. Not sampled as KT15 is grossly polluted. It is highly likely that a reduction in the pollution load in the channel at KT15 would lead to eventual re-colonisation by pollution-sensitive species.

	Key Findings of Ecological Surveys
Fish	There is no natural stream at KT14. KT15 had 6 fish species richness. It is grossly polluted, receiving livestock waste and domestic discharge in the upper portion of the stream. However, large fish including Snakehead, Tilapia and Catfish (<i>Clarias gariepinus</i>) were found in the middle section of the stream. The common Mosquito Fish and Chinese Barb were also found during the survey.

Evaluation of Potential Ecological Impacts

8. For KT14, the potential loss of 1.34 ha of agricultural lands/fallow fields/low-lying grassland is considered, in itself, to comprise a small adverse impact of low significance. However, the proposed works will increase the fragmentation of the habitats, and thus the overall impact level is of low to moderate significance. The impact of draining the wet cultivated lands/fallow fields/low-lying grasslands from the channelization works is of moderate significance, since the quality of the wetland habitat will be degraded.
9. For KT15, potential impacts include disturbance, destruction and loss of a natural stream section, several patches of grasslands, part of an orchard, and a small abandoned fishpond (<0.1 ha). There will be an increase in the fragmentation of seasonally wet grasslands east of Kam Sheung Road. The Study Area in KT15 is subject to a high level of disturbance from the surrounding urban environment, which includes the West Rail works, the Kam Sheung Road, and the residential areas, etc. The ecological significance of the Study Area is relatively low. Thus any additional impact is unlikely to be unacceptable. A higher level impact is the draining of the wet fallow fields/low-lying grasslands upstream.
10. The significance of the ecological impact of KT14 and KT15 are tabulated below.

Criteria	KT14	KT15
Impact on habitat quality	Loss of some cultivated lands and grasslands Low-moderate impact	Loss of a stream section, parts of an orchard and grasslands, and a small fishpond Low impact
Impact on species	Loss of some common species found in abandoned paddy fields Low impact	Loss of the riparian vegetation and large fish species along the stream. Loss of utility value of habitat for aquatic fauna and wetland-dependent birds. Low impact

Criteria	KT14	KT15
Duration of impact	Permanent but low impact (as area of direct impact is small and no permanent impact on populations of species of conservation concern)	Permanent but low impact (as area of direct impact is small and no permanent impact on populations of species of conservation concern)
Magnitude of impact	Low impact	Low impact
Reversibility of impact	Low impact	Low impact
Cumulative impacts	Small additional loss of low-lying grassland Small additional cumulative impact	Small additional loss of low-lying grassland Small additional cumulative impact
Overall impact evaluation	Low	Low

Mitigation Measures

11. Mitigation considerations and measures for KT14 and KT15 are the following:
 - (a) Channels comprising a small drainage conduit for flood flows only, should be used for where the channel passes through areas of urban habitat. Where the channel passes through agricultural or seasonal marsh areas, the channels should have no side weep holes and a wide base slab to counter uplift. This will prevent lowering of the groundwater table, ensuring that the wetland character of these areas is retained.
 - (b) Gabion lining channels are proposed for KT14 and KT15. The channel bed should be provided with rocky bottom (gabion mattress) to help sustain aquatic life.
 - (c) During the construction phase, the discharge of site effluent to nearby wetland, the stockpiling or disposal of materials, and any dredging or construction activities at this area are to be prohibited.

Conclusion

12. With the implementation of the recommended mitigation measures, the residual ecological impacts regarding the Designated Projects of KT14 and KT15 are expected to be minor and acceptable.

ATTACHMENT 3

Ecological Assessments for KT14 and KT15

1. INTRODUCTION

1.1 Attachment 3 provides an ecological assessment of the proposed drainage improvement works at drainage channels KT14 and KT15. The objectives of the ecological study are as follows:

- to establish an ecological baseline for each of the study areas, focusing on identifying key areas and key species present;
- to assess the ecological impacts of the proposed drainage improvement;
- to propose feasible and effective mitigation measures for significant impacts;
- to determine whether residual, post mitigation impacts are acceptable; and
- to assess the post mitigation acceptability of the drainage improvement.

1.2 The study area comprises two sites, KT14 and KT15, located in the Kam Tin valley. Surveys were conducted at these two sites. KT14 contains three proposed channels and drains to be constructed through village/agricultural habitat, while KT15 is aligned along the existing river channel which is generally heavily to grossly polluted with organic waste discharges from farm livestock in the upper portion of the stream. Faunal surveys were focused on species occurring along the proposed alignments or utilizing the watercourse, but also included observations to a distance of 50 m from the stream channel and the proposed drainage channels.

1.3 General wildlife surveys of both sites were conducted in the wet season (April-July 2000). This period coincides with peak annual activity amongst herpetofauna, dragonflies and butterflies. Following the revision of proposed channel alignments for KT14, which involved addition of a new alignment as well as restructuring of previously proposed alignments, further wet season surveys were conducted in July and August 2002 to cover areas of the revised site not previously surveyed. Preliminary surveys of avifauna and herpetofauna were conducted in KT15 and the original KT14 in March 2000. These data are also presented below.

1.4 The baseline ecological conditions of the study areas are presented in different sections according to their geographic locations:

- KT14
- KT15

2. BASELINE ECOLOGICAL CONDITIONS

2.1 KT14

Habitat surveys

2.1.1 The proposed alignment of KT14 will be constructed through agricultural lands low-lying grasslands/fallow fields, developed areas and a small area of fishpond.

2.1.2 Habitat surveys were conducted to:

- identify the types of habitat present within the Study Area;
- provide an overview of the habitats identified;
- describe ecological characteristics of each habitat.

2.1.3 The habitats present within 300 m radius of the KT14 alignment are shown in Figure 4.4 and detailed in Table ATT3-1.

Table ATT3-1 Habitat types within 300 m radius of the KT14 channels alignment

Habitat Type	Area (ha)
Bare ground / works in progress	17.65
Agricultural land	11.98
Drainage channel	1.30
Fishpond	0.01
Low lying grassland / fallow land	30.11
Marsh	0.20
Orchard / garden	0.96
Open storage	1.16
Urban / industrial area	47.74
Woodland	0.34
Total	113.01

Note: some areas lie within 300 m of both KT14 and KT15 and are, therefore, included in both habitat tables.

- 2.1.4 Habitats within the 300m-radius from the proposed alignments for KT14 are dominated by urban/industrial area and low lying grassland / fallow land. There are also significant areas of construction sites / bare ground and agricultural land. Of these habitats, that of most ecological interest is the low lying grassland and fallow land, much of which is seasonally wet. However, it is highly fragmented by urban areas. Agricultural areas, many of which are given over to the cultivation of the wetland crop *Ipomoea aquatica*, are also of ecological interest. Other habitats of potential ecological importance are areas of marsh, fishpond and woodland. However, the areas of all of these habitats is very small.

Project Area

- 2.1.5 Within the project area boundary, the important habitats include wet agricultural land dominated by *Ipomoea aquatica* and low-lying grasslands/fallow fields. Some areas of fallow fields which have the potential to form freshwater marsh and are dominated by wetland floral species including *Colocasia esculenta*, and *Hedychium coronarium*.

Flora Surveys, KT14

- 2.1.6 A list of the floral species identified within the works area of KT 14 is given in Appendix 2 of this Attachment.

Fauna Surveys, KT14

- 2.1.7 Site visits were on 3rd and 9 March and 13th, 15th and 21 July 2000, and, for the revised alignment, on 29th and 31 July and 10th, 15th, 17th, 21st and 22 August 2002. The Study Area consists of village-type habitats interspersed with agricultural land and low-lying grassland/fallow field fragmented by village and industrial areas as well as construction sites and bare ground. There are no natural streams present.

(i) ***Birds***

Five wetland dependent bird species were observed, all in small numbers. White-throated Kingfisher is considered to be a species of conservation concern in Hong Kong by Fellowes *et al.* (2002) as a consequence of the decline of its breeding population. Observations were made on 3 March 2000 and 29 July 2002, suggesting that the species breeds locally (most wintering birds occur on the coast). This species often nests some way from watercourses and has a largely non-piscivorous diet during the breeding season (Carey *et al.* 2001). Only two species of wetland dependent bird (White-throated Kingfisher

Halcyon Smyrnensis and White-breasted Waterhen *Amaurornis Phoenicurus*) were observed in the 2002 surveys, so these data are combined with the 2000 survey data in Table ATT3-2.

All other species recorded are listed in Appendix 1 at the end of this Attachment 3. These include Barn Swallow *Hirundo rustica*, Grey Wagtail *Motacilla alba*, Yellow-bellied Prinia *Prinia flaviventris* and Plain Prinia *Prinia inornata* which, whilst not wetland - dependant are frequently associated with wetland habitats in Hong Kong (Carey et al. 2001). These and all the other species noted in Appendix 1 are common and widespread species of open habitats in Hong Kong.

Table ATT3-2
Bird species of conservation importance and wetland-dependant bird species recorded at KT14 during survey visits in March and July 2000, and July and August 2002

Species	Mean no./ visit	Range	Reason for listing
Little Egret <i>Egretta garzetta</i>	0.1	0 - 1	Wetland dependant
Cattle Egret <i>Bubulcus ibis</i>	0.1	0 - 1	Wetland dependant
Chinese Pond Heron <i>Ardeola bacchus</i>	0.3	0 - 3	Wetland dependant
White-breasted Waterhen <i>Amaurornis phoenicurus</i>	0.4	0 - 1	Wetland dependant
White-throated Kingfisher <i>Halcyon smyrnensis</i>	0.2	0 - 1	Declining in HK Wetland dependant

(ii) *Amphibians and Reptiles*

Six amphibians, three lizards and one snake were recorded at the site (see Tables ATT3-3a and b). The most frequently recorded species were Asian Common Toad *Bufo melanostictus*, Ornate Pygmy Frog *Microhyla ornata* and Bowring's Gecko *Hemidactylus bowringii*. The marshy area east of Yuen Kong and south of Kam Sheung Road supported populations of several common and widespread amphibians - Asian Common Toad was particularly abundant (>100 individuals estimated) on 21 July 2000, several Asiatic Painted Frogs were observed, and Paddy Frog, Günther's Frog and Brown Tree Frog were also present. Ornate Pygmy Frogs were abundant at a location off the south side of Kam Sheung Road, to the west of Yuen Kong, in a shallowly flooded patch of wasteland, on 31 July and 10th, 15th and 21 August 2002. A mature male Changeable Lizard in breeding condition was recorded at the marsh site on 13 July 2000. A Chinese Skink was spotted beside the channel at the southern alignment on 13 July 2000. Bowring's Gecko was present on numerous buildings across the site on

21 July 2000, and 31 July and 10th, 15th and 21 August 2002. Single specimens of Checkered Keelback *Xenochrophis piscator* were encountered on the access road to Yuen Kong San Tsuen and at the Ornate Pygmy Frog location on 31 July and 21 August 2002 respectively. All of the species encountered are common and widespread in Hong Kong (Karsen *et al.*, 1998).

Table ATT3-3a
Herpetofauna species recorded at KT14, March and July 2000

Species	Average abundance
Asian Common Toad <i>Bufo melanostictus</i>	30-40
Günther's Frog <i>Rana guentheri</i>	1.66
Paddy Frog <i>Rana limnocharis</i>	2.66
Brown Tree Frog <i>Polypedates megacephalus</i>	1.33
Asiatic Painted Frog <i>Kaloula pulchra</i>	2
Bowring's Gecko <i>Hemidactylus bowringii</i>	2.66
Chinese Skink <i>Eumeces chinensis</i>	0.33

Table ATT3-3b
Herpetofauna species recorded at revised KT14, July and August 2002

Species	Average abundance
Asian Common Toad <i>Bufo melanostictus</i>	2
Paddy Frog <i>Rana limnocharis</i>	2.75
Brown Tree Frog <i>Polypedates megacephalus</i>	3.75
Asiatic Painted Frog <i>Kaloula pulchra</i>	1.5
Ornate Pygmy Frog <i>Microhyla ornata</i>	>20
Bowring's Gecko <i>Hemidactylus bowringii</i>	17
Chinese Skink <i>Eumeces chinensis</i>	1.5
Checkered Keelback <i>Xenochrophis piscator</i>	1

(iii) *Mammals*

No species of mammal were noted during the 2000 surveys. Foraging insectivorous bats were, however, counted but not identified during the 2002 surveys. These counts are summarized below:

31st July 2002 : none
10th August 2002 : >30
15th August 2002 : 12
21st August 2002 : >20

The majority of bats were seen south of Kam Sheung Road in the east of the Study Area.

A fan palm clump (*Livistona chinensis*) is located at Yuen Kong. This clump was examined during daytime surveys in July and August 2002 for evidence of Short-nosed Fruit Bats *Cynopterus sphinx*, since these bats are known to roost in trees of this species. However, no bats were observed.

(iv) *Odonates*

Only nine species were encountered (see Tables ATT3-4a and b). No notable records were made during the survey. All species recorded are common and widespread in Hong Kong (Wilson, 1997).

Table ATT3-4a
Odonate species recorded at KT14, May to July 2000

Species	Average abundance
<i>Ischnura senegalensis</i>	6.5
<i>Ceriagrion auranticum</i>	5.5
<i>Orthetrum pruinosum</i>	3
<i>Orthetrum sabina</i>	7.5
<i>Brachythemis contaminata</i>	4
<i>Crocothemis servilia</i>	2.5
<i>Pantala flavescens</i>	18

Table ATT3-4b
Odonate species recorded at revised KT14, July to August 2002

Species	Average abundance
<i>Ischnura senegalensis</i>	4.5
<i>Ceriagrion auranticum</i>	0.75
<i>Orthetrum glaucum</i>	0.25
<i>Orthetrum prunosum</i>	1.25
<i>Orthetrum sabina</i>	3.75
<i>Brachythemis contaminata</i>	2.5
<i>Crocothemis servilia</i>	1
<i>Pantala flavescens</i>	13.25
<i>Tramea virginia</i>	1

(v) *Butterflies*

Twenty-three species were recorded: 11 in 2000 and a further 12 in 2002 (see Tables ATT3-5a and b). There were no notable records. All species are common and widespread in Hong Kong, with the exception of Three-spot Grass Yellow *Eurema blanda* which is uncommon (Young & Yiu, 2002). No species of conservation importance was recorded.

Table ATT3-5a
Butterflies recorded at KT14, May to July 2000

Species	Average abundance
Common Bluebottle <i>Graphium sarpedon</i>	1.5
Common Mime <i>Papilio clytia</i>	1
Angled Castor <i>Ariadne ariadne</i>	1.5
Blue-spotted Crow <i>Euploea midamus</i>	1.5
Common Palmfly <i>Elymnias hypermnestra</i>	0.5
Peacock Pansy <i>Junonia almana</i>	1
Dark Brand Bush Brown <i>Mycalesis mineus</i>	3
Common Sailer <i>Neptis hylas</i>	1
Common Five-ring <i>Ypthima baldus</i>	2.5

Species	Average abundance
Indian Cabbage White <i>Pieris canidia</i>	4.5
Pale Grass Blue <i>Zizeeria maha</i>	3.5

Table ATT3-5b
Butterflies recorded at revised KT14, July to August 2002

Species	Average abundance
Lime Butterfly <i>Papilio demoleus</i>	0.25
Common Mormon <i>Papilio polytes</i>	0.25
Great Eggfly <i>Hypolimnna bolina</i>	0.25
Grey Pansy <i>Junonia atlites</i>	0.5
Indian Cabbage White <i>Pieris canidia</i>	0.75
Lemon Emigrant <i>Catopsilia pomona</i>	1
Mottled Emigrant <i>Catopsilia pyranthe</i>	0.25
Three-spot Grass Yellow <i>Eurema blanda</i>	0.25
Common Grass Yellow <i>Eurema hecabe</i>	3
Great Orangetip <i>Hebomoia glaucippe</i>	0.25
Pea Blue <i>Lampides boeticus</i>	0.5
Lesser Grass Blue <i>Zizina otis</i>	0.25
Common Straight Swift <i>Parnara guttata</i>	0.25

(vi) *Aquatic Invertebrates*

Not sampled due to absence of stream channel.

(vii) *Fish*

Not sampled due to absence of stream channel.

2.2 **KT15**

Habitat surveys

2.2.1 The proposed alignment of KT15 will be constructed through low-lying grasslands/fallow fields, developed areas and small areas of fishpond, orchard/garden and plantation. Unlike KT14, the proposed channel alignment follows an existing streamcourse.

2.2.2 Habitat surveys were conducted to:

- identify the types of habitat present within the Study Area;
- provide an overview of the habitats identified; and
- describe ecological characteristics of each habitat.

2.2.3 The habitats present within 300 m radius of the KT15 alignment are shown in Figure 4.4 and detailed in Table ATT3-6.

Table ATT3-6 Habitat types within 300 m radius of the KT15 channels alignment

Habitat type	Area (ha)
Bare ground / works in progress	6.21
Agricultural land	11.03
Drainage channel	2.20
Fishpond	0.57
Low lying grassland / fallow land	14.32
Marsh	0.22
Orchard / garden	2.24
Plantation	2.59
River / stream	0.89
Urban / industrial area	40.32
Woodland	0.60
Total	78.86

Note: some areas lie within 300 m of both KT14 and KT15 and are, therefore, included in both habitat tables.

2.2.4 The main habitats within a 300-m radius of KT15 are urban/industrial areas, low-lying grassland and fallow land and agricultural land. There are also significant areas occupied by construction sites / bare ground. Most ecological interest lies in the low lying grassland and fallow land, much of which is seasonally wet. This grassland is moderate in size and is adjacent to two areas of active agricultural land with which it has some linkages, especially in respect of use by wetland-dependent birds such as Chinese Pond Heron *Ardeola bacchus* and Cattle Egret *Bubulcus ibis*. Wetland floral species found in the grasslands within the Project Area include *Solanum nigrum*, *Ricinus communis*, *Polygonum perfoliatum*, *Panicum paludosum*, *Amaranthus viridis*, *Polygonum hydropiper*, *Cyperus kyllingia*, *Commelina nudiflora*, *Eclipta prostrata*, *Eleusine indica*, *Soliva anthemifolia*, *Colocasia esculenta*, *Microstegium ciliatum*, *Alocasia macrorrhiza*, and *Pennisetum purpureum*. Other habitats of potential ecological interest include a small area of marsh, an abandoned fishpond and the existing streamcourse itself. Though this streamcourse is flushed with domestic sewage and industrial discharge, which cause moderate pollution of the stream, large fishes such as Tilapia *Oreochromis niloticus*, Snakehead *Ophiocephalus maculatus*, and Common Carp *Cyprinus carpio* are present in the middle course of the stream.

2.2.5 Three species protected under *Forestry Regulation* were found within the Study Area of KT15: *Michelia alba* and *Michelia figo* inside an orchard west of the West Rail, a *Camellia japonica* at a pond bund north of Shek Wu Tong. Because of their remote location from the works area (over 100 m from the proposed alignment of isolated by some urban environment), no adverse impact to these species was expected.

Flora Surveys, KT15

2.2.6 A list of the floral species identified within the works area of KT15 is given in Appendix 2 of this Attachment.

Fauna Surveys, KT15

2.2.7 Field surveys were conducted on 6 March, 15th and 30 May, 12th, 15 and 21 July 2000. The study area is a grossly polluted narrow channel with sluggish current, winding through cleared land and village type habitats. Much disturbance was caused by earth-moving works at the western end. The channel is bisected by a busy road.

(i) *Birds*

Single individuals of only two wetland dependant bird species were observed (Table ATT3-7).

All other species recorded are listed in Appendix 1 at the end of this Attachment 3. These included Barn Swallow *Hirundo rustica* and White Wagtail *Motacilla alba*, which, whilst not wetland-dependant are frequently associated with wetland habitats in Hong Kong (Carey *et al.* 2001). These and all the other species noted in Appendix 1 are common and widespread species of open habitats in Hong Kong.

Table ATT3-7
Bird species of conservation importance and wetland-dependant bird species recorded at KT15 during survey visits in March, May and July 2000

Species	Mean no./ visit	Range	Reason for listing
Cattle Egret <i>Bubulcus ibis</i>	0.4	0 – 1	Wetland dependant
Chinese Pond Heron <i>Ardeola bacchus</i>	0.8	0 – 1	Wetland dependant

(ii) *Amphibians and Reptiles*

Three common amphibians were present in the Study Area (see Table ATT3-8). A Changeable Lizard was seen in village habitat to the south of the western part of the alignment on 15 July 2000.

Table ATT3-8
Herpetofauna species recorded at KT15, May to July 2000

Species	Average abundance
Asian Common Toad <i>Bufo melanostictus</i>	2
Günther's Frog <i>Rana guentheri</i>	2.33
Brown Tree Frog <i>Polypedates megacephalus</i>	1.33
Changeable Lizard* <i>Calotes versicolor</i>	0.33

*Also recorded during ad hoc survey on 15 May 2000

(iii) *Mammals*

No species of mammal were observed during the surveys.

(iv) *Odonates*

Only six species were observed (see Table ATT3-9). No notable species were recorded. All species are common and widespread in Hong Kong (Wilson, 1997).

Table ATT3-9
Odonate species recorded at KT15, May to July 2000

Species	Average abundance
<i>Ischnura senegalensis</i>	4.5
<i>Ceriagrion auranticum</i>	6
<i>Orthetrum pruinosum</i>	1.5
<i>Trithemis aurora</i>	0.5
<i>Tramea virginia</i>	1
<i>Pantala flavescens</i>	8.5

(v) *Butterflies*

Only eleven species were observed (see Table ATT3-10). No notable species were recorded.

Table ATT3-10
Butterflies recorded at KT15, May to July 2000

Species	Average abundance
Common Bluebottle <i>Graphium sarpedon</i>	0.5
Common Mormon <i>Papilio polytes</i>	1.5
Angled Castor <i>Ariadne ariadne</i>	2
Blue-spotted Crow <i>Euploea midamus</i>	2.5
Ceylon Blue Glassy Tiger <i>Ideopsis similis</i>	1.5
Dark Brand Bush Brown <i>Mycalesis mineus</i>	1.5

Species	Average abundance
Lemon Emigrant <i>Catopsilia pomona</i>	0.5
Common Grass Yellow <i>Eurema hecabe</i>	1
Pale Grass Blue <i>Zizeeria maha</i>	2.5
Forest Hopper <i>Astictopterus jama</i>	0.5
Banana Skipper <i>Erionota torus</i>	3

(vi) *Aquatic Invertebrates*

Not sampled due to grossly polluted state of the water.

(vii) *Fish*

Tilapia, Common Carp and Snakehead, all of which are tolerant of polluted conditions, were observed in a slow flowing shady reach of the stream. Several catfish *Clarias gariepinuss* were also observed at this reach on 12 July 2000. Many Chinese Barbs *Puntius semifasciolatus* were observed at the lower portion of the stream. None of these species is of conservation interest (e.g. Fellowes *et al.*, 2002).

3. ECOLOGICAL EVALUATION OF STUDY SITES

3.1 KT14

- 3.1.1 Most of the site is of limited ecological importance, however a marshy area at the east of the Study Area is of moderate ecological value. The moderate ecological value of this area is reflected in the overall evaluation for KT14 presented in Table ATT3-11 below.

Table ATT3-11
Evaluation of the Yuen Kong San Tsuen Habitat, KT14

Criteria	Remarks
Naturalness	A semi-natural seasonally-wet grassland with wetland vegetation, derived from an abandoned agricultural land.
Size	Small (0.57ha for agricultural lands and 0.77 for fallow fields)
Diversity	Wetland/riparian species including grasses, reeds, herbs and a relatively diverse assemblage of butterflies and dragonflies, reptiles and birds were recorded.
Rarity	Habitats and species commonly found in lowland and rural areas, but becoming increasingly rare due to urbanisation and stream channelization.
Re-creatability	Readily re-creatable so long as a suitable water source is available
Fragmentation	A large area of low-lying grassland fragmented by urban and industrial area and small footpaths.
Ecological linkage	The grassland and agricultural land are isolated by urbanized environments.
Potential value	Moderate potential for remaining seasonally wet grassland.
Nursery/breeding ground	Invertebrates (including dragonflies and damselflies), amphibians.
Age	Semi-natural habitats formed relatively recently
Abundance/Richness of wildlife	Low abundance
Overall ecological value	Moderate

3.2 **KT15**

- 3.2.1 This is a highly disturbed site, but large fish with high pollution tolerance are present in the stream.

Table ATT3-12
Evaluation of the Shek Wu Tong/Tin Sam San Tsuen Habitat, KT15

Criteria	Remarks
Naturalness	The low-lying seasonally-wet grassland has been modified. The stream is moderately polluted by domestic and industrial discharge, and has been modified with concrete banks for a short portion.
Size	1.03ha of low-lying grasslands and 0.11ha of a small pond. Existing stream measures 970m in length.
Diversity	Riparian species including grasses, reeds, herbs and an assemblage of lizards, butterflies, and dragonflies as well as common fish species and non-urban birds were recorded.
Rarity	Habitats and species commonly found in lowland, rural areas, stream and ditches.
Re-creatability	Re-creatable
Fragmentation	Footpaths, local roads, villages and other urban environment fragment the low-lying grassland.
Ecological linkage	The upper course of the stream is linked to agricultural areas. The downstream portion is isolated by urbanized environments.
Potential value	Habitat value would improve if pollution of the stream was reduced
Nursery/breeding ground	N/A
Age	A modified habitat of limited age
Abundance/ Richness of wildlife	Rich in Six-banded Barb
Overall ecological value	Low to moderate

4. KEY ECOLOGICAL FINDINGS

4.1 Introduction

- 4.1.1 With reference to the survey work reported above, the following conclusions can be drawn based on the observed habitat quality and the species diversity which was observed.

4.2 Birds

- 4.2.1 Only a few, common and widespread wetland dependent bird species (Chinese Pond Heron, Little Egret, Cattle Egret, White-breasted Waterhen, White-throated Kingfisher) were recorded during the surveys. White-throated Kingfisher is, however, regarded as a species of conservation concern by Fellowes *et al.* (2002). Insensitive river channelization at KT15, involving the removal of perches such as overhanging vegetation and replacement with a concrete envelope, would reduce the utility of the channels for herons and kingfishers. Removal of low riparian vegetation would greatly reduce the utility of the channels for 'skulking' birds such as White-breasted Waterhens.

4.3 Amphibians and Reptiles

- 4.3.1 There is no natural stream at KT14. Significantly, no obligate stream species (amphibian or reptile) were recorded during surveys of KT15, undoubtedly as a consequence of severe pollution and other anthropogenic disturbance at most sites. Seasonal marshes are present at KT14. These should be protected during channelisation works at this site.
- 4.3.2 Sightings of herpetofauna within the channels themselves were rare and involved only one frog species (Asiatic Painted Frog in drainage channel at KT14). Channelization would remove refugia and therefore make the channels even less attractive for breeding amphibians.
- 4.3.3 With the exception of Checkered Keelback (two individuals of which were seen at KT14) none of the reptile species encountered is particularly associated with wetland habitats.
- 4.3.4 Table ATT3-13 summarizes the amphibian and reptile species observed during field visits.

Table ATT3-13
Amphibian and Reptile Species Observed during Field Visits

Site ▶	HK Status*	KT14	KT15
Species ▼			
Asian Common Toad <i>Bufo melanostictus</i>	Common	✓	✓
Günther's Frog <i>Rana guentheri</i>	Common	✓	✓
Paddy Frog <i>Rana limnocharis</i>	Common	✓	
Brown Tree Frog <i>Polypedates megacephalus</i>	Common	✓	✓
Asiatic Painted Frog <i>Kaloula pulchra</i>	Common	✓	
Ornate Pygmy Frog <i>Microhyla ornata</i>	Abundant	✓	
Bowring's Gecko <i>Hemidactylus bowringii</i>	Very common	✓	
Changeable Lizard <i>Calotes versicolor</i>	Common	✓	✓
Chinese Skink <i>Eumeces chinensis</i>	Common	✓	
Checkered Keelback <i>Xenochrophis piscator</i>	Common	✓	
No. of species recorded		10	4

*After Karsen et al, 1998

4.3.5 Dragonfly records were generally of little consequence, being primarily comprised of extremely tolerant and widespread lowland lentic species. The absence of several typical lowland stream species (such as *Rhinocypha perforata* and several species of Gomphidae) at KT15 is undoubtedly a consequence of pollution and other anthropogenic impacts.

4.3.6 Although some lowland dragonflies (e.g. *Pantala flavescens*, *Brachythemis contaminata*, *Orthetrum sabina*) can breed successfully in almost any body of water, many species require a specific substrate such as submerged vegetation, woody or weedy margins, or coarse gravel as oviposition site, and/or larval

habitat, and partially submerged objects such as boulders or emergent vegetation as larval emergence sites (see e.g. Corbet, 1999). Insensitive channelization which resulted in removal of such substrates would therefore also remove many breeding odonates, including the seemingly ubiquitous *Ischnura senegalensis*, as well as more sensitive species.

4.3.7 Table ATT3-14 summarizes the odonate species observed during field visits.

Table ATT3-14
Odonate Species Observed during Field Visits

Site ▶	HK Status*	KT14	KT15
Species ▼			
<i>Ischnura senegalensis</i>	Abundant	✓	✓
<i>Ceriagrion auranticum</i>	Common	✓	✓
<i>Orthetrum glaucum</i>	Abundant	✓	
<i>Orthetrum pruinosum</i>	Abundant	✓	✓
<i>Orthetrum sabina</i>	Abundant	✓	
<i>Brachythemis contaminata</i>	Abundant	✓	
<i>Crocothemis servilia</i>	Common	✓	
<i>Trithemis aurora</i>	Abundant		✓
<i>Tamea virginia</i>	Common	✓	✓
<i>Pantala flavescens</i>	Abundant	✓	✓
No. of species recorded		9	6

*After Wilson, 1997

4.4 Butterflies

4.4.1 Butterflies are not especially associated with wetland habitats. However they tend to be numerous and species-rich where floral diversity is high, and where woodland edge is a common element of the landscape.

4.4.2 Table ATT3-15 summarizes the butterfly species observed during field visits.

Table ATT3-15
Butterfly Species Observed during Field Visits

Site ▶	HK Status*	KT14	KT15
Species ▼			
Common Bluebottle	Very common	✓	✓
Common Mime	Common	✓	
Lime Butterfly	Common	✓	
Common Mormon	Very common	✓	✓
Angled Castor	Common	✓	✓
Common Palmfly	Common	✓	
Blue-spotted Crow	Very common	✓	✓
Great Eggfly	Very common	✓	
Ceylon Blue Glassy Tiger	Very common		✓
Peacock Pansy	Common	✓	
Grey Pansy	Common	✓	
Dark Brand Bush Brown	Very common	✓	✓
Common Sailer	Very common	✓	
Common Five-ring	Common	✓	
Lemon Emigrant	Common	✓	✓
Mottled Emigrant	Common	✓	
Three-spot Grass Yellow	Uncommon	✓	
Common Grass Yellow	Very common	✓	✓
Great Orangetip	Common	✓	
Indian Cabbage White	Very common	✓	
Pea Blue	Common	✓	
Pale Grass Blue	Common	✓	✓
Lesser Grass Blue	Common	✓	
Forest Hopper	Common		✓
Banana Skipper	Uncommon		✓
Common Straight Swift	Common	✓	
No. of species recorded		23	11

*After Young & Yiu, 2002

4.4.3 Butterflies were more diverse at KT14 (which is a larger Study Area with a greater area of vegetated land) than at KT15. However, all species recorded are common or very common in Hong Kong, with the exception of the uncommon Three-spot Grass Yellow and Banana Skipper (Young & Yiu, 2002). One individual of the Three-Spot Grass Yellow and three Banana Skippers were observed. Neither of these species was considered to be a species of conservation concern by Fellowes *et al.* (2002).

4.5 Aquatic invertebrates

4.5.1 There is no natural stream at KT14. It is highly likely that a reduction in the pollution load in the channel at KT15 would lead to eventual re-colonisation by pollution-sensitive species. River channelization, on the other hand, would inevitably lead to a loss of appropriate microhabitats (e.g. coarse gravel, boulders, trailing vegetation, and submerged woody material) for many invertebrate species, and a consequent decline in species diversity. Any deposits on the channel bottoms would be dominated by fine sediments and organic particles, which can clog the gills and feeding apparatus of some animals, as well as restricting water movement within the substrate, thereby reducing oxygen levels (Dudgeon & Corlett, 1994). Removal of overhead shading vegetation would result in elevated water temperatures which would also impact on heat-intolerant fauna.

4.6 Fish

4.6.1 Fishes were observed in KT15 channel during the surveys: (see Table ATT3-16).

Table ATT3-16
Fish Species Recorded within the Study Area

Species	Common Name	Hong Kong Status*	Study Area
Family Channidae <i>Channa maculata</i>	Snakehead	Uncommon; introduced	KT 15
Family Cichlidae <i>Oreochromis niloticus</i>	Tilapia	Common	KT 15
Family Clariidae <i>Clarias gariepinus</i> <i>Cyprinus carpio</i>	Catfish Common Carp	Common Common	KT 15 KT 15
Family Cyprinidae <i>Puntius semifasciolatus</i>	Chinese Barb	Common	KT 15
Family Poeciliidae <i>Gambusia affinis</i>	Mosquito fish	Common	KT 15

* Status follows *Checklist of Hong Kong Fauna* 1998 by Kadoorie Farm & Botanic Garden.

4.6.2 KT15 had 6 fish species richness. It is grossly polluted, receiving livestock waste and domestic discharge in the upper portion of the stream. However, large fish including Snakehead, Tilapia and Catfish (*Clarias gariepinuss*) were found in the middle section of the stream. The common Mosquito Fish and Chinese Barb were also found during the survey.

4.7 **Conclusions**

4.7.1 No species of conservation concern were recorded at either Study Site, with the exception of White-throated Kingfisher at KT14. There is no natural watercourse at KT14. River channelization at KT15 should employ a wildlife-friendly design which retains a semblance of the natural channel. Otherwise, the existing aquatic faunal diversity will inevitably be severely impacted.

4.7.2 New drainage installations should avoid draining the seasonal marshes near KT14. The marsh provides breeding habitat for several common and widespread amphibian species and should be maintained and safeguarded. Seasonal marshes also help to ameliorate the effects of flooding by acting as slow-release 'sponges' during periods of high rainfall.

5. **POTENTIAL ECOLOGICAL IMPACTS**

5.1 **Identification of Ecological Impacts**

5.1.1 This section identifies all potential impacts caused by the unmitigated channelization works within the Study Areas of KT14 and KT15 during the construction and operational phases. The next section will evaluate these ecological impacts.

5.1.2 Major impacts relate to destruction of the natural watercourse at KT15, and the draining of seasonal wetlands and the effects on wetland-dependent birds and amphibians.

Construction Phase

5.1.3 Activities during the construction phase include site clearance, site formation, dredging, paving of access road, *etc.* These are likely to have the impacts described below on fauna and flora species and the habitat in which they live.

(i) Habitat Loss /Damage (Direct Impacts)

The direct impact of site clearance is removal of vegetation, and, at KT15, loss of natural banks with woody or weedy margins and loss of substrate including submerged vegetation and or coarse gravel. Direct impact will therefore arise to vegetation and non-vagile animal groups, notably invertebrates and amphibians. There will also be direct habitat loss to all other animal groups using the stream corridor, agricultural lands and seasonal marsh, notably birds, amphibians, reptiles and dragonflies (which have vagile adults but non-vagile larvae).

Changes in the watertable arising from construction activities are likely to have short-term effects on the watertable in the low-lying wet grassland derived from abandoned paddy fields, abandoned fish ponds and adjacent freshwater. Lowering of the watertable may arise as a consequence of increased drainage, whereas compaction or deliberate or accidental stream diversions may result in temporary flooding.

The land after site clearance will be occupied by structures, supporting facilities and storage area for materials and equipment etc. Several habitats adjacent to the Project Area will be damaged, or even destroyed by such activities.

(ii) Disturbance of Wildlife (Indirect Impacts)

Indirect impacts may arise through disturbance activities affecting disturbance-sensitive animal groups, such as birds. However, birds present in the Study Areas, including the conservation concern species White-throated Kingfisher, show little sensitivity to disturbance activities.

Any changes in the watertable of the wet grassland areas will have short-term effects on the fauna of these areas, including changes in their suitability for breeding amphibians and dragonflies and other invertebrates. Similarly, their value as feeding areas for ardeids will be affected.

(iii) Fragmentation of Habitats

Site clearance of the Project Areas at KT14 and KT15 will increase habitat fragmentation. Animals may have more difficulty in crossing these fragmented areas.

(iv) Dust Deposition on Vegetation

Some construction activities will generate suspended particulates that can cause vegetation damage, which in turn, have secondary effects on associated fauna, such as insects and birds.

(v) Increased Sediment Load

During the construction phase, dust and exposed soil may enter the watercourses through run-off, especially during heavy rainfall periods. However, ecological degradation of the affected habitat may not occur if pollutant levels due to run-off do not exceed those of the watercourse.

KT14

- 5.1.4 Potential impacts include loss of some agricultural lands and low-lying grasslands, and increase in fragmentation of the agricultural lands/fallow fields/low-lying grasslands. Indirect impact comprises of the withdrawal of water from the nearby wet agricultural lands, and possible disruption of amphibian breeding activities.

KT15

- 5.1.5 Potential impacts include the disturbance, destruction and loss of a natural stream section, several patches of grasslands, part of an orchard, and a small abandoned fishpond (< 0.1 ha). There will be an increase in the fragmentation of seasonally wet grasslands east of Kam Sheung Road.

Operation Phase

KT14

- 5.1.6 Permanent loss of some agricultural lands, fallow fields/low-lying grasslands, and the draining of water from, and increase in fragmentation of, the agricultural lands/fallow fields/low-lying grasslands are the main ecological impacts.

KT15

- 5.1.7 Impacts include the permanent loss of the natural stream, resulting in reduction of wildlife use of the watercourse, as well as loss of grasslands and a small

fishpond within the proposed alignment, and the withdrawal of water away from the wetland upstream.

5.2 Evaluation of Ecological Impacts

Cumulative Impacts

5.2.1 The principal cumulative impact of these projects is the further increase in the loss and fragmentation of low-lying seasonally wet grassland and agricultural land. In the wider Kam Tin area, such loss and fragmentation has already been caused by the construction of West Rail and the Stage 1 of Yuen Long, Kam Tin, Ngau Tam Mei and Tin Shui Wai Drainage Improvement works to the main river channel. However, in the areas adjacent to proposed alignments of the KT14 and KT15 channels the loss and fragmentation effects of these projects is minor as their alignments lie to the west of most of the grassland and agricultural areas (see Figure 4.4). Of much greater cumulative importance is the loss of low-lying grassland and agricultural habitat in the areas adjacent to KT14 and KT15 to ad hoc small-scale developments including house construction, small-scale industrial development and open storage. Compared with the cumulative fragmentation effects of these developments, the additional cumulative impact of the proposed KT14 and KT15 channels is localized and minor.

KT14

5.2.2 The potential loss of 1.34 ha of agricultural lands/fallow fields/low-lying grasslands is considered, in itself, to comprise a small adverse impact of low significance. However, the proposed works will increase the fragmentation of the habitats, and thus the overall impact level is of low to moderate significance. The impact of draining the wet cultivated lands/fallow fields/low-lying grasslands from the channelization works is of moderate significance, since the quality of the wetland habitat will be degraded.

Table ATT3-17
Evaluating the Significance of the Ecological Impact of the Project at KT14

Criteria	On-Site	Off-Site
Impact on habitat quality	Loss of some cultivated lands and grasslands Low-moderate impact	Draining of the adjacent wet cultivated lands, and grasslands; increase in fragmentation of the adjacent grasslands will lead to degradation of the wetland habitat quality

Criteria	On-Site	Off-Site
		Moderate impact
Impact on species	Loss of some common species found in abandoned paddy fields Low impact	Loss of some wetland species Low-moderate impact
Duration of impact	Permanent but low Impact (as area of direct impact is small and no permanent impact on populations of species of conservation concern)	May be permanent if further draining cannot be avoided Low-moderate impact
Magnitude of impact	Low impact	Moderate impact
Reversibility of impact	Low impact	Habitat will survive if draining can be prevented Low-moderate impact
Cumulative Impacts	Small additional loss of low-lying grassland Small additional cumulative impact	Increased fragmentation of low-lying grassland and agricultural land Small additional cumulative impact
Overall impact evaluation	Low	Low-moderate

KT15

5.2.3 The Study Area is subject to a high level of disturbance from the surrounding urban environment, which includes the West Rail works, the Kam Sheung Road, and the residential areas, etc. The ecological significance of the Study Area is relatively low. Thus any additional impact is unlikely to be unacceptable. A higher level impact is the draining of the wet fallow fields/low-lying grasslands upstream.

Table ATT3-18
Evaluating the Significance of the Ecological Impact of the Project at KT15

Criteria	On-Site	Off-Site
Impact on habitat quality	Loss of a stream section, parts of an orchard and grasslands, and a small fishpond Low impact	Draining and increase in fragmentation of the grassland upstream will reduce the wetland habitat quality Moderate impact
Impact on species	Loss of the riparian	Loss of some wetland flora

Criteria	On-Site	Off-Site
	vegetation and large fish species along the stream. Loss of utility value of habitat for aquatic fauna and wetland-dependent birds. Low impact	species Low-moderate impact
Duration of impact	Permanent but low Impact (as area of direct impact is small and no permanent impact on populations of species of conservation concern)	May be permanent if further draining cannot be avoided Low-moderate impact
Magnitude of impact	Low impact	Low-moderate impact
Reversibility of impact	Low impact	Habitat will be maintained if draining can be avoided Low-moderate impact
Cumulative Impacts	Small additional loss of low-lying grassland Small additional cumulative impact	Increased fragmentation of low-lying grassland and agricultural land Small additional cumulative impact
Overall impact evaluation	Low	Low-moderate

6. SPECIFIC ECOLOGICAL IMPACT MITIGATION MEASURES

6.1 KT14

6.1.1 Mitigation considerations and measures are the following:

- (a) KT14 is not to be constructed on an existing stream, but is to be excavated through open grassland, some of which is seasonal wetland. Agricultural land and grassland (both wetland) are present in the KT14 area. The ecological value of the habitat however is not sufficiently significant to warrant the avoidance of channelization.
- (b) Box channels comprising a small drainage conduit for flood flows only, should be used for where the channel passes through areas of urban habitat. Where the channel passes through agricultural or seasonal marsh areas, the box channel should have no side weep holes and a wide base slab to counter uplift. This will prevent lowering of the groundwater

table, ensuring that the wetland character of these areas is retained. This arrangement is illustrated in Figure 5.1.

6.2 KT15

6.2.1 Mitigation considerations and measures are the following:

- (a) Grassland, a small abandoned fishpond, and an orchard (non-wetland) are present in the KT15 area. The ecological value of the habitat however is not sufficiently significant to warrant the avoidance of channelization.
- (b) A gabion lining channel is proposed throughout the whole alignment. The channel bed should be provided with a rocky bottom (gabion mattress) to help sustain aquatic life. The proposed arrangement is shown in Figure 5.2.
- (c) During the construction phase, the discharge of site effluent to nearby wetland, the stockpiling or disposal of materials, and any dredging or construction activities at this area are to be prohibited.

7. CONCLUSION

- 7.1 With the implementation of the recommended mitigation measures, the residual ecological impacts regarding the Designated Projects of KT14 and KT15 are expected to be minor and acceptable.

Appendix 1

Full List of Bird Species Observed during Field Visits

Site ▶	KT14	KT15
Species ▼		
Little Egret <i>Egretta garzetta</i>	✓	
Cattle Egret <i>Bubulcus ibis</i>	✓	✓
Chinese Pond Heron <i>Ardeola bacchus</i>	✓	✓
White-breasted Waterhen <i>Amaurornis phoenicurus</i>	✓	✓
Spotted Dove <i>Streptopelia chinensis</i>	✓	✓
Common Koel <i>Eudynamys scolopacea</i>	✓	
Lesser Coucal <i>Centropus benghalensis</i>	✓	
White-throated Kingfisher <i>Halcyon Smyrnensis</i>	✓	
Barn Swallow <i>Hirundo rustica</i>	✓	✓
Grey Wagtail <i>Motacilla cinerea</i>	✓	
White Wagtail <i>Motacilla alba</i>	✓	✓
Red-whiskered Bulbul <i>Pycnonotus jocosus</i>	✓	✓
Chinese Bulbul <i>Pycnonotus sinensis</i>	✓	✓
Long-tailed Shrike <i>Lanius schach</i>	✓	✓
Oriental Magpie Robin <i>Copsychus saularis</i>	✓	✓
Masked Laughing-thrush <i>Garrulax perspicillatus</i>	✓	
Yellow-bellied Prinia <i>Prinia flaviventris</i>	✓	
Plain Prinia <i>Prinia subflava</i>	✓	
Common Tailorbird <i>Orthotomus sutorius</i>		✓
Japanese White-eye <i>Zosterops japonicus</i>	✓	
White-rumped Munia <i>Lonchura striata</i>		✓
Eurasian Tree Sparrow <i>Passer montanus</i>	✓	✓
Black-collared Starling <i>Sturnus nigricollis</i>	✓	✓
Crested Myna <i>Acridotheres cristatellus</i>	✓	✓
Common Magpie <i>Pica pica</i>	✓	
No. of species recorded	23	15

Appendix 2

Floral Species Observed during Field Visits

KT14	Status	KT15	Status
<i>Acalypha wilkesiana</i>	E	<i>Ageratum conyzoides</i>	E
<i>Ageratum conyzoides</i>	E	<i>Alocasia macrorrhiza</i>	L
<i>Alocasia macrorrhiza</i>	L	<i>Alternanthera sessilis</i>	L
<i>Alternanthera sessilis</i>	L	<i>Amaranthus viridis</i>	L
<i>Amaranthus viridis</i>	L	Bamboo sp.	L
<i>Apluda mutica</i>	L	<i>Bauhinia</i> sp.	L
<i>Artocarpus macrocarpus</i>	E	<i>Bidens pilosa</i>	L
<i>Averrhoa carambola</i>	E	<i>Bridelia tomentosa</i>	L
<i>Axonopus compressus</i>	E	<i>Canna indica</i>	E
<i>Bidens pilosa</i>	L	<i>Celtis sinensis</i>	L
<i>Camelia japonica</i>	P	<i>Chenopodium album</i>	L
<i>Canna indica</i>	E	<i>Chenopodium ambrosioides</i>	E
<i>Carica papaya</i>	E	<i>Colocasia esculenta</i>	L
<i>Caryota ochlandra</i>	E	<i>Commelina nudiflora</i>	L
<i>Catharanthus roseus</i>	E	<i>Cuscuta chinensis</i>	L
<i>Celtis sinensis</i>	L	<i>Kyllingia monocephala</i>	L
<i>Chenopodium album</i>	L	<i>Cyperus imbricatus</i>	L
<i>Citrus maxima</i>	E	<i>Cyperus rotundus</i>	L
<i>Citrus limon</i>	E	<i>Echinochloa crus-galli</i>	L
<i>Clausena lansium</i>	E	<i>Eclipta prostrata</i>	L
<i>Coix lachryma-jobi</i>	L	<i>Eleusine indica</i>	L
<i>Colocasia esculenta</i>	L	<i>Erigeron floribundus</i>	L
<i>Commelina nudiflora</i>	L	<i>Euphorbia hirta</i>	L
<i>Cordyline fruticosa</i>	E	<i>Dimocarpus longan</i>	E
<i>Cyclosorus</i> sp.	L	<i>Ficus benjamina</i>	E
<i>Cynodon dactylon</i>	L	<i>Ficus elastica</i>	E
<i>Kyllingia monocephala</i>	L	<i>Ficus hispida</i>	L
<i>Cyperus rotundus</i>	L	<i>Ipomoea aquatica</i>	E
<i>Daucus carota</i>	E	<i>Ipomoea cairica</i>	L
<i>Digitaria sanguinalis</i>	L	<i>Lactuca indica</i>	L
<i>Echinochloa crus-galli</i>	L	<i>Leonurus japonicus</i>	L

KT14	Status	KT15	Status
<i>Eclipta prostrata</i>	L	<i>Lygodium japonicum</i>	L
<i>Eleusine indica</i>	L	<i>Macaranga tanarius</i>	L
<i>Emilia sonchifolia</i>	L	<i>Manihot esculenta</i>	E
<i>Erigeron floribundus</i>	L	<i>Melia azedarach</i>	E
<i>Eriobotrya japonica</i>	E	<i>Microstegium ciliatum</i>	L
<i>Erythrina speciosa</i>	E	<i>Mikania micrantha</i>	E
<i>Euphorbia hirta</i>	L	<i>Musa paradisiaca</i>	E
<i>Euphorbia pulcherrima</i>	E	<i>Oxalis corniculata</i>	L
<i>Dimocarpus longan</i>	E	<i>Pandanus forceps</i>	L
<i>Ficus hispida</i>	L	<i>Panicum brevifolium</i>	L
<i>Gnaphalium pensylvanicum</i>	L	<i>Panicum maximum</i>	E
<i>Gynura bicolor</i>	E	<i>Panicum repens</i>	L
<i>Hedychium coronarium</i>	E	<i>Pennisetum purpureum</i>	E
<i>Imperata koenigii</i>	L	<i>Plantago major</i>	L
<i>Ipomoea aquatica</i>	E	<i>Polygonum chinense</i>	L
<i>Ipomoea cairica</i>	L	<i>Polygonum hydropiper</i>	L
<i>Quamoclit pennata</i>	E	<i>Polygonum perfoliatum</i>	L
<i>Lantana camara</i>	E	<i>Prunus persica</i>	E
<i>Leonurus japonicus</i>	L	<i>Pueraria lobata</i>	L
<i>Ligustrum sinense</i>	L	<i>Ranunculus sceleratus</i>	L
<i>Litchi chinensis</i>	E	<i>Ricinus communis</i>	E
<i>Macaranga tanarius</i>	L	<i>Rumex trisetifer</i>	L
<i>Michelia alba</i>	P	<i>Sansevieria trifasciata</i>	E
<i>Michelia figo</i>	P	<i>Scoparia dulcis</i>	E
<i>Microstegium ciliatum</i>	L	<i>Solanum nigrum</i>	L
<i>Mikania micrantha</i>	E	<i>Solvia anthemifolia</i>	E
<i>Miscanthus floridulus</i>	L	<i>Wedelia trilobata</i>	E
<i>Morus alba</i>	L	<i>Camelia japonica</i>	P
<i>Musa paradisiaca</i>	E	<i>Michelia alba</i>	P
<i>Oxalis corymbosa</i>	E	<i>Michelia figo</i>	P
<i>Oxalis corniculata</i>	L		
<i>Panicum maximum</i>	E		
<i>Panicum paludosum</i>	L		
<i>Panicum repens</i>	L		
<i>Pennisetum purpureum</i>	E		

KT14	Status	KT15	Status
<i>Plantago major</i>	L		
<i>Polygonum chinense</i>	L		
<i>Polygonum hydropiper</i>	L		
<i>Polygonum perfoliatum</i>	L		
<i>Portulaca oleracea</i>	L		
<i>Pueraria lobata</i>	L		
<i>Ricinus communis</i>	E		
<i>Rumex trisetifer</i>	L		
<i>Saccharum officinarum</i>	E		
<i>Scoparia dulcis</i>	E		
<i>Sida rhombifolia</i>	L		
<i>Solanum nigrum</i>	L		
<i>Solanum torvum</i>	L		
<i>Solvia anthemifolia</i>	E		
<i>Spilanthes paniculata</i>	L		
<i>Wedelia trilobata</i>	E		
<i>Zea mays</i>	E		

Note:

Status: E = exotic species; L = Local species; P = species protected under the Forestry Regulation

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Attachment 4

Environmental Monitoring and Audit Manual

ATTACHMENT 4 ENVIRONMENTAL MONITORING AND AUDIT MANUAL

CONTENTS

	Page
Summary of the Environmental Monitoring and Audit (EM&A) Requirements	ATT4-ES-1
1. INTRODUCTION	ATT4-1
1.1 Purpose of the Manual	ATT4-1
2. PROJECT DESCRIPTION	ATT4-2
2.1 Background of the Study	ATT4-2
2.2 Location and Scope of the Designated Projects and Existing Environment	ATT4-2
2.3 Project Programme	ATT4-4
2.4 Possible Impact on the Environment	ATT4-4
3. PROJECT ORGANISATION	ATT4-4
3.1 Project Organisation	ATT4-4
4. AIR QUALITY	ATT4-8
4.1 Air Quality Parameters	ATT4-8
4.2 Monitoring Equipment	ATT4-9
4.3 Laboratory Measurement/Analysis	ATT4-11
4.4 Monitoring Locations	ATT4-11
4.5 Baseline Monitoring	ATT4-13
4.6 Impact Monitoring	ATT4-14
4.7 Event and Action Plan for Air Quality	ATT4-14
5. NOISE	ATT4-17
5.1 Noise Parameters	ATT4-17
5.2 Monitoring Equipment	ATT4-17
5.3 Monitoring Locations	ATT4-17
5.4 Baseline Monitoring	ATT4-18
5.5 Impact Monitoring	ATT4-19
5.6 Event and Action Plan for Noise	ATT4-19
6. WATER QUALITY	ATT4-22
6.1 Water Quality Parameters	ATT4-22
6.2 Monitoring Equipment	ATT4-22
6.3 Laboratory Measurement/Analysis	ATT4-24
6.4 Monitoring Locations	ATT4-25
6.5 Baseline Monitoring	ATT4-26
6.6 Impact Monitoring	ATT4-27
6.7 Event and Action Plan for Water Quality	ATT4-27

CONTENTS
(cont'd)

7.	ECOLOGY	ATT4-30
7.1	Objectives	ATT4-30
7.2	Equipment	ATT4-30
7.3	Monitoring Areas	ATT4-30
7.4	Baseline Monitoring	ATT4-31
7.5	Impact Monitoring	ATT4-31
7.6	Ecology Event and Action Plan	ATT4-32
8.	WASTE	ATT4-33
8.1	Construction Phase	ATT4-33
8.2	Operation Phase	ATT4-34
9.	SITE ENVIRONMENTAL AUDIT	ATT4-34
9.1	Site Inspections	ATT4-34
9.2	Compliance with Legal and Contractual Requirements	ATT4-35
9.3	Environmental Complaints	ATT4-36
10.	REPORTING	ATT4-37
10.1	General	ATT4-37
10.2	Baseline Monitoring Report	ATT4-38
10.3	Monthly EM&A Reports	ATT4-38
10.4	Quarterly EM&A Summary Reports	ATT4-43
10.5	Final EM&A Review Report	ATT4-44
10.6	Data Keeping	ATT4-45
10.7	Interim Notifications of Environmental Quality Limit Exceedances	ATT4-45

END OF TEXT

ANNEXES

Annex A	Mitigation Measures Implementation Schedule
Annex B	Sample Record Forms

CONTENTS

(cont'd)

LIST OF TABLES

Table ATT4-1	Air Quality Monitoring Stations during the Construction Stage
Table ATT4-2	Action and Limit Levels for Air Quality
Table ATT4-3	Event/Action Plan for Air Quality
Table ATT4-4	Noise Monitoring Stations during the Construction Stage
Table ATT4-5	Action and Limit Levels for Construction Noise
Table ATT4-6	Event/Action Plan for Construction Noise
Table ATT4-7	Water Quality Monitoring Locations during the Construction Stage
Table ATT4-8	Action and Limit Levels for Water Quality
Table ATT4-9	Event and Action Plan for Water Quality
Table ATT4-10	Action and Limit Levels for Ecology
Table ATT4-11	Event and Action Plan for Ecology

LIST OF FIGURES

Figure ATT4-2.1	Location Plan of Secondary Channels KT14 & KT15
Figure ATT4-2.2	Yuen Kong San Tsuen Channel KT14 Proposed Layout Plan (Sheet 1 of 2)
Figure ATT4-2.2	Yuen Kong San Tsuen Channel KT14 Proposed Layout Plan (Sheet 2 of 2)
Figure ATT4-2.3	Kam Tsin Wai Channel 15 Proposed Layout Plan
Figure ATT4-3.1	Project Organisation and Lines of Authority for EM&A
Figure ATT4-4.1	Construction Phase Air Quality / Noise / Water Quality Monitoring Locations at KT14
Figure ATT4-4.2	Construction Phase Air Quality / Noise / Water Quality Monitoring Locations at KT14
Figure ATT4-4.3	Construction Phase Air Quality / Noise / Water Quality Monitoring Locations at KT15
Figure ATT4-7.1	Ecological Monitoring Area KT14
Figure ATT4-7.2	Ecological Monitoring Area KT15
Figure ATT4-9.1	Construction Phase Environmental Monitoring & Audit Procedures
Figure ATT4-9.2	Complaint Response Procedures

ATTACHMENT 4

Summary of the Environmental Monitoring and Audit (EM&A) Requirements

Upon appointment, the Environmental Team (ET) Leader shall review the most up to date construction programme, the information in the EM&A Manual, the appropriate recommendations and mitigation from this Study, the implementation schedule as well as any conditions stipulated by the Director of Environmental Protection in the relevant Environmental Permit (EP). If required, the ET Leader shall provide an updated EM&A Manual to be verified by the Independent Environmental Checker (IEC) before submission to the Engineer and EPD.

A summary of the EM&A requirements for the “Secondary Drainage Channels KT14 & KT15” is listed below. Details are provided in the attachment.

Parameters	Locations	Baseline Monitoring	Impact Monitoring
Air Quality (24-hr & 1-hr total suspended particulates)	A8 (RASR KT14-1) A9 (RASR KT14-4) A10 (RASR KT15-2)	14 consecutive days prior to commencement of construction works	Once every 6 days for 24-hr sampling Three times every six-days for 1-hr sampling
Noise (Leq)	N7 (RNSR KT14-3) N8 (RNSR KT14-1) N9 (RNSR KT14-4) N10 (RNSR KT15-2)	14 consecutive days prior to commencement of construction works	One set of Leq (30 minutes) between 0700-1900 hours on normal weekdays
Water Quality (pH, dissolved oxygen, turbidity, suspended solids, ammoniacal nitrogen and zinc)	W8A – W8D (for KT14) W9A & W9B (for KT15)	3 days per week for 4 weeks prior to commencement of construction works	Twice a week
Ecology	Seasonal wetland	Flora monitoring prior to commencement of construction works (baseline fauna monitoring is not required)	Monthly monitoring of wetland areas Monthly surveys during wet season (April to July inclusive) for reptiles, amphibians, dragonflies and butterflies. Monthly bird surveys conducted throughout the year.
Ecology	Within the channels and in the wetland areas	Operational Monitoring Monthly surveys during wet season (April to July inclusive) for reptiles, amphibians, dragonflies and butterflies. Monthly bird surveys conducted throughout the year for one year. Quarterly invertebrate surveys within the section of KT15 where a rock bed to the channel will be formed, surveys to be conducted four times during the one year monitoring period.	

Notes:

The ET leader shall seek approval from the IEC, Engineer and EPD (and where applicable AFCD) on all aspects of the monitoring (e.g. locations, parameters, etc.) before carrying out any monitoring works.

ENVIRONMENTAL MONITORING AND AUDIT MANUAL

1. INTRODUCTION

1.1 Purpose of the Manual

- 1.1.1 The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the setup of an EM&A programme to ensure compliance with the Project Profile recommendations, to assess the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action. This Manual outlines the monitoring and audit programme for the construction and operational phases of the proposed “Secondary Drainage Channels KT14 & KT15” (the Project). The EM&A Programme aims to provide systematic procedures for monitoring, auditing and minimizing the environmental impacts associated with the proposed Project.
- 1.1.2 Findings, recommendations and requirements of the Project Profile, all relevant requirements under the Environmental Impact Assessment Ordinance (EIAO) and other environmental legislation, the Hong Kong Planning Standards and Guidelines (HKPSG) are adopted in the preparation of this EM&A Manual. Reference has also been made to EPD’s “Environmental Monitoring and Audit Guidelines for Development Projects in Hong Kong”.
- 1.1.3 The EM&A Manual describes the following:
- (a) duties of the Environmental Team (ET) and ET Leader, the Independent Environmental Checker (IEC), Engineer’s Representative (ER) and Contractor, in relation to the project’s environmental monitoring and audit requirements during construction;
 - (b) information on the project organisation and programming of construction activities;
 - (c) the project construction schedule and the necessary environmental monitoring and audit programme to track the environmental impacts;
 - (d) requirements for the review of pollution sources and working procedures in the event of non-compliance of the project’s environmental performance criteria;
 - (e) environmental monitoring protocols and their technical requirements;
 - (f) environmental auditing procedures;

- (g) requirements for the documentation of environmental monitoring and audit data, and appropriate reporting procedures; and
- (h) complaint resolution procedures.

1.1.4 The EM&A Manual is an evolving document that should be updated to maintain its relevance as the Project progresses. The primary focus for these updates will be to ensure the impacts predicted and the recommended mitigation measures remain consistent and appropriate to the manner in which the works are to be carried out.

2. PROJECT DESCRIPTION

2.1 Background of the Study

2.1.1 In accordance with the findings of the Yuen Long, Kam Tin, Ngau Tam Mei and Tin Shui Wai Drainage Master Plan (YLDMP), the proposed Project aimed at relieving the present drainage problems that have repeatedly led to severe flooding in the areas.

2.1.2 A Project Profile was submitted to seek approval from the authorities to apply directly for an Environmental Permit for the Designated Project (DP), in accordance with S.5(1)(b) of the Environmental Impact Assessment Ordinance (EIAO) (Cap 499). The predicted impacts from the implementation of the proposed Designated Projects KT14 and KT15 are not expected to be adverse and sufficient information is provided in the Project Profile on mitigation measures to meet the requirements under the Technical Memorandum on Environmental Impact Assessment Process (TMEIAP).

2.2 Location and Scope of the Designated Projects and Existing Environment

2.2.1 Figure ATT4-2.1 shows the location of the proposed Project. The downstream ends of both KT14 and KT15 will be connected to the primary channels constructed by Kowloon-Canton Railway Corporation (KCRC) - West Rail (MDC 97CD) (already completed by others).

KT14

2.2.2 The location of KT14 is at Yuen Kong San Tsuen and Tin Sam Tsuen areas in Pat Heung. The areas currently comprise abandoned dry agricultural land, and low lying grassland/fallow fields. A small part of the alignments is inside a paved area and construction site/ bare ground. There is no history of

contaminating land use in the areas. The abandoned agricultural area is considered to be a seasonal marsh and is a breeding ground for common amphibian species. This is a new channel to be constructed on land where there is currently no stream or other drainage channel, and comprises four discrete sections with the following dimensions:

Section A	– 2.5 m width and 2.8 m height, 145 m
Section B	– 2.5 m width and 1.6 m height, 339 m
Section C	– 2.5 m width and 1.6 m height, 474 m
Drain along Kam Sheung Road	– 900 mm nominal size U-channel
Bank raising along the existing toe channel of Pat Heung Road	

2.2.3 The proposed layout of KT14 is shown in Figure ATT4-2.2 (2 sheets).

KT15

2.2.4 KT15 is to be formed by channelising an existing stream that passes though the Shek Wu Tong, Tin Sam San Tsuen and Kam Tsin Wai areas in Pat Heung. These are areas of mainly modified low-lying grassland with village houses and farms around the stream. There is no history of contaminating land use in the areas.

2.2.5 The length of KT15 is about 796 m. The proposed layout of KT15 is shown in Figure ATT4-2.3. The dimensions of the new KT15 channel are summarized as follows:

Chainage 0 – 11	3 x 3 m (W) x 2 m (H) box culvert
Chainage 11 – 200	Channel width 9.9 m, depth 1.6 m, with 0.8 m wide verge on both sides
Chainage 200 – 450	Channel width 9.9 m, depth 1.6 m, with 0.8 m wide verge on both sides, and 3.5 m wide maintenance access road to the south
Chainage 450 – 550	Channel width 6.7 m, depth 1.6 m, with 0.8 m wide verge on both sides, and 3.5 m wide maintenance access road to the north
Chainage 550 – 686	Channel width 9.9 m, depth 1.6 m, with 0.8 m wide verge on both sides, and 3.5 m wide maintenance access road to the north
Chainage 686 - 796	Channel width 3.5 m, depth 1.6 m, with 0.8 m wide verge on both sides

2.3 Project Programme

- 2.3.1 KT14 and KT15 are scheduled to commence in mid 2006 for completion by mid 2009.
- 2.3.2 This programme is for the ET Leader to get an initial idea of the works programme. The ET Leader shall make reference to the actual works progress and programme during the construction phase to schedule the EM&A programme, and the Contractor shall provide the respective information to the ET Leader for formulating the EM&A schedule. The construction programme, and related EM&A schedule shall be updated in the baseline/monthly report submissions, as necessary.

2.4 Possible Impact on the Environment

- 2.4.1 Construction activities for the Projects involve the forming of two groups of secondary drainage channels. In particular, works would include site clearance, excavation to formation levels of the channels, bank formation, dredging, widening, realignment and lining of channels, re-provisioning of vehicular and pedestrian crossings, drainage and utility diversion works, and other ancillary works.
- 2.4.2 The construction and operational phases impacts of the Project are assessed and presented in the Project Profile. The Project Profile recommended mitigation measures to minimise the potential environmental impacts associated with the Project. An implementation schedule of the recommended mitigation measures is prepared as part of the Project Profile and is attached in Annex A of this Manual.

3. PROJECT ORGANISATION

3.1 Project Organisation

- 3.1.1 The project organization and lines of communication with respect to EM&A requirements are shown in Figure ATT4-3.1.
- 3.1.2 For the purpose of this EM&A Manual, the “Engineer” shall refer to the Engineer as defined in the Contract and the Engineer’s Representative (ER), in cases where the Engineer’s powers have been delegated to the ER, in accordance with the Contract. The ET Leader, who shall be responsible for and in charge of the ET, shall refer to the person delegated the role of executing the

environmental monitoring programme. The IEC shall undertake the auditing role.

3.1.3 The general duties and responsibilities of various parties are as follows:

Environmental Team (ET) and ET Leader

3.1.4 The ET Leader and the ET shall be employed by the Contractor to conduct the EM&A program and ensure the Contractor's compliance with the project's environmental performance requirements during construction. The duties are:

- (a) sampling, analysis and statistical evaluation of monitoring parameters with reference to the Project Profile recommendations and requirements;
- (b) environmental site surveillance;
- (c) audit of compliance with environmental protection, and pollution prevention and control regulations;
- (d) monitor the implementation of environmental mitigation measures;
- (e) monitor compliance with the environmental protection clauses/specifications in the Contract;
- (f) review construction program and comment as necessary;
- (g) review construction methodology and comment as necessary;
- (h) complaint investigation, evaluation and identification of corrective measures;
- (i) liaison with Independent Environmental Checker (IEC) on all environmental performance matters, and timely EM&A submission for IEC's approval;
- (j) advice to the Contractor on environmental improvement, awareness, enhancement matters, etc. on site; and
- (k) timely submission of the EM&A report to the Project Proponent and the Director of Environmental Protection (DEP).

3.1.5 The ET and ET Leader shall not be in any way an associated body of the Contractor. The ET shall be led and managed by the ET leader. Suitably

qualified staff shall be included in the ET, and resources for the implementation of the EM&A program shall be allocated in time under the Contract to enable fulfillment of the project's EM&A requirements as specified in the EM&A Manual.

- 3.1.6 The ET Leader shall have relevant education, training, knowledge, experience and professional qualifications and at least 7 years experience in EM&A subject to the approval of the ER and the DEP.

Independent Environmental Checker (IEC)

- 3.1.7 The IEC shall be employed by the project proponent and shall advise the ER on environmental issues related to the Project. The role of the IEC shall be independent from the management of construction works, but the IEC shall be empowered to audit the environmental performance of construction.
- 3.1.8 The IEC shall be employed prior to commencement of construction of the Project. The IEC shall have at least 7 years experience in EM&A or environmental management. The appointment of the IEC is subject to the approval of the ER and DEP.
- 3.1.9 The IEC shall arrange and conduct monthly general site inspections of the works site during the construction period. The IEC shall ensure the impact monitoring is conducted according to the prescribed schedule at the correct locations.
- 3.1.10 The main duty of the IEC is to carry out environmental audit of the Project; this shall include, inter alia, the followings:
- (a) review and audit all aspects of the EM&A program;
 - (b) validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and locations of sensitive receivers;
 - (c) carry out random sample check and audit on monitoring data and sampling procedures, etc;
 - (d) conduct random site inspection;
 - (e) audit the Project Profile recommendations and requirements against the status of implementation of environmental protection measures on site;

- (f) review the effectiveness of environmental mitigation measures and project environmental performance;
- (g) on a needs basis, audit the Contractor's construction methodology and agree the least impact alternative in consultation with the ET Leader and the Contractor;
- (h) check complaint cases and the effectiveness of corrective measures;
- (i) review EM&A report submitted by the ET Leader; and
- (j) feedback audit results to ET.

Contractor

3.1.11 The Contractor shall:

- (a) provide information/advice to the ET regarding works activities which may contribute, or be continuing to the generation of adverse environmental conditions;
- (b) submit proposals on mitigation measures in case of exceedances of Action and Limit levels in accordance with the Event and Action Plans;
- (c) implement measures to reduce impact whenever Action and Limit levels are exceeded;
- (d) implement the corrective actions instructed by the Engineer;
- (e) accompany joint site inspection undertaken by the ET; and
- (f) adhere to the procedures for carrying out complaint investigation.

Engineer or Engineer's Representative (ER)

3.1.12 The ER shall:

- (a) monitor the Contractor's compliance with contract specifications, including the effective implementation and operation of environmental mitigation measures;
- (b) instruct the Contractor to follow the agreed protocols or those in the Contract Specifications in the event of exceedances or complaints;
- (c) comply with the agreed Event and Action Plan in the event of any exceedance; and
- (d) Provide assistance to the ET as necessary in the implementation of the environmental monitoring and audit programme.

3.1.13 Sufficient suitably qualified professionals and technical staff should be employed by the respective parties to ensure full compliance with their duties and responsibilities as specified in this Manual.

4. AIR QUALITY

4.1 Air Quality Parameters

4.1.1 Monitoring and audit of Total Suspended Particulate (TSP) levels shall be carried out by the ET to ensure that any deteriorating air quality could be readily detected and timely action taken to rectify the situation.

4.1.2 1-hour and 24-hour TSP levels should be measured to indicate the impacts of construction dust on air quality. The TSP levels shall be measured by following the standard high volume sampling method as set out in the Title 40 of the Code of (US) Federal Regulations, Chapter 1 (Part 50), Appendix B. Upon approval by the Engineer, 1-hour TSP levels can be measured by direct reading methods which are capable of producing comparable results as that by the high volume sampling method, to indicate short event impacts.

4.1.3 All relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of the sampler, identification and weight of the filter paper, and other special phenomena and work progress of the concerned site etc. shall be recorded in detail. A sample data sheet is shown in Annex B.

4.2 Monitoring Equipment

4.2.1 High volume samplers (HVS) in compliance with the following specifications shall be used for carrying out the TSP monitoring:

- (a) 0.6-1.7 m³/min (20-60 SCFM) adjustable flow range;
- (b) equipped with a timing/control device with +/- 5 minutes accuracy for 24 hours operation;
- (c) installed with elapsed-time meter with +/- 2 minutes accuracy for 24 hours operation;
- (d) capable of providing a minimum exposed area of 406 cm² (63 in²);
- (e) flow control accuracy: +/- 2.5% deviation over 24-hr sampling period;
- (f) equipped with a shelter to protect the filter and sampler;
- (g) incorporated with an electronic mass flow rate controller or other equivalent devices;
- (h) equipped with a flow recorder for continuous monitoring;
- (i) provided with a peaked roof inlet;
- (j) incorporated with a manometer;
- (k) able to hold and seal the filter paper to the sampler housing at horizontal position;
- (l) easy to change the filter; and
- (m) capable of operating continuously for 24-hr period.

4.2.2 The Contractor's ET leader is responsible for provision of the monitoring equipment. He shall ensure that sufficient number of HVSs with an appropriate calibration kit are available for carrying out any baseline checks, regular impact monitoring and ad hoc monitoring. The HVSs shall be equipped with an electronic mass flow controller and be calibrated against a traceable standard at regular intervals. All the equipment, calibration kit, filter papers, etc. shall be clearly labelled.

- 4.2.3 Initial calibration of dust monitoring equipment shall be conducted upon installation and thereafter at bi-monthly intervals. The transfer standard shall be traceable to the internationally recognised primary standard and be calibrated annually. The calibration data shall be properly documented for future reference. All the data should be converted into standard temperature and pressure condition.
- 4.2.4 The flow-rate of the sampler before and after the sampling exercise with the filter in position shall be verified to be constant and be recorded down in a data sheet.
- 4.2.5 If the Contractor's ET leader proposes to use a direct reading dust meter to measure 1-hr TSP levels, he shall submit sufficient information to the ER to prove that the instrument is capable of achieving a comparable result as that the HVS and may be used for the 1-hr sampling. The instrument should also be calibrated regularly, and the 1-hr sampling shall be determined periodically by HVS to check the validity and accuracy of the results measured by direct reading method.
- 4.2.6 Wind data monitoring equipment shall also be provided and set up at conspicuous locations for logging wind speed and wind direction near to the dust monitoring locations. The equipment installation location shall be proposed by the Contractor's ET leader and agreed with the ER. For installation and operation of wind data monitoring equipment, the following points shall be observed:
- (a) the wind sensors should be installed on masts at an elevated level 10m above ground so that they are clear of obstructions or turbulence caused by the buildings;
 - (b) the wind data should be captured by a data logger and be downloaded for processing at least once a month;
 - (c) the wind data monitoring equipment should be re-calibrated at least once every six months; and
 - (d) wind direction should be divided into 16 sectors of 22.5 degrees each.
- 4.2.7 In exceptional situations, the Contractor's ET leader may propose alternative methods to obtain representative wind data upon approval from the ER and agreement from the ER and agreement from the IEC.

4.3 Laboratory Measurement/Analysis

- 4.3.1 A clean laboratory with constant temperature and humidity control, and equipped with necessary measuring and conditioning instruments, to handle the dust samples collected, shall be available for sample analysis, and equipment calibration and maintenance. The laboratory should be HOKLAS accredited or other internationally accredited laboratory.
- 4.3.2 If a site laboratory is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment shall be approved by the ER and in consultation with the IEC. Measurement performed by the laboratory shall be demonstrated to the satisfaction of the ER and the IEC. The IEC shall conduct regular audit to the measurement performed by the laboratory to ensure the accuracy of measurement results. The Contractor's ET leader shall provide the ER with one copy of the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B for his reference.
- 4.3.3 Filter paper of size 8"x10" shall be labelled before sampling. It shall be a clean filter paper with no pin holes, and shall be conditioned in a humidity controlled chamber for over 24-hr and be pre-weighed before use for the sampling.
- 4.3.4 After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper is then returned to the laboratory for reconditioning in the humidity controlled chamber followed by accurate weighing by an electronic balance with a readout down to 0.1 mg. The balance shall be regularly calibrated against a traceable standard.
- 4.3.5 All the collected samples shall be kept in a good condition for 6 months before disposal.

4.4 Monitoring Location

- 4.4.1 The dust monitoring locations are shown in Table ATT4-1 and Figures ATT4-4.1 to ATT4-4.3

Table ATT4-1
Air Quality Monitoring Stations during the Construction Stage

Monitoring Stations	RASR	Description	Secondary Channel
A8	KT14-1	Tin Sam Kau Tsuen	KT14
A9	KT14-4	Yuen Kong San Tsuen	KT14
A10	KT15-2	Tin Sam San Tsuen	KT15

- 4.4.2 Should the status and locations of dust sensitive receivers change after the issuing of this EM&A Manual, the ET Leader shall propose updated monitoring locations and seek approval from the Contractor, Engineer, IEC, DSD and EPD on the proposal.
- 4.4.3 In the case where alternative monitoring locations are proposed, the following criteria, as far as practicable, should be followed:
- (a) at the site boundary or such locations close to the major dust emission source;
 - (b) close to the sensitive receptors; and
 - (c) take into account the prevailing meteorological conditions.
- 4.4.4 The Contractor's ET leader shall agree with the ER on the position of the HVS for installation of the monitoring equipment. When positioning the samplers, the following points shall be noted:
- (a) a horizontal platform with appropriate support to secure the samplers against gusty wind should be provided;
 - (b) no two samplers should be placed less than 2 metres apart;
 - (c) the distance between the sampler and an obstacle, such as buildings, must be at least twice the height that the obstacle protrudes above the sampler;
 - (d) a minimum of 2 metres separation from walls, parapets and penthouses is required for rooftop samplers;
 - (e) a minimum of 2 metres separation from any supporting structure, measured horizontally is required;
 - (f) no furnace or incinerator flue is nearby;

- (g) airflow around the sampler is unrestricted;
- (h) the sampler is more than 20 metres from the dripline;
- (i) any wire fence and gate, to protect the sampler, should not cause any obstruction during monitoring;
- (j) permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
- (k) a secured supply of electricity is needed to operate the samplers.

4.5 Baseline Monitoring

- 4.5.1 The ET Leader shall carry out baseline monitoring at the designated monitoring locations for at least 14 consecutive days prior to the commissioning of the construction works to obtain daily 24-hr TSP samples. 1-hr sampling shall also be performed at least 3 times per day during the hours when highest TSP levels are expected.
- 4.5.2 During the baseline monitoring, there should not be any construction or dust generation activities in the vicinity of the monitoring stations.
- 4.5.3 In case that the baseline monitoring cannot be carried out at the designated monitoring locations during the baseline monitoring period, the ET Leader shall carry out the monitoring at alternative locations which can effectively represent the baseline conditions at the impact monitoring locations. The alternative baseline monitoring locations shall be approved by the Engineer and agreed with the IEC and EPD.
- 4.5.4 In exceptional case, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with IEC and EPD to agree on an appropriate set of data to be used as a baseline reference and submit this to the Engineer for approval.
- 4.5.5 Ambient conditions may vary seasonally and shall be reviewed at three monthly intervals. If the ET Leader considers that the ambient conditions have been changed and a repeat of the baseline monitoring is required to be carried out for obtaining the updated baseline levels, the monitoring should be conducted at times when construction activities are not generating dust, at least in the proximity of the monitoring stations. Should change in ambient conditions be determined, the baseline levels and, in turn, the air quality criteria, should be

revised. The revised baseline levels and air quality criteria should be agreed with the IEC and EPD.

4.6 Impact Monitoring

4.6.1 The ET Leader shall carry out impact monitoring at the designated monitoring locations during the course of the works. For regular impact monitoring, the sampling frequency of at least once in every six-days, shall be strictly observed at all the designated monitoring stations for 24-hr TSP monitoring. For 1-hr TSP monitoring, the sampling frequency of at least three times in every six-days should be undertaken when the highest dust impact occurs.

4.6.2 The specific time to start and stop the 24-hr TSP monitoring shall be clearly defined for the location and be strictly followed by the operator.

4.6.3 In case of non-compliance with the air quality criteria, more frequent monitoring exercise, as specified in the following Action Plan, shall be conducted within 24 hours after the result is obtained. This additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality is rectified.

4.7 Event and Action Plan for Air Quality

4.7.1 The baseline monitoring results shall form the basis for determining the air quality criteria for impact monitoring. The ET Leader shall compare the impact monitoring results with air quality criteria set up for 24-hour TSP and 1-hour TSP. Table ATT4-2 shows the air quality criteria, namely Action and Limit levels to be used. Should non-compliance of the air quality criteria occur, the ET, Engineer and Contractor shall undertake relevant actions in accordance with the Action Plan in Table ATT4-3.

Table ATT4-2
Action and Limit Levels for Air Quality

Parameters	Action Level		Limit Level
24 Hour TSP Level in $\mu\text{g}/\text{m}^3$	For baseline level $\leq 200 \mu\text{g}/\text{m}^3$ For baseline level $> 200 \mu\text{g}/\text{m}^3$	Action level = (Baseline level* 1.3 + Limit level)/2; Action level = Limit level	260
1 Hour TSP Level in $\mu\text{g}/\text{m}^3$	For baseline level $\leq 384 \mu\text{g}/\text{m}^3$ For baseline level $> 384 \mu\text{g}/\text{m}^3$	Action level = (Baseline level* 1.3 + Limit level)/2; Action level = Limit level	500

Table ATT4-3
Event/Action Plan for Air Quality

Event	ACTION			
	ET	IEC	Engineer	Contractor
ACTION LEVEL				
1. exceedance for one sample	1. Identify source 2. Inform IEC and Engineer 3. Repeat measurement to confirm finding 4. Increase monitoring frequency to daily	1. Check monitoring data submitted by ET 2. Check Contractor's working method	Notify Contractor	1. Rectify any unacceptable practice 2. Amend working methods if appropriate
2. Exceedance for two or more consecutive samples	1. Identify source 2. Inform IEC and Engineer 3. Repeat measurements to confirm findings 4. Increase monitoring frequency to daily 5. Discuss with IEC and Contractor on remedial actions required 6. If exceedance continues, arrange meeting with IEC and Engineer 7. If exceedance stops, cease additional monitoring	1. Check monitoring data submitted by ET 2. Check Contractor's working method 3. Discuss with ET and Contractor on possible remedial measures 4. Advice Engineer on the effectiveness of the proposed remedial measures 5. Supervise implementation of remedial measures	1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Ensure remedial measures properly implemented	1. Submit proposals for remedial actions to IEC within 3 working days of notification 2. Implement the agreed proposals 3. Amend proposal if appropriate

Event	ACTION			
	ET	IEC	Engineer	Contractor
LIMIT LEVEL				
1. Exceedance for one sample	1. Identify source 2. Inform Engineer and EPD 3. Repeat measurement to confirm finding 4. Increase monitoring frequency to daily 5. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and Engineer informed of the results	1. Check monitoring data submitted by ET 2. Check Contractor's working method 3. Discuss with ET and Contractor on possible remedial measures 4. Advice Engineer on the effectiveness of the proposed remedial measures 5. Supervise implementation of remedial measures	1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Ensure remedial measures properly implemented	1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to IEC within 3 working days of notification 3. Implement the agreed proposals 4. Amend proposal if appropriate
2. Exceedance for two or more consecutive samples	1. Notify IEC, Engineer and EPD 2. Identify source 3. Repeat measurement to confirm findings 4. Increase monitoring frequency to daily 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented. 6. Arrange meeting with IEC and Engineer to discuss the remedial actions to be taken 7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and Engineer informed of the results 8. If exceedance stops, cease additional monitoring	1. Discuss amongst Engineer, ET and Contractor on potential remedial actions 2. Review Contractor's remedial actions whether necessary to assure their effectiveness and advice the Engineer accordingly 3. Supervise implementation of remedial measures	1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. In consultation with the IEC, agree with the Contractor on the remedial measures to be implemented 4. Discuss amongst Environmental Team Leader and the Contractor potential remedial actions 5. Ensure remedial measures properly implemented 6. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated	1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to IEC within 3 working days of notification 3. Implement the agreed proposals 4. Resubmit proposals if problem still not under control 5. Stop the relevant portion of works as determined by the Engineer until the exceedance is abated

5. NOISE

5.1 Noise Parameters

5.1.1 The construction noise level shall be measured in terms of the A-weighted equivalent continuous sound pressure level (Leq). Leq (30 min) shall be used as the monitoring parameter for the time period between 0700-1900 hours on normal weekdays.

5.1.2 As supplementary information for data auditing, statistical results such as L₁₀ and L₉₀ shall also be obtained for reference. A sample data record sheet is shown in Annex B of this Manual.

5.2 Monitoring Equipment

5.2.1 As referred to in the Technical Memorandum (TM) issued under the Noise Control Ordinance (NCO), sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications shall be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement, the accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration level from before and after the noise measurement agree to within 1.0 dB.

5.2.2 Noise measurements should not be made in the presence of fog, rain, wind with a steady speed exceeding 5ms⁻¹ or wind with gusts exceeding 10ms⁻¹. The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s. Standard acoustical principles and practices should be observed during monitoring.

5.2.3 The ET leader is responsible for the provision of the monitoring equipment. He shall ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation shall be clearly labelled.

5.3 Monitoring Locations

5.3.1 Noise monitoring locations are shown in Table ATT4-4 and Figures ATT4-4.1 to ATT4-4.3.

Table ATT4-4

Noise Monitoring Stations during the Construction Stage

Monitoring Stations	RNSR	Description	Secondary Channel
N7	KT14-3	Yuen Kong San Tsuen	KT14
N8	KT14-1	Tin Sam Kau Tsuen	KT14
N9	KT14-4	Yuen Kong San Tsuen	KT14
N10	KT15-1	Tin Sam San Tsuen	KT15

5.3.2 Should the status and locations of noise sensitive receivers change after the issuing of this EM&A Manual, the ET Leader shall propose updated monitoring locations and seek approval from the Contractor, Engineer, IEC, DSD and EPD on the proposal.

5.3.3 In the case where alternative monitoring locations are proposed, the monitoring locations should be chosen based on the following criteria:

- (a) at locations close to the major site activities which are likely to have noise impacts;
- (b) close to the noise sensitive receivers (for the purpose of this section, any domestic premises, hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing art centre should be considered as noise sensitive receiver); and
- (c) for monitoring locations located in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance to the occupants during monitoring.

5.4 Baseline Monitoring

5.4.1 The ET Leader shall carry out baseline noise monitoring prior to the commencement of the construction works. The baseline monitoring shall be carried out continuously for a period of at least two weeks at interval of 5 minutes. The A-weighted noise level L_{eq} , L_{10} and L_{90} shall be recorded. A schedule on the baseline monitoring shall be submitted to the ER for approval before the monitoring starts.

5.4.2 There shall not be any construction activities in the vicinity during the baseline monitoring. In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with the IEC to agree on an appropriate set of data to be used as a baseline reference and submit to the EPD for approval.

5.5 Impact Monitoring

5.5.1 Noise monitoring shall be carried out at all the designated monitoring stations. The monitoring frequency for each station on a basis of each calendar week when noise generating activities are underway is as follows:

- one set of Leq (30min) between 0700-1900 hours on normal weekdays.

5.5.2 General construction work carried out during restricted hours is controlled by Construction Noise Permit (CNP) system under the Noise Control Ordinance (NCO). If a school is built near the construction activity, noise monitoring shall be carried out at the monitoring stations for the school during the examination periods. The ET Leader shall liaise with the school's personnel and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract.

5.6 Event and Action Plan for Noise

5.6.1 The Action and Limit levels for construction noise are defined in Table ATT4-5.

Table ATT4-5
Action and Limit Levels for Construction Noise

Time Period	Action Level	Limit Level
0700-1900 hrs on normal weekdays	When one documented complaint is received	75* dB(A)

* reduces to 70 dB(A) for schools and 65 dB(A) during school examination periods.

5.6.2 In the case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Action Plan in Table ATT4-6 shall be carried out. This additional monitoring shall be continued until the recorded noise levels are rectified or proved to be irrelevant to the construction activities.

Table ATT4-6
Event/Action Plan for Construction Noise

Event	ACTION			
	ET Leader	IEC	Engineer	Contractor
ACTION LEVEL	<ol style="list-style-type: none"> 1. Notify Contractor and Engineer 2. Carry out investigation 3. Report the results of investigation to the IEC and Contractor 4. Discuss with the Contractor and formulate remedial measures 5. Increase monitoring frequency to check mitigation effectiveness 	<ol style="list-style-type: none"> 1. Review the analysed results submitted by ET 2. Review the proposed remedial measures by the Contractor and advice the Engineer accordingly 3. Supervise implementation of remedial measures 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Require Contractor to propose remedial measures for the analysed noise problem 4. Ensure remedial measures properly implemented 	<ol style="list-style-type: none"> 1. Submit noise mitigation proposals for remedial actions to IEC 2. Implement the agreed proposals

Event	ACTION			
	ET Leader	IEC	Engineer	Contractor
LIMIT LEVEL	<ol style="list-style-type: none"> 1. Notify IEC, Engineer, EPD and Contractor 2. Identify source 3. Repeat measurement to confirm findings 4. Increase monitoring frequency 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented 6. Inform IEC, Engineer and EPD the causes & actions taken for the exceedances 7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and Engineer informed of the results 8. If exceedance stops, cease additional monitoring 	<ol style="list-style-type: none"> 1. Discuss amongst Engineer, ET and Contractor on potential remedial actions 2. Review Contractor's remedial actions whether necessary to assure their effectiveness and advice the Engineer accordingly 3. Supervise implementation of remedial measures 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Require Contractor to propose remedial measures for the analysed noise problem 4. Ensure remedial measures properly implemented 5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated 	<ol style="list-style-type: none"> 1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to IEC within 3 working days of notification 3. Implement the agreed proposals 4. Resubmit proposals if problem still not under control 5. Stop the relevant portion of works as determined by the Engineer until the exceedance is abated

- 5.6.3 If the proposed noise mitigation measures in the Project Profile are not sufficient to restore the construction noise quality to an acceptable levels, upon the advice of ET Leader, the Contractor shall liaise with the ET Leader on determining some other mitigation measures, propose to the Engineer for approval, and implement the alternative mitigation measures.

6. WATER QUALITY

6.1 Water Quality Parameters

- 6.1.1 Monitoring of pH value, dissolved oxygen (DO), turbidity, suspended solids (SS), ammoniacal nitrogen and zinc in mg/l shall be carried out by the ET to ensure that any deteriorating water quality could be readily detected and timely action be taken to rectify the situation. The former three parameters are measured in-situ while the latter three are determined in laboratory.
- 6.1.2 In association with the water quality parameters, other relevant data shall also be recorded, such as monitoring location/position, time, water depth, water temperature, salinity, DO saturation, weather conditions, and any special phenomena and work underway at the construction site. A sample data record sheet is shown in Annex B.

6.2 Monitoring Equipment

- 6.2.1 Water samples for all monitoring parameters shall be collected, stored, preserved and analysis according to the Standard Methods, APHA 17 ed. (or its update version) and/or methods agreed by the Director of Environmental Protection. In-situ measurements at monitoring locations including DO, turbidity, salinity and water depth shall be collected using equipment with the characteristics and functions listed in the following sections.

Dissolved Oxygen and Temperature Measuring Equipment

- 6.2.2 The instrument shall be a portable, weatherproof dissolved oxygen measuring instrument complete with cable, sensor, comprehensive operation manuals, and with the use of a DC power source. (e.g. YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument). It shall be capable of measuring:-
- a dissolved oxygen level in the range of 0-20 mg/l and 0-200% saturation; and
 - a temperature of 0-45 degree Celsius.

- 6.2.3 It shall have a membrane electrode with automatic temperature compensation complete with a cable. Sufficient stocks of spare electrodes and cables shall be available for replacement where necessary.
- 6.2.4 Should salinity compensation not be built-in to the DO equipment, in-situ salinity shall be measured to calibrate the DO equipment prior to each DO measurement.

Turbidity Measurement Instrument

- 6.2.5 The instrument shall be a portable, weatherproof turbidity-measuring instrument complete with comprehensive operation manual. The equipment shall use a DC power source. It shall have a photoelectric sensor capable of measuring turbidity between 0-1000 NTU (e.g. Hach model 2100P or an approved similar instrument).

Suspended Solids

- 6.2.6 Sampling shall be carried out using a water sampler which comprises a transparent PVC cylinder, with a capacity of not less than 2 litres, and can be effectively sealed with latex cups at both ends. The sampler shall have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth (e.g. Kahlsico Water Sampler or an approved similar instrument).
- 6.2.7 Water samples for suspended solids measurement shall be collected in high density polythene bottles, packed in ice (cooled to 4°C without being frozen), and delivered to the laboratory as soon as possible after collection.

Water Depth Detector

- 6.2.8 A portable, battery-operated echo sounder shall be used for the determination of water depth at each designated monitoring station. This unit can either be handheld or affixed to the bottom of the work boat, if the same vessel is to be used throughout the monitoring programme.

Salinity

- 6.2.9 A portable salinometer capable of measuring salinity in the range of 0-40 mg/l shall be provided for measuring salinity of the water at each monitoring location.
- 6.2.10 If necessary a hand-held or boat-fixed type digital Global Positioning System (GPS) with way point bearing indication or other equivalent instrument of similar accuracy shall be provided and used during monitoring to ensure the monitoring vessel is at the correct location before taking measurements.
- 6.2.11 All in-situ monitoring instrument shall be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes shall be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter shall be carried out before measurement at each monitoring location.
- 6.2.12 For the on-site calibration of field equipment, the BS 127:1993, "Guide to Field and on-site test methods for the analysis of waters" shall be observed.
- 6.2.13 Sufficient stocks of spare parts shall be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when some equipment is under maintenance, calibration, etc.

6.3 Laboratory Measurement/Analysis

- 6.3.1 Analysis of suspended solids shall be carried out in a HOKLAS or other international accredited laboratory. Water samples of about 1,000 ml shall be collected at the monitoring stations for carrying out the laboratory determination of SS, ammoniacal nitrogen and zinc. The laboratory determination shall follow APHA 17ed (or its update version) 2540D or equivalent methods subject to the approval of the IEC and EPD.
- 6.3.2 If a site laboratory is set up or a non-HOKLAS and non-international accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control shall be approved by the IEC and EPD. All the analyses shall be approved by the Engineer. The ET Leader shall provide the Engineer with one copy of the relevant chapters of the "Standard Methods for the Examination of Water and Wastewater" updated edition and any other relevant document for reference.

- 6.3.3 For the testing methods of other parameters as recommended in the report or required by EPD, detailed testing methods, pre-treatment procedures, instrument use, Quality Assurance/Quality Control (QA/QC) details (such as blank, spike recovery, number of duplicate samples per batch, etc.), detection limits and accuracy shall be submitted to EPD for approval prior to the commencement of monitoring programme. The QA/QC shall be in accordance with the requirement of HOKLAS or international accredited scheme. The QA/QC results shall be reported. EPD may also request the laboratory to carry out analysis of known standards provided by EPD for quality assurance. Additional duplicate samples may be required by EPD for inter laboratory calibration. Remaining samples after analysis shall be kept by the laboratory for 3 months in case repeat analysis is required. If in-house or non-standard methods are proposed, details of the method verification may also be required to submit to EPD. In any circumstance, the sample testing shall have comprehensive quality assurance and quality control programmes. The laboratory shall prepare to demonstrate the programmes to EPD or his representatives when requested.

6.4 Monitoring Locations

- 6.4.1 The water quality monitoring locations are shown in shown in Table ATT4-7 and Figures ATT4-4.1 to ATT4-4.3. Should the status and locations of water quality sensitive receivers change after the issuing of this EM&A Manual, the ET Leader shall propose updated monitoring locations and seek approval from the Contractor, Engineer, IEC, DSD and EPD.

Table ATT4-7
Water Quality Monitoring Locations during the Construction Stage

Monitoring Stations	Description	Secondary Channel
W8A & W8B	Tin Sam Kau Tsuen	KT14
W8C & W8D	Yuen Kong San Tsuen	KT14
W9A & W9B	Tin Sam San Tsuen	KT15

- 6.4.2 In the case where alternative monitoring locations are proposed, these should be chosen based on the following criteria:
- (a) at locations close to and preferably at the boundary of major site activities which are likely to have water quality impacts;
 - (b) close to the sensitive receptors which are directly or likely to be affected;

- (c) for monitoring locations located in the vicinity of the sensitive receptors, care should be taken to cause minimal disturbance during monitoring; and
- (d) at two or more control stations which shall be at locations representative of the project site in its undisturbed condition; control stations should be located, as far as is practicable, both upstream and down stream of the works area.

6.4.3 Control stations are necessary to compare the water quality from potentially impacted sites with the ambient water quality. Control stations shall be located within the same body of water as the impact monitoring stations but should be outside the area of influence of the works and, as far as practicable, not affected by any other works.

6.4.4 Measurements shall be taken at 3 water depths, namely, 1m below water surface, mid-depth and 1m above channel bed, except where the water depth is less than 6m, the mid-depth may be omitted. Should the water depth be less than 3m, only the mid-depth will be monitored. The ET Leader shall seek approval from the IEC and EPD on all the monitoring stations.

6.5 Baseline Monitoring

6.5.1 Baseline conditions for water quality shall be established and agreed with the IEC and EPD prior to the commencement of works. The purposes of the baseline monitoring are to establish ambient conditions prior to the commencement of the works and to demonstrate the suitability of the monitoring stations. The baseline conditions shall normally be established by measuring the water quality parameters specified in this Chapter. The measurements shall be taken at all designated monitoring stations, 3 days per week, for four weeks prior to the commencement of the works.

6.5.2 There shall not be any construction activities in the vicinity of the stations during the baseline monitoring.

6.5.3 In the exceptional case when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall seek approval from the IEC and EPD on an appropriate set of data to be used as baseline reference.

6.5.4 Baseline monitoring schedule shall be sent to EPD 1 week prior to the commencement of baseline monitoring. The interval between 2 sets of monitoring shall not be lesser than 36 hours.

6.6 Impact Monitoring

6.6.1 DO, SS, pH, ammonia, turbidity and zinc should be measured at all the designated monitoring locations.

6.6.2 Monitoring shall be undertaken twice a week with sampling/measurement at the designated monitoring stations.

6.7 Event and Action Plan for Water Quality

6.7.1 The water quality criteria, namely Action and Limit levels are shown in Table ATT4-8.

Table ATT4-8
Action and Limit Levels for Water Quality

Parameters	Action Level	Limit Level
DO in mg/L (mid-depth)	5%-ile of baseline data	4 mg/L or 1%-ile of baseline data
SS in mg/L (mid-depth)	95%-ile of baseline data or 120% of upstream control station's SS of the same day	99%-ile of baseline or 130% of the results of upstream control station's SS of the same day
Turbidity in NTU, pH, ammonia and Zinc (mid-depth)	95%-ile of baseline data or 120% of upstream control station's turbidity, pH, ammonia and Zinc of the same day	99%-ile of baseline or 130% of the results of upstream control station's turbidity, pH, ammonia and Zinc of the same day

Notes:

- For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- For SS, turbidity, pH, ammonia and Zinc, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.
- All the figures given in the table are used for reference only and the EPD may amend the figures whenever it is considered as necessary.

6.7.2 Should the monitoring results of the water quality parameters at any designated monitoring stations indicate non-compliance with the water quality criteria, actions in accordance with the Action Plan in Table ATT4-9 shall be carried out.

Table ATT4-9
Event and Action Plan for Water Quality

Event	ET Leader	IEC	Engineer	Contractor
Action Level (being exceeded by one sampling day)	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings 2. Identify source(s) of impact 3. Inform IEC and Contractor 4. Check monitoring data, all plant, equipment and Contractor's working methods 5. Discuss mitigation measures IEC and Contractor 6. Repeat measurement on next day of exceedance 	<ol style="list-style-type: none"> 1. Discuss with ET and Contractor on the mitigation measures 2. Review proposals on mitigation measures submitted by Contractor and advice Engineer accordingly 3. Assess the effectiveness of the implemented mitigation measures 	<ol style="list-style-type: none"> 1. Discuss with IEC on the proposed mitigation measures 2. Make agreement on the mitigation measures to be implemented 	<ol style="list-style-type: none"> 1. Inform Engineer and confirm notification of the non-compliance in writing 2. Rectify unacceptable practice 3. Check all plant and equipment 4. Consider changes of working methods 5. Discuss with ET and IEC and propose mitigation measures to IEC and Engineer 6. Implement the agreed mitigation measures
Action Level (being exceeded by more than one sampling day)	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings 2. Identify source(s) of impact 3. Inform IEC, Contractor and EPD 4. Check monitoring data, all plant, equipment and Contractor's working methods 5. Discuss mitigation measures IEC, Engineer and Contractor 6. Repeat measurement on next day of exceedance 7. Ensure mitigation measures are implemented 8. Prepare to increase the monitoring frequency to daily 9. Repeat measurement on next day of exceedance 	<ol style="list-style-type: none"> 1. Discuss with ET and Contractor on the mitigation measures 2. Review proposals on mitigation measures submitted by Contractor and advice Engineer accordingly 3. Assess the effectiveness of the implemented mitigation measures 	<ol style="list-style-type: none"> 1. Discuss with IEC on the proposed mitigation measures 2. Make agreement on the mitigation measures to be implemented 3. Assess the effectiveness of the implemented mitigation measures 	<ol style="list-style-type: none"> 1. Inform Engineer and confirm notification of the non-compliance in writing 2. Rectify unacceptable practice 3. Check all plant and equipment 4. Consider changes of working methods 5. Discuss with ET and IEC and propose mitigation measures to IEC and Engineer within 3 working days 6. Implement the agreed mitigation measures

Event	ET Leader	IEC	Engineer	Contractor
Limit Level (being exceeded by one sampling days)	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings 2. Identify source(s) of impact 3. Inform IEC, Contractor and EPD 4. Check monitoring data, all plant, equipment and Contractor's working methods 5. Discuss mitigation measures IEC, Engineer and Contractor 6. Ensure mitigation measures are implemented 7. Increase the monitoring frequency to daily until no exceedance of Limit level 	<ol style="list-style-type: none"> 1. Discuss with ET and Contractor on the mitigation measures 2. Review proposals on mitigation measures submitted by Contractor and advice Engineer accordingly 3. Assess the effectiveness of the implemented mitigation measures 	<ol style="list-style-type: none"> 1. Discuss with IEC, ET and Contractor on the proposed mitigation measures 2. Request Contractor to critically review the working methods 3. Make agreement on the mitigation measures to be implemented 4. Assess the effectiveness of the implemented mitigation measures 	<ol style="list-style-type: none"> 1. Inform Engineer and confirm notification of the non-compliance in writing 2. Rectify unacceptable practice 3. Check all plant and equipment 4. Consider changes of working methods 5. Discuss with ET, IEC and Engineer and propose mitigation measures to IEC and Engineer within 3 working days 6. Implement the agreed mitigation measures
Limit Level (being exceeded by more than one sampling days)	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform Contractor, Engineer, IEC and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, Engineer and Contractor; 6. Ensure mitigation measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of Limit level 	<ol style="list-style-type: none"> 1. Discuss with ET and Contractor on the mitigation measures 2. Review proposals on mitigation measures submitted by Contractor and advice Engineer accordingly 3. Assess the effectiveness of the implemented mitigation measures 	<ol style="list-style-type: none"> 1. Discuss with IEC, ET and Contractor on the proposed mitigation measures 2. Request Contractor to critically review the working methods 3. Make agreement on the mitigation measures to be implemented 4. Assess the effectiveness of the implemented mitigation measures 5. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the construction activities until daily until no exceedance of Limit level 	<ol style="list-style-type: none"> 1. Inform Engineer and confirm notification of the non-compliance in writing 2. Rectify unacceptable practice 3. Check all plant and equipment 4. Consider changes of working methods 5. Discuss with ET, IEC and Engineer and propose mitigation measures to IEC and Engineer within 3 working days Propose mitigation measures to Engineer within 3 working days 6. Implement the agreed mitigation measures; 7. As directed by Engineer, to slow down or to stop all or part of the construction activities

7. ECOLOGY MONITORING AND AUDIT

7.1 Objectives

7.1.1 The objectives of the ecology monitoring are:

- (a) To verify the accuracy of the impact predictions;
- (b) To check if the recommended mitigation measures are implemented fully;
- (c) To examine the effectiveness of the recommended mitigation measures;
- (d) To check whether the residual impacts comply with relevant ecological requirements; and
- (e) To recommend timely action plans to rectify any unacceptable impacts.

7.2 Equipment

7.2.1 Standard portable field survey equipment is required for ecological monitoring as follows:

- (a) Binoculars of not less than 8 x 30 magnification;
- (b) Butterfly net (to confirm identities of butterflies and dragonflies);
- (c) Camera (films or digital); and
- (d) Notebook and field survey forms.

7.3 Monitoring Areas

7.3.1 Ecological monitoring during the construction period should be undertaken in the seasonal wetland area shown in Figures ATT4-7.1 and ATT4-7.2. The purpose of this monitoring is to check that adverse effects on wetland-dependent fauna do not occur as a consequence of direct impacts on the wetlands by construction activities or through indirect impacts as a consequence of alterations to the water table.

7.3.2 Post-construction monitoring should cover both this area and the section of KT15 where a rock bed to the channel will be formed. The purpose of this post-construction monitoring is twofold. As well as monitoring any direct and indirect impacts on the seasonal wetlands (as in the construction period) the

monitoring of the section of KT15 where a rock bed to the channel will be formed will permit assessment of the success of this technique in creating suitable conditions for colonisation by aquatic invertebrates.

7.4 Baseline Monitoring

7.4.1 The baseline monitoring should be performed within the seasonal wetland areas indicated in Section 7.3. This monitoring is required in order to provide a baseline record of the status of the seasonal-wetland adapted flora prior to the commencement of construction works. This monitoring should:

- (a) establish a habitat map showing current conditions throughout the monitoring area; and
- (b) establish a photographic record of vegetation within the monitoring area.

7.4.2 Note that baseline fauna monitoring is not required as adequate data has been collected during the course of the Study to provide a baseline for the monitoring of future changes.

7.5 Impact Monitoring

Construction Phase

7.5.1 Construction phase monitoring at areas as indicated in Section 7.3 should cover the following:

- (a) Monitoring of construction activities:
 - (i) Monthly monitoring of construction activities adjacent to the wetland areas to identify any intrusions of construction activities into the wetland areas and monthly monitoring of the wetland areas themselves to check that there is no adverse impact on the wetlands as a consequence of changes to the water table that are attributable to the project, if any.
 - (ii) A photographic record should be made at six monthly intervals and checked against the baseline record.

(b) Fauna Monitoring:

Monthly surveys should be undertaken during the construction phase in the wetland areas during the wet season (April to July inclusive) for the following faunal groups: reptiles, amphibians, dragonflies and butterflies. Monthly bird surveys should be conducted throughout the year.

Operation Phase

7.5.2 Operational phase monitoring should be conducted within the channels and in the wetland areas for one year after the completion of construction. Monthly surveys should be conducted during the wet season (April to July inclusive) for reptiles, amphibians, dragonflies and butterflies and monthly bird surveys should be conducted throughout the one year period. In addition, quarterly aquatic invertebrate surveys should be conducted within the section of KT15 where a rock bed to the channel will be formed (surveys to be conducted four times during the one year monitoring period).

7.5.3 The ET and IEC are required to verify all the specific channel lining designs as described in the Project Profile are implemented at design and construction stage.

7.6 Ecology Event and Action Plan

7.6.1 Ecological changes around the Project sites may occur as a result of many unforeseen circumstances. The ET Leader may amend the action and limit levels set out in Table ATT4-10 in consultation with AFCD.

7.6.2 If the monitoring results of the ecological parameters at any designated monitoring stations indicate non-compliance with the ecological criteria listed in Table ATT4-10 below during either the construction period or during the one year post-construction monitoring period, the actions in accordance with the Action Plan in Table ATT4-11 should be undertaken.

Table ATT4-10.
Action and Limit Levels for Ecology

Parameters	Action level	Limit level
Fauna: decrease in the total number of wetland dependant species or individuals of the surveyed faunal groups from baseline	20-40%	> 40%

Table ATT4-11.
Event/Action Plan for Ecology

Event	ET Leader	IEC	Contractor	Engineer
Fauna The total number of species or individuals of the surveyed wetland dependant faunal groups is reduced by 20-40% from baseline	<ul style="list-style-type: none"> Notify IEC and Contractor; Check the position and state of the current works to identify the causes; Discuss mitigation measures with IEC and Contractor 	<ul style="list-style-type: none"> Discuss with ET and Contractor on the mitigation measures Review proposals on mitigation measures submitted by Contractor and advice Engineer accordingly Assess the effectiveness of the implemented mitigation measures 	<ul style="list-style-type: none"> Inform Engineer and confirm notification of non-compliance in writing; Take immediate action to avoid further exceedances; Check all plant and equipment and working methods, especially noise emanating ones Discuss with ET and IEC and propose mitigation measures to IEC and Engineer Implement the agreed mitigation measures 	<ul style="list-style-type: none"> Discuss with IEC on the proposed mitigation measures; Reach agreement on the mitigation measures to be implemented;

7.6.3 Proposed ecological mitigation measures are given in the Project Profile. Upon the advice of ET Leader, the Contractor shall liaise with the ET Leader on determining additional mitigation measures, propose to the Engineer for approval, and implement these measures.

8. WASTE

8.1 Construction Phase

8.1.1 Prior construction, a Sediment Quality Report should be prepared to assess the quality of the potentially contaminated sediments to be excavated from KT15 stream and to propose suitable disposal plans for this waste.

8.1.2 The Contractor is also required to follow the proposed mitigation measures described in the Project Profile and to prepare and submit a Waste Management Plan (WMP) to the Engineer. He shall assess qualitatively and quantitatively the construction waste likely to arise from the proposed works for KT14 and KT15, and to propose suitable disposal and recycling procedures for the construction waste.

8.2 Operation Phase

- 8.2.1 The Sediment Quality Report should also include a characterization and a prediction of the quantity of the sediments likely to arise during maintenance dredging of the proposed secondary channels KT14 and KT15.

9. SITE ENVIRONMENTAL AUDIT

9.1 Site Inspections

- 9.1.1 Site inspections provide a direct means to trigger and enforce the specified environmental protection and pollution control measures. These shall be undertaken regularly to inspect the construction activities in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented. With well defined pollution control and mitigation specifications and a well established site inspection, deficiency and action reporting system, the site inspection is one of the most effective tools to enforce the environmental protection requirements on the construction site.
- 9.1.2 The ET Leader is responsible for formulation of the environmental site inspection, deficiency and action reporting system, and for carrying out the site inspection works. The ET Leader shall submit a proposal on the site inspection, deficiency and action reporting procedures within 21 days of the construction contract commencement to the Contractor for agreement and to the Engineer for approval.
- 9.1.3 Regular site inspections shall be carried out at least once per week. The areas of inspection shall not be limited to the environmental situation, pollution control and mitigation measures within the site; it should also review the environmental situation outside the site area which is likely to be affected, directly or indirectly, by the site activities. The ET Leader shall make reference to the following information in conducting the inspection:
- (a) recommendations on environmental protection and pollution control mitigation measures as documented in the Project Profile and its Attachments;
 - (b) works progress and program;
 - (c) individual works methodology proposals (which shall include proposal on associated pollution control measures);
 - (d) the contract specifications on environmental protection;

- (e) the relevant environmental protection and pollution control laws; and
- (f) previous site inspection results.

9.1.4 The Contractor shall update the ET Leader with all relevant information of the construction activities. The inspection results and the associated recommendations on improvements to environmental protection and pollution control shall be submitted to the Engineer and Contractor within 24 hours, for reference and for taking immediate action. The Contractor shall follow the procedures and time-frame as stipulated in the environmental site inspection, deficiency and action reporting system formulated by the ET Leader to report on any remedial measures subsequent to the site inspection.

9.1.5 Ad hoc site inspections shall also be carried out if significant environmental problems are identified. Inspections may also be required subsequent to receipt of an environmental complaint, or as part of the investigation work, as specified in the Action Plan for environmental monitoring and audit.

9.2 Compliance with Legal and Contractual Requirements

9.2.1 The Contractor shall comply with all relevant legal requirements as well as contractual requirements.

9.2.2 All the works method statements submitted by the Contractor to the Engineer for approval shall be sent to the ET Leader for reviewing whether sufficient environmental protection and pollution control measures are included.

9.2.3 The ET Leader shall also review the progress and program of the works to check that relevant environmental laws have not been violated, and that the any foreseeable potential for violating the laws can be prevented.

9.2.4 The Contractor shall regularly copy relevant documents to the ET Leader so that the checking work can be carried out. The document shall at least include the updated Work Progress Reports, the updated Works Program, the application letters for different licence/permits under the environmental protection laws, and all valid licences/permits. The site diary shall also be available for the ET Leader's inspection upon request.

9.2.5 After reviewing the document, the ET Leader shall advise the Engineer and Contractor of any non-compliance with the contractual and legislative requirements on environmental protection and pollution control. If this review concludes that the current status on licence/permit application and any environmental protection and pollution control preparation works may not cope

with the works program or may result in potential violation of environmental protection and pollution control requirements, the ET leader shall advise the Contractor and the Engineer accordingly.

9.2.6 Upon receipt of the advice, the Contractor shall undertake immediate action to remedy the situation. The Engineer shall follow up to ensure that appropriate action has been taken by the Contractor in order that the environmental protection and pollution control requirements are fulfilled.

9.2.7 A flow chart of the general construction phase EM&A procedures is shown in Figure ATT4-9.1.

9.3 Environmental Compliants

9.3.1 Complaints shall be referred to the ET Leader for the carrying out complaint investigation. The ET Leader shall undertake the following procedures upon receipt of the complaints:

- (a) log complaint and date of receipt onto the complaint database and inform the IEC immediately;
- (b) investigate the complaint to determine its validity, and to assess whether the source of the problem is due to project works;
- (c) if a complaint is valid and due to project works, identify mitigation measures in consultation with the IEC;
- (d) if mitigation measures are required, advise the Contractor accordingly;
- (e) review the Contractor's implementation of the identified and required mitigation measures, and the current situation ;
- (f) if the complaint is transferred from EPD, submit interim report to EPD on status of the complaint investigation and follow-up action within the time frame assigned by EPD;
- (g) undertake additional monitoring and audit to verify the complaint if necessary, and ensure that any valid reason for complaint does not recur through proposed amendments to work methods, procedures, machines and/or equipment, etc.;
- (h) report the investigation results and the subsequent actions to the source of complaint for responding to complainant (If the source of complaint

is EPD, the results should be reported within the time frame assigned by EPD); and

- (i) log a record of the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

9.3.2 During the complaint investigation work, the Contractor and Engineer shall co-operate with the ET Leader in providing all the necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation (in consultation with the IEC), the Contractor shall promptly carry out the measures. The Engineer shall ensure that the measures have been carried out by the Contractor.

9.3.3 A flow chart of the complaint response procedures, which addresses complaint receiving channels, responsible parties/contacts for information/action, the investigation process, procedures for the implementation of mitigation/remedial action, guidelines for communication and public relation with the complainant etc., is shown in Figure ATT4-9.2.

9.3.4 A sample complaint log form is included in Annex B.

10. REPORTING

10.1 General

10.1.1 Reports can be provided in an electronic medium upon agreeing the format with the ER and EPD. This would enable a transition from a paper / historic and reactive approach to an electronic / real time and proactive approach. All the monitoring data (baseline and impact) shall also be submitted on diskettes.

10.1.2 Types of reports that the ET Leader shall prepare and submit include baseline monitoring report, monthly EM&A report, quarterly EM&A summary report and final EM&A review report. In accordance with Annex 21 of the EIAO-TM, a copy of the monthly, quarterly summary and final review EM&A reports shall be made available to the Director of Environmental Protection.

10.2 Baseline Monitoring Report

10.2.1 The ET Leader shall prepare and submit a Baseline Environmental Monitoring Report within 10 working days of completion of the baseline monitoring. Copies of the Baseline Environmental Monitoring Report shall be submitted to the Contractor, the IEC, the ER and the EPD. The ET Leader shall liaise with

the relevant parties on the exact number of copies they require. The report format and baseline monitoring data format shall be agreed with the EPD prior to submission.

10.2.2 The baseline monitoring report shall include at least the following:

- (i) up to half a page executive summary;
- (ii) brief Project background information;
- (iii) drawings showing locations of the baseline monitoring stations;
- (iv) monitoring results (in both hard and diskette copies) together with the following information:
 - monitoring methodology;
 - name of laboratory and types of equipment used and calibration details;
 - parameters monitored;
 - monitoring locations;
 - monitoring date, time, frequency and duration; and
 - quality assurance (QA) / quality control (QC) results and detection limits;
- (v) details of influencing factors, including:
 - major activities, if any, being carried out on the site during the period;
 - weather conditions during the period; and
 - other factors which might affect the monitoring results;
- (vi) determination of the Action and Limit Levels for each monitoring parameter and statistical analysis of the baseline data, the analysis shall conclude if there is any significant difference between control and impact stations for the parameters monitored;
- (vii) revisions for inclusion in the EM&A Manual; and
- (viii) comments, recommendations and conclusions.

10.3 Monthly EM&A Report

10.3.1 The results and findings of all EM&A work required in the Manual shall be recorded in the monthly EM&A reports prepared by the ET Leader. The EM&A report shall be prepared and submitted within 10 working days of the end of each reporting month, with the first report due one month after construction commences. Each monthly EM&A report shall be submitted to the following parties: the Contractor, the IEC, the ER and the EPD. Before submission of the first EM&A report, the ET Leader shall liaise with the parties on the required number of copies and format of the monthly reports in both hard copy and electronic medium.

- 10.3.2 The ET leader shall review the number and location of monitoring stations and parameters every six months, or on as needed basis, in order to cater for any changes in the surrounding environment and the nature of works in progress.

First Monthly EM&A Report

- 10.3.3 The first monthly EM&A report shall include at least the following:
- (i) executive summary (1-2 pages):
 - breaches of Action and Limit levels;
 - complaint log;
 - notifications of any summons and successful prosecutions;
 - reporting changes; and
 - future key issues.
 - (ii) basic Project information:
 - Project organisation including key personnel contact names and telephone numbers;
 - programme;
 - management structure; and
 - work undertaken during the month.
 - (iii) environmental status:
 - work undertaken during the month with illustrations (such as location of works, daily excavation rate, etc); and
 - drawings showing the Project area, any environmental sensitive receivers and the locations of the monitoring and control stations (with co-ordinates of the monitoring locations).
 - (iv) a brief summary of EM&A requirements including:
 - all monitoring parameters;
 - environmental quality performance limits (Action and Limit levels);
 - Event-Action Plans;

- environmental mitigation measures, as recommended for the Project; and
 - environmental requirements in contract documents.
- (v) implementation status:
advice on the implementation status of environmental protection and pollution control / mitigation measures, as recommended for the Project, summarized in the updated implementation schedule.
- (vi) monitoring results (in both hard and diskette copies) together with the following information:
- monitoring methodology;
 - name of laboratory and types of equipment used and calibration details;
 - parameters monitored;
 - monitoring locations;
 - monitoring date, time, frequency, and duration;
 - weather conditions during the period;
 - any other factors which might affect the monitoring results; and
 - QA/QC results and detection limits.
- (vii) report on non-compliance, complaints, and notifications of summons and successful prosecutions:
- record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
 - record of all complaints received (written or verbal) for each media, including locations and nature of complaints, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
 - record of all notification of summons and successful prosecutions for breaches of current environmental protection / pollution control legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary;
 - review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
 - description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.

(viii) others

- an account of the future key issues for the next three months as reviewed from the works programme and works method statements;
- advice on the solid and liquid waste management status; and
- comments (for examples, effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.

Subsequent EM&A Reports

10.3.4 Subsequent monthly EM&A reports shall include the following:

- (i) executive summary (1 - 2 pages):
 - breaches of Action and Limit levels;
 - complaints log;
 - notifications of any summons and successful prosecutions;
 - reporting changes; and
 - future key issues.
- (ii) basic Project information:
 - Project organisation including key personnel contact names and telephone numbers;
 - programme;
 - management structure; and
 - work undertaken during the month.
- (iii) environmental status:
 - work undertaken during the month with illustrations (such as location of works, daily excavation rate, etc.); and
 - drawing showing the Project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
- (iv) implementation status:

advice on the implementation status of environmental protection and pollution control / mitigation measures, as recommended for the Project, summarized in the updated implementation schedule.
- (v) monitoring results (in both hard and diskette copies) together with the following information:
 - monitoring methodology;
 - name of laboratory and types of equipment used and calibration details;

- parameters monitored;
 - monitoring locations;
 - monitoring date, time, frequency, and duration;
 - weather conditions during the period;
 - any other factors which might affect the monitoring results; and
 - QA / QC results and detection limits.
- (vi) report on non-compliance, complaints, and notifications of summons and successful prosecutions:
- record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
 - record of all complaints received (written or verbal) for each media, including locations and nature of complaints, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
 - record of all notification of summons and successful prosecutions for breaches of current environmental protection / pollution control legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary;
 - review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
 - description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.
- (vii) others
- an account of the future key issues for the next three months as reviewed from the works programme and works method statements;
 - advice on the solid and liquid waste management status; and
 - comments (for examples, effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.
- (viii) appendix
- Action and Limit levels;
 - graphical plots of trends of monitored parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following:
 - a) major activities being carried out on site during the period;
 - b) weather conditions during the period; and

- c) any other factors that might affect the monitoring results.
- monitoring schedule for the present and next reporting period;
- cumulative statistics on complaints, notifications of summons and successful prosecutions; and
- outstanding issues and deficiencies.

10.4 Quarterly EM&A Summary Report

10.4.1 A quarterly EM&A summary report of around five pages shall be produced and shall contain at least the following information. The quarterly EM&A report shall be prepared and submitted **within** 10 working days of the end of each reporting quarter.

- (i) executive summary (1 - 2 pages);
- (ii) basic Project information including a synopsis of the project organisation, programme, contacts of key management, and the work undertaken during the quarter;
- (iii) a brief summary of EM&A requirements including:
 - monitoring parameters;
 - environmental quality performance limits (Action and Limit levels); and
 - environmental mitigation measures, as recommended for the Project;
- (iv) advice on the implementation status of environmental protection and pollution control / mitigation measures, as recommended for the Project, summarised in the updated implementation schedule;
- (v) drawings showing the Project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
- (vi) graphical plots of any trends of monitored parameters over the past four months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against the following:
 - the major activities being carried out on site during the period;
 - weather conditions during the period; and
 - any other factors which might affect the monitoring results;
- (vii) advice on the solid and liquid waste management status;
- (viii) a summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- (ix) a brief review of the reasons for and the implications of any non-compliance, including a review of pollution sources and working procedures;
- (x) a summary description of actions taken in the event of non-compliance and any follow-up procedures related to any earlier non-compliance;

- (xi) a summarised record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
- (xii) comments (for examples, a review of the effectiveness and efficiency of the mitigation measures and the performance of the environmental management system, that is, of the overall EM&A programme); recommendations (for example, any improvement in the EM&A programme) and conclusions for the quarter; and
- (xiii) proponents' contacts and any hotline telephone number for the public to make enquiries.

10.5 Final EM&A Review Report

10.5.1 The final EM&A report shall be prepared and submitted within one month after the completion of post-Project monitoring, and it should contain at least the following information:

- (i) executive summary (1 - 2 pages);
- (ii) drawings showing the Project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
- (iii) basic Project information including a synopsis of the project organisation, contacts of key management, and the work undertaken during the course of the Project or past twelve months;
- (iv) a brief summary of EM&A requirements including:
 - environmental mitigation measures, as recommended for the Project;
 - environmental quality performance limits (Action and Limit levels);
 - all monitoring parameters; and
 - event-action plans.
- (v) a summary of the implementation status of environmental protection and pollution control / mitigation measures, as recommended for the Project, summarised in the updated implementation schedule ;
- (vi) graphical plots and the statistical analysis of the trends of monitored parameters over the course of the Project, including the post-project monitoring for all monitoring stations annotated against the following:
 - the major activities being carried out on site during the period;
 - weather conditions during the period; and
 - any other factors which might affect the monitoring results;
- (vii) a summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);

- (viii) a review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures as appropriate;
- (ix) a description of the actions taken in the event of non-compliance;
- (x) a summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
- (xi) a summary record of notifications of summons and successful prosecutions for breaches of the current environmental protection / pollution control legislation, locations and nature of the breaches, investigation, follow-up actions taken and results;
- (xii) a review of the validity of environmental predictions and identification of shortcomings in the environmental recommendations;
- (xiii) comments (for examples, a review of the effectiveness and efficiency of the mitigation measures and a review of the performance of the environmental management system, that is, of the overall EM&A programme); and
- (xiv) recommendations and conclusions (for example, a review of success of the overall EM&A programme to cost-effectively identify deterioration and to initiate prompt effective mitigatory action when necessary).

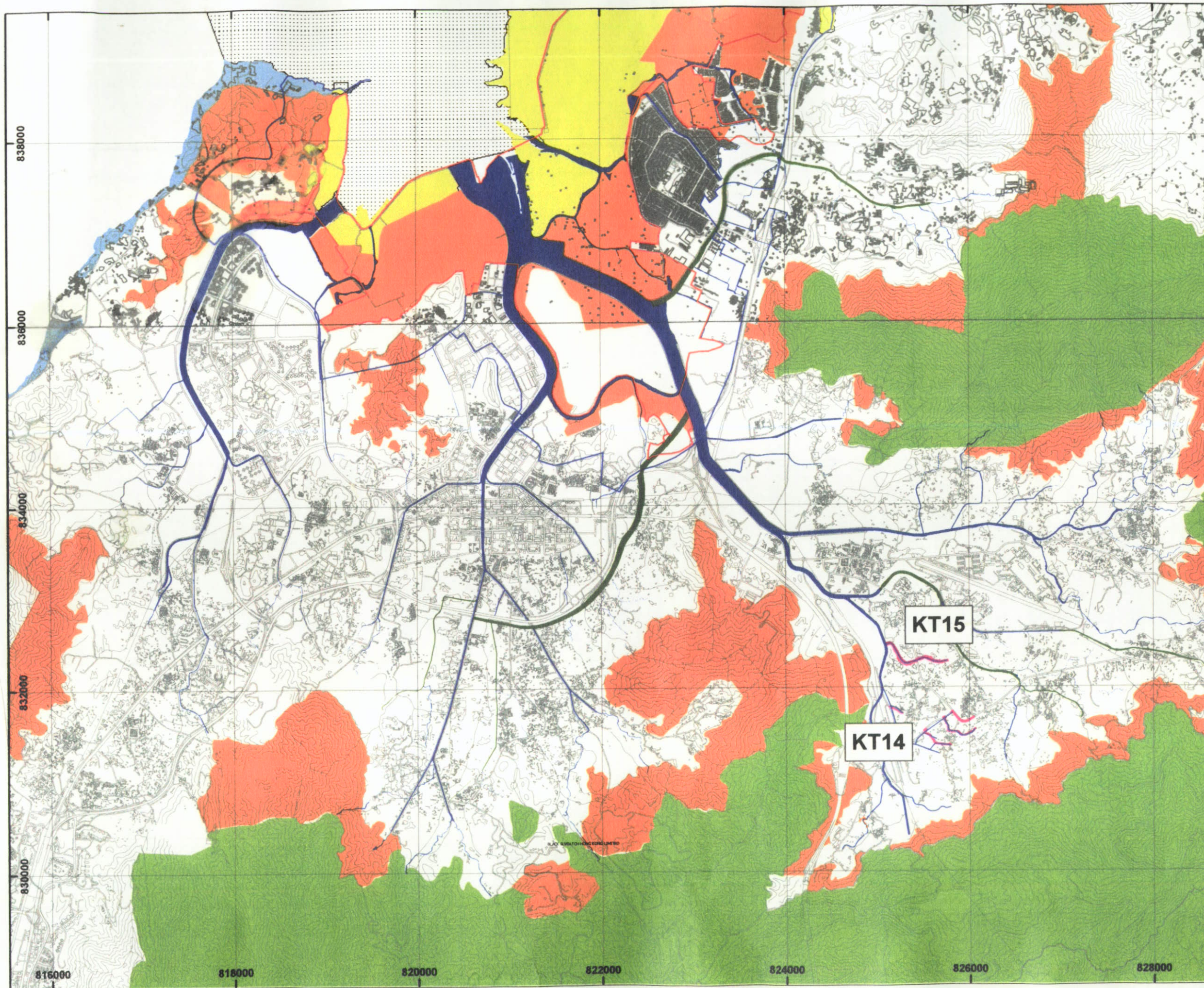
10.6 Data Keeping

- 10.6.1 No site-based documents (such as monitoring field records, laboratory analysis records, site inspection forms, etc.) are required to be included in the monthly EM&A reports. However, any such document shall be well kept by the ET Leader and be ready for inspection upon request. All relevant information shall be clearly and systematically recorded in the document. Monitoring data shall also be recorded in magnetic media form, and the software copy must be available upon request. Data format shall be agreed with the EPD. All documents and data shall be kept for at least one year following completion of the construction contract.

10.7 Interim Notifications of Environmental Quality Limit Exceedances

- 10.7.1 With reference to the Event and Action Plan, when the environmental quality performance limits are exceeded, the ET Leader shall immediately notify the IEC and EPD, as appropriate. The notification shall be followed up with advice to IEC and EPD on the results of the investigation, proposed actions and success of the actions taken, with any necessary follow-up proposals.
- 10.7.2 Sample template for the interim notifications is presented in Annex B of this Manual.

FIGURES



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Legend

- Works proposed under this Study
- Existing River Channel
- Future River Channels (by others)
- Sites of Special Scientific Interest
- Wetland Buffer Area
- Wetland Conservation Area
- Sites of Conservation Importance Under OZP**
- Conservation Area
- Country Park
- Coastal Protection Area
- Sites of Special Scientific Interest

Revision	Date	Description	Initial
	Design	Check	Drawn
Initial	MC	KIL	CWYC
Date	01/05	01/05	01/05

Approved

AGREEMENT NO. CE 67/98

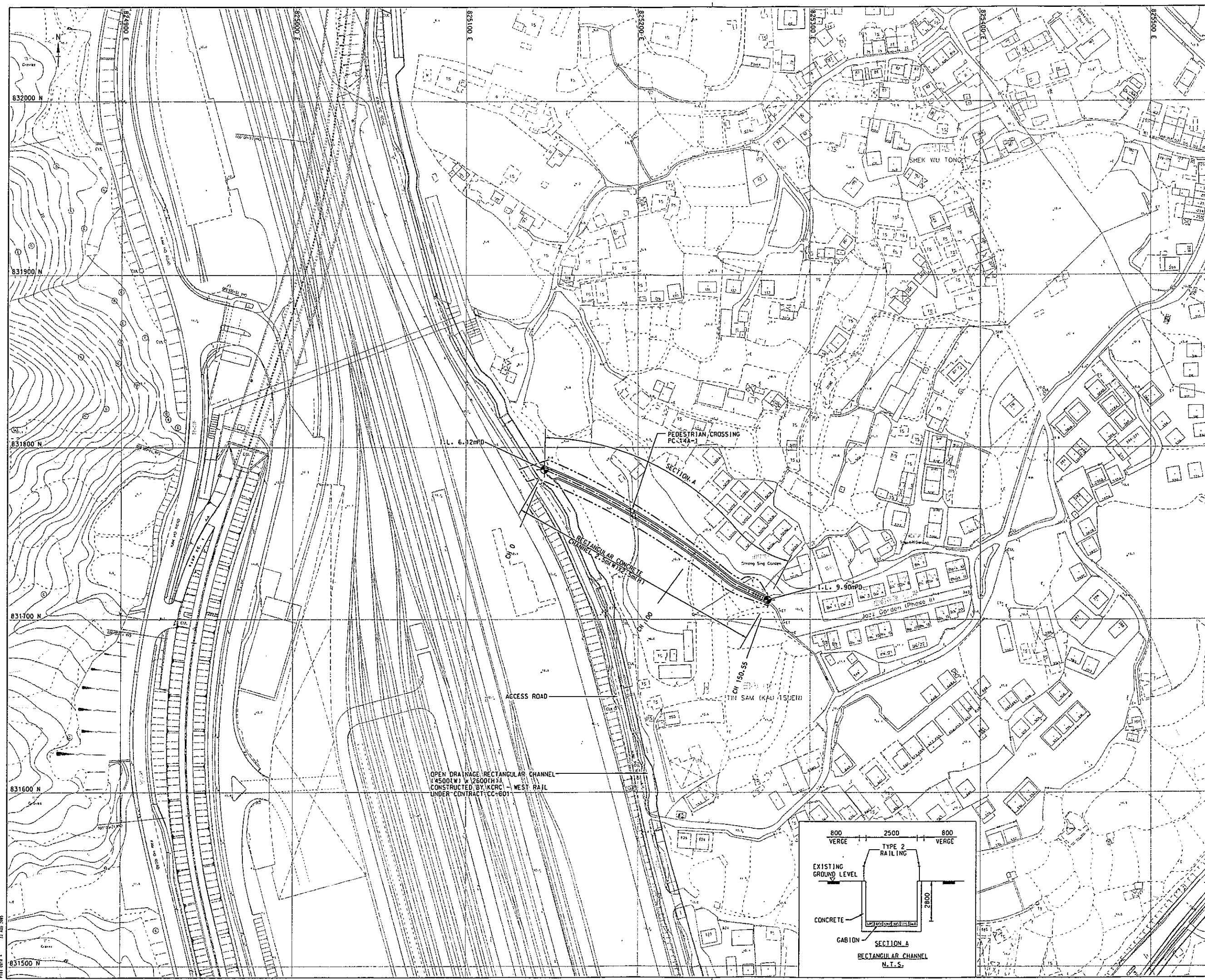
Contract Title
YUEN LONG, KAM TIN,
NGAU TAM MEI AND
TIN SHUI WAI
DRAINAGE IMPROVEMENT
STAGE 1

Figure Title
LOCATION PLAN OF
SECONDARY CHANNELS
KT14 & KT15

Drawing No. ATT4-2.1 Scale 1 : 40000

Client
 香港特別行政區政府
THE GOVERNMENT OF THE
HONG KONG SPECIAL ADMINISTRATIVE REGION

Consultant
 BLACK & VEATCH HONG KONG LIMITED
博威工程顧問有限公司



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NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
2. GRID LINES ARE HONG KONG METRIC GRID 1980.
3. TYPE 2 RAILING WITH DEBRIS TRAP BAR AND GENERAL MESH FILL SHALL BE PROVIDED AT BOTH SIDES OF THE CHANNEL BANKS

LEGEND :

- SITE BOUNDARY
- PROPOSED CHANNEL
- I.L. INVERT LEVEL
- PEDESTRIAN CROSSING/VEHICULAR CROSSING

Revision	Date	Description			Initial
		Designed	Checked	Drawn	
Initial					
Date					
Approved					

AGREEMENT NO. CE 67/98

Contract title

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NGAU TAM MEI AND TIN SHUI WAI
DRAINAGE IMPROVEMENT, STAGE 1,
PHASE 2B - KAM TIN

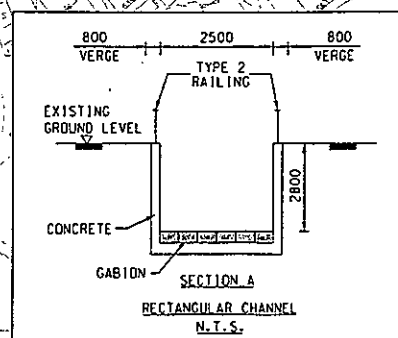
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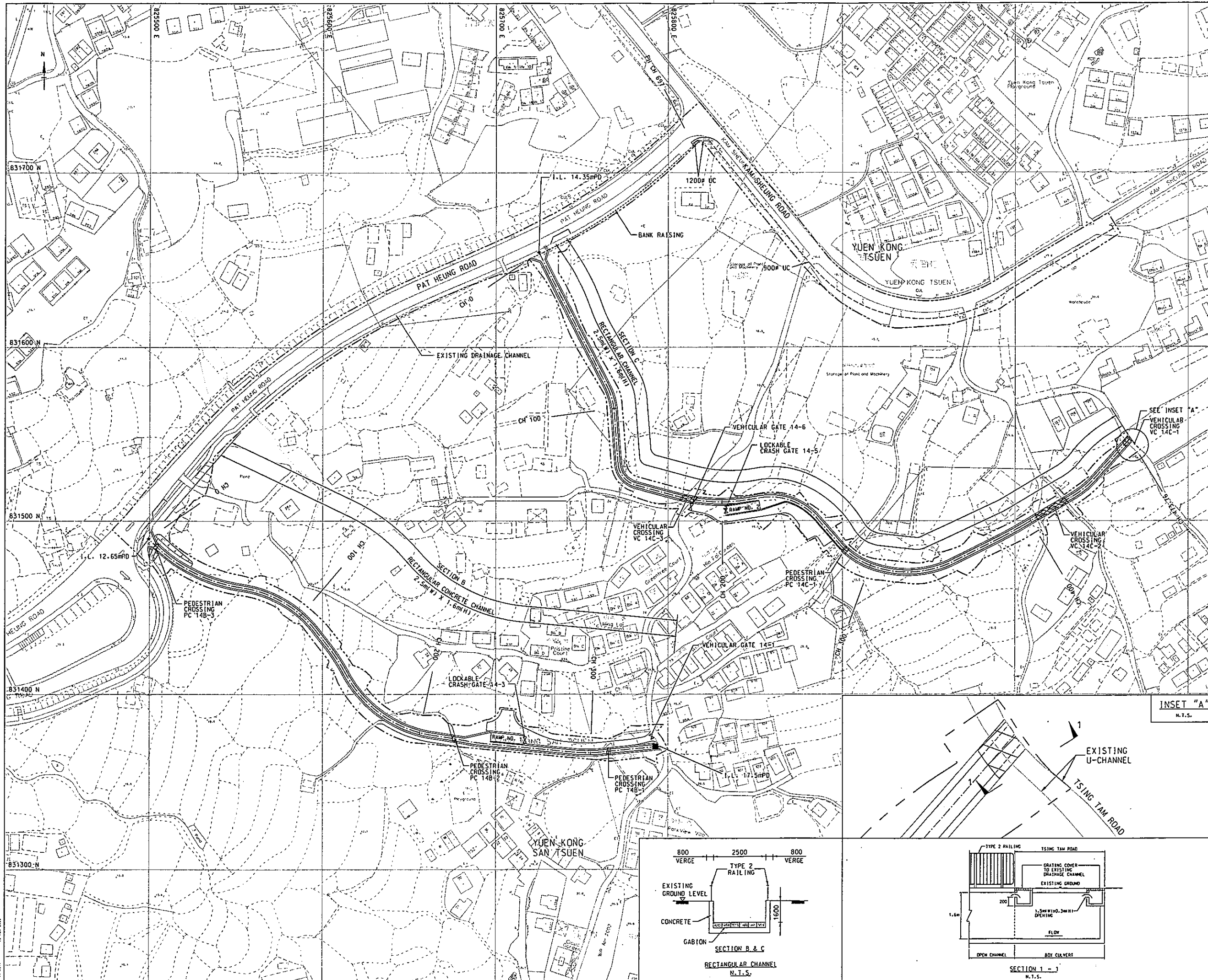
YUEN KONG SAN TSUEN
CHANNEL KT14
PROPOSED LAYOUT PLAN
(SHEET 1 OF 2)

Drawing no.	Scale
ATT4-2.2 (Sheet 1 of 2)	1:1000 A1 1:2000 A3

香港特別行政區政府渠務署
THE GOVERNMENT OF THE
HONG KONG
SPECIAL ADMINISTRATIVE REGION
DRAINAGE SERVICES DEPARTMENT

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- GRID LINES ARE HONG KONG METRIC GRID 1980.
- TYPE 2 RAILING WITH DEBRIS TRAP BAR AND GENERAL MESH FILL SHALL BE PROVIDED AT BOTH SIDES OF THE CHANNEL BANKS

LEGEND :

- SITE BOUNDARY
- PROPOSED CHANNEL
- I.L. INVERT LEVEL
- CHAMBER
- PEDESTRIAN CROSSING/VEHICULAR CROSSING

Revision	Date	Description	Initial
Designed		Checked	Drawn
Initial			Checked
Date			
Approved			

AGREEMENT NO. CE 67/98

Contract title

YUEN LONG, KAM TIN, NGAU TAM MEI AND TIN SHUI WAI DRAINAGE IMPROVEMENT, STAGE 1, PHASE 2B - KAM TIN

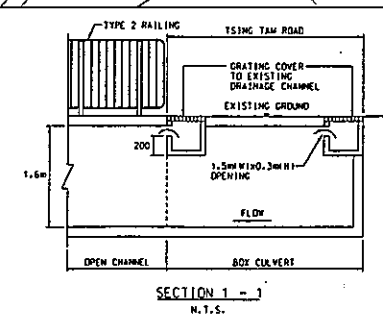
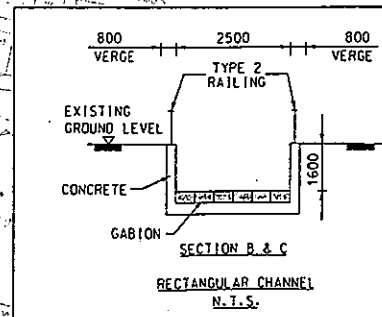
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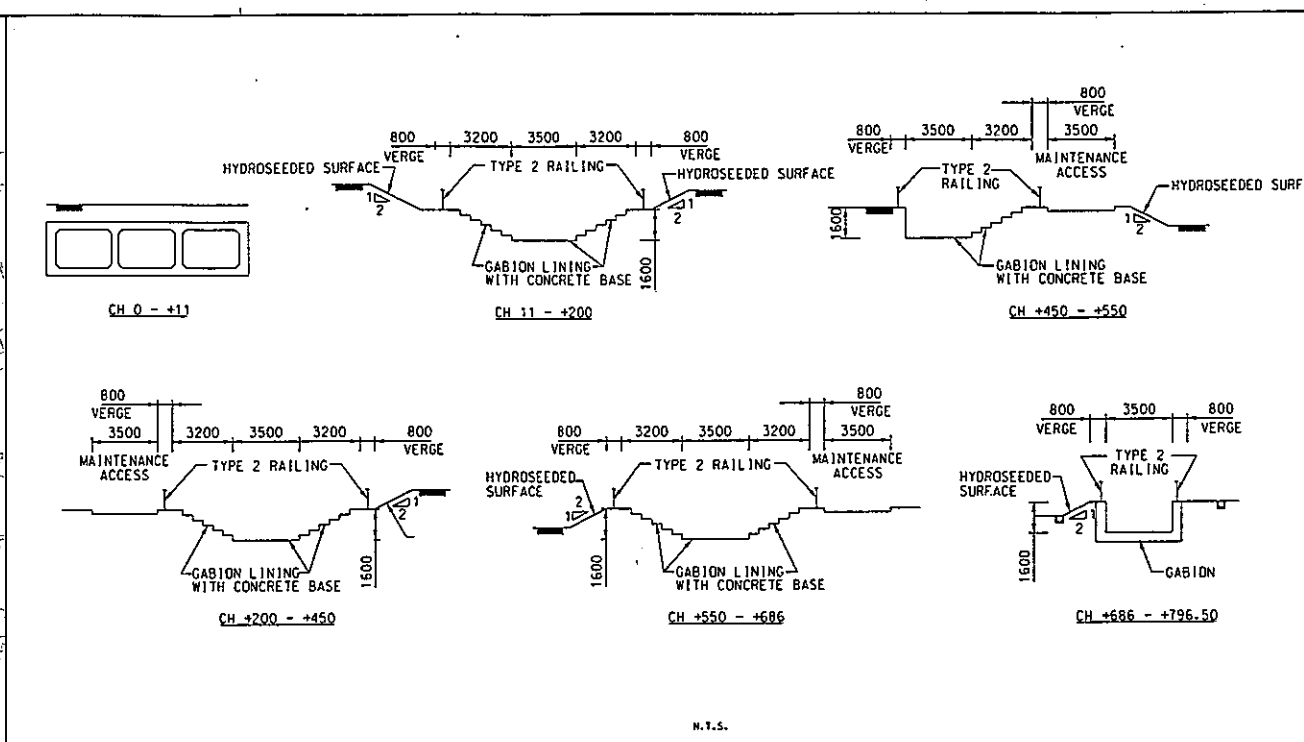
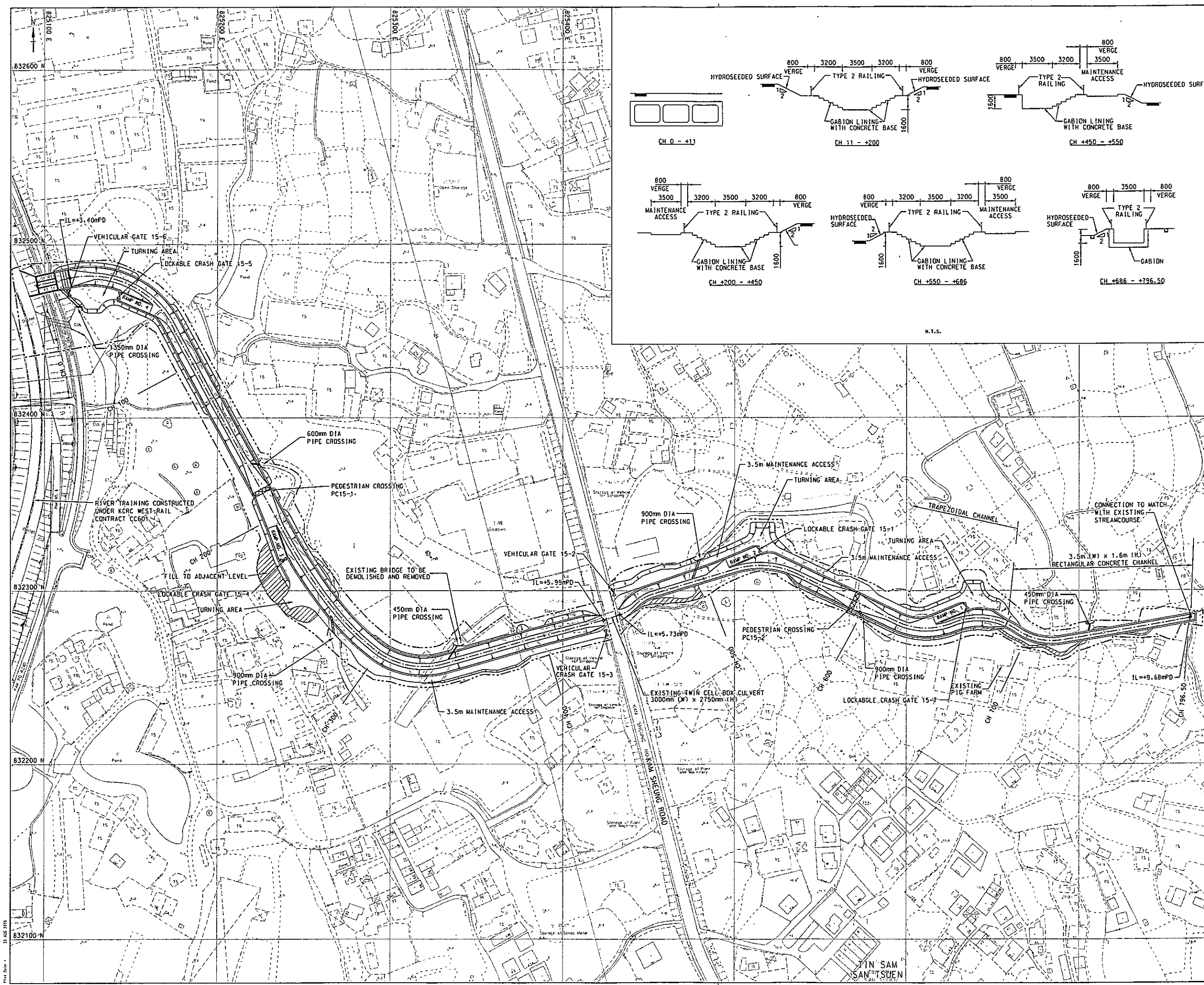
YUEN KONG SAN TSUEN CHANNEL KT14 PROPOSED LAYOUT PLAN (SHEET 2 OF 2)

Drawing no.	Scale
ATT4-2.2 (Sheet 2 of 2)	1:1000 A1 1:2000 A3

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2. GRID LINES ARE HONG KONG METRIC GRID 1980.
3. TYPE 2 RAILING WITH DEBRIS TRAP BAR AND GENERAL MESH FILL SHALL BE PROVIDED AT BOTH SIDES OF THE CHANNEL BANKS

LEGEND :

- SITE BOUNDARY
- PROPOSED CHANNEL
- PROPOSED SLOPE
- ▨ AREA TO BE FILLED TO ADJACENT GROUND LEVEL
- ▩ PEDESTRIAN CROSSING/VEHICULAR CROSSING
- I.L. INVERT LEVEL

Revision	Date	Description	Initial
Designed		Checked	Drawn
Initial			Checked
Date			
Approved			

AGREEMENT NO. CE 67/98

Contract title

YUEN LONG, KAM TIN, NGAU TAM MEI AND TIN SHUI WAI DRAINAGE IMPROVEMENT, STAGE 1, PHASE 2B - KAM TIN

Drawing title

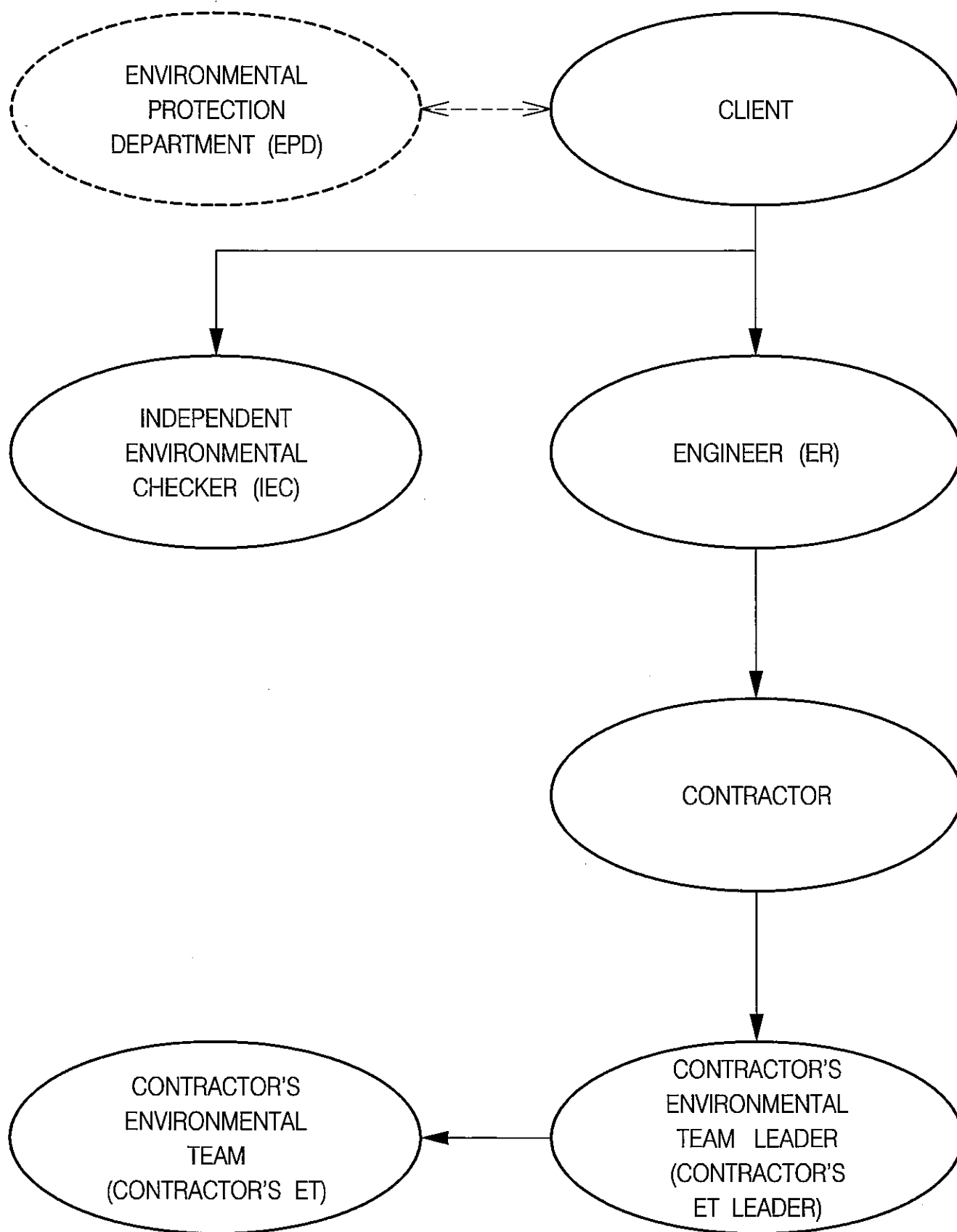
KAM TSIN WAI CHANNEL KT15 PROPOSED LAYOUT PLAN

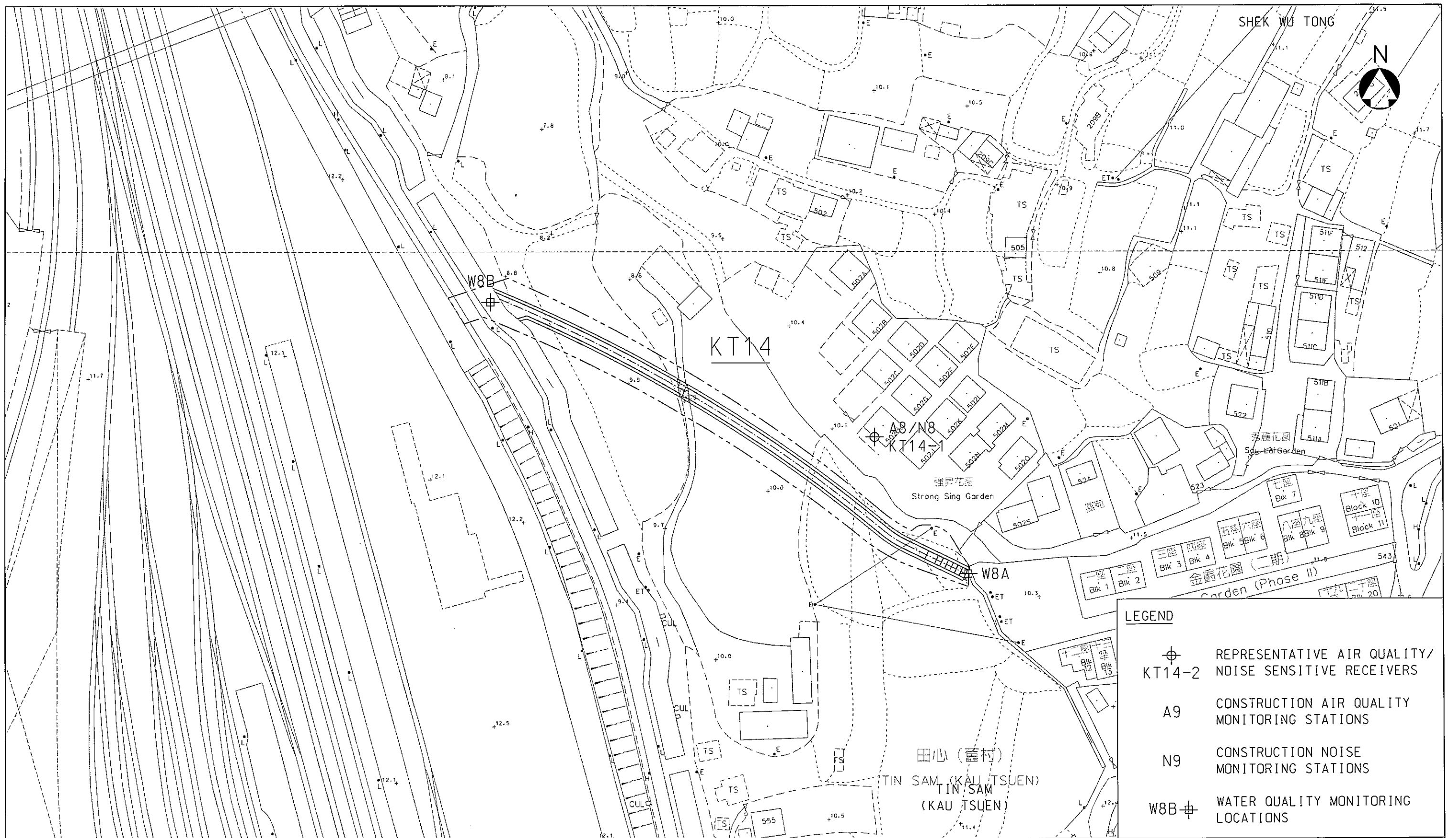
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THE GOVERNMENT OF THE HONG KONG
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DRAINAGE SERVICES DEPARTMENT

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Figure ATT4-3.1 Project Organisation and Lines of Authority for EM&A





LEGEND	
	REPRESENTATIVE AIR QUALITY/ NOISE SENSITIVE RECEIVERS
	CONSTRUCTION AIR QUALITY MONITORING STATIONS
	CONSTRUCTION NOISE MONITORING STATIONS
	WATER QUALITY MONITORING LOCATIONS

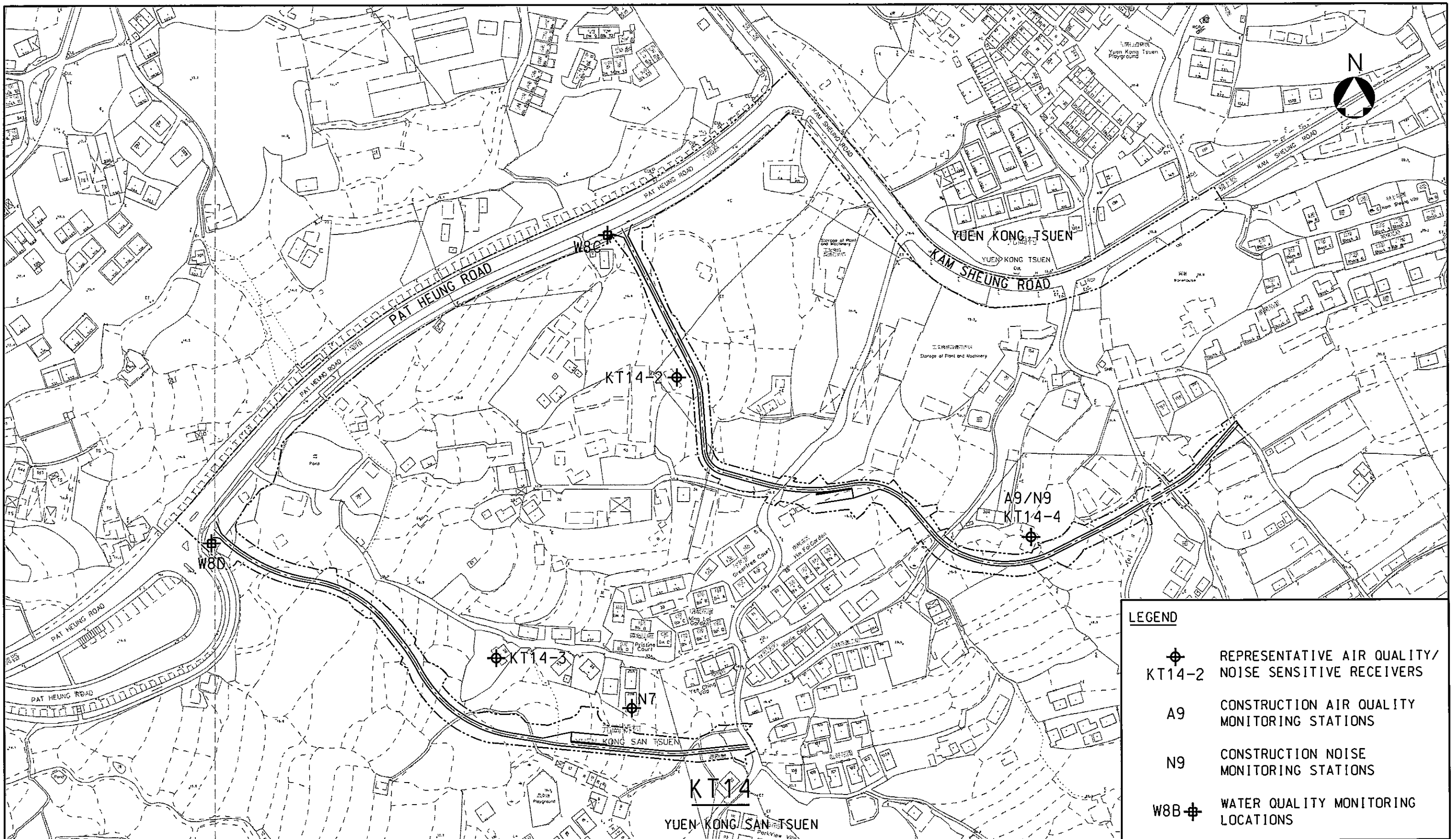
YUEN LONG, KAM TIN,
NGAU TAM MEI AND TIN SHUI WAI
DRAINAGE IMPROVEMENT, STAGE 1, PHASE 2B

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Title :

CONSTRUCTION PHASE AIR QUALITY/NOISE/WATER QUALITY
MONITORING LOCATIONS AT KT14

Figure No. ATT4-4.1	Revision -
Reference -	File Name 3820470201-136.DGN
Prepared WYC	Checked MC
Date DEC. 2002	Scale 1 : 1000



YUEN LONG, KAM TIN,
NGAU TAM MEI AND TIN SHUI WAI
DRAINAGE IMPROVEMENT, STAGE 1, PHASE 2B

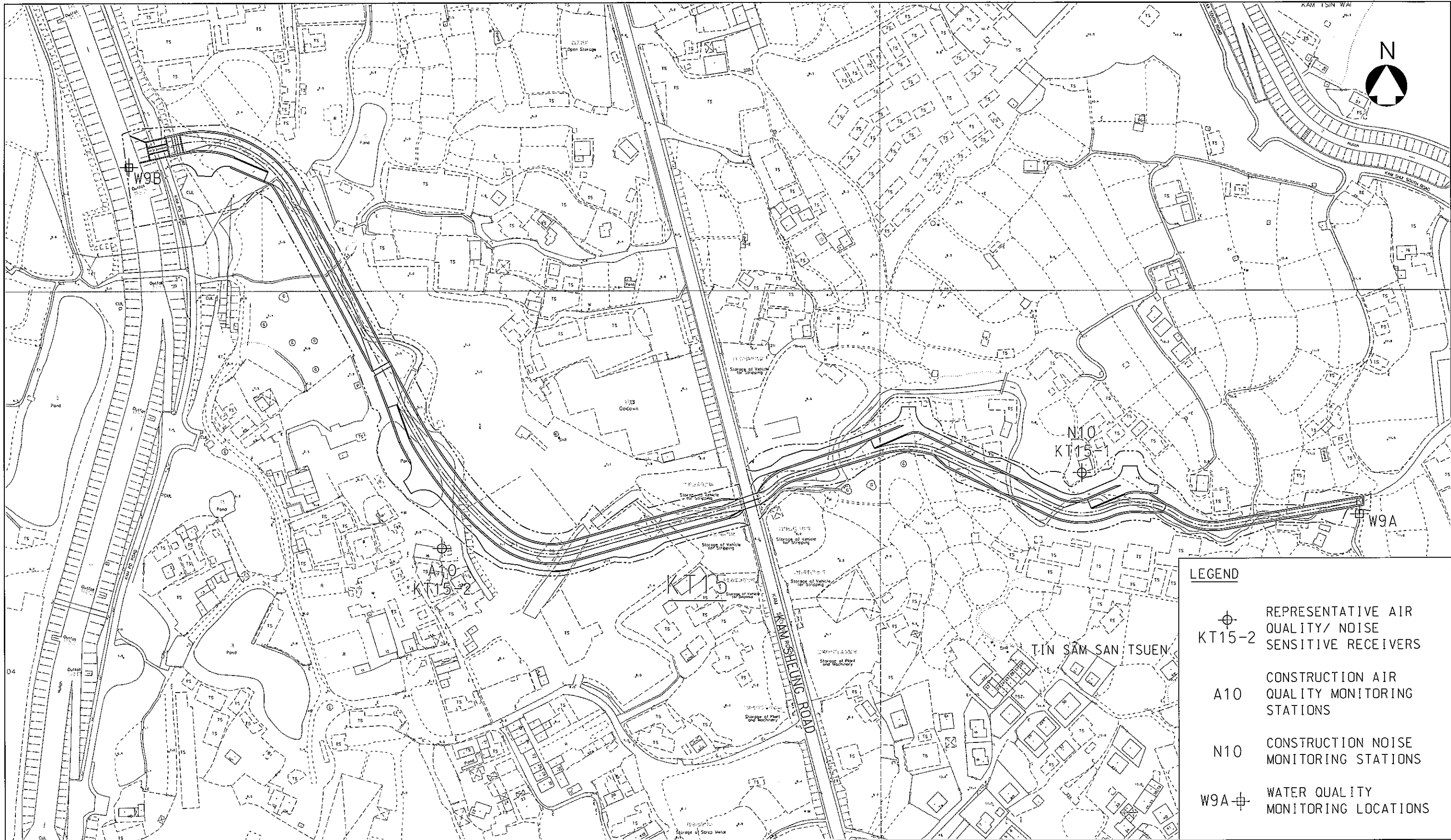



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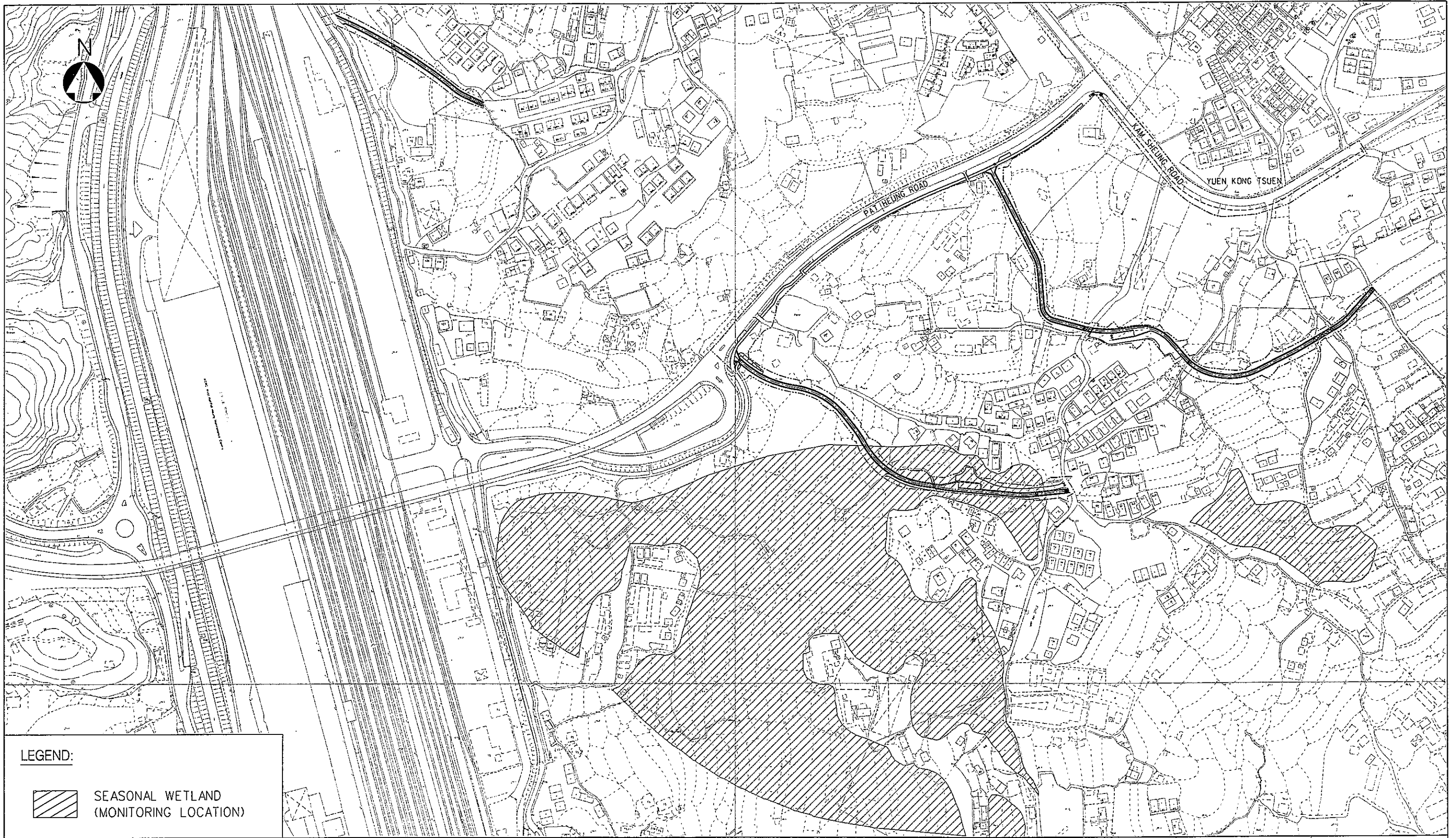
Title :

CONSTRUCTION PHASE AIR QUALITY/NOISE/WATER QUALITY MONITORING LOCATIONS AT KT14

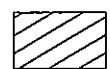
Figure No. ATT4-4.2	Revision -
Reference -	File Name 3820470201-135.DGN
Prepared WYC	Checked MC
Date DEC. 2002	Scale 1 : 2000



<p>YUEN LONG, KAM TIN, NGAU TAM MEI AND TIN SHUI WAI DRAINAGE IMPROVEMENT, STAGE1, PHASE 2B</p>	<p>Title :</p>		<p>Figure No. ATT4-4.3</p>	<p>Revision -</p>
<p> BLACK & VEATCH HONG KONG LIMITED 博威工程顧問有限公司</p>	<p>CONSTRUCTION PHASE AIR QUALITY/NOISE/WATER QUALITY MONITORING LOCATIONS AT KT15</p>		<p>Reference -</p>	<p>File Name 3820470201-137.DGN</p>
			<p>Prepared WYC</p>	<p>Checked MC</p>
			<p>Date DEC. 2002</p>	<p>Scale 1 : 2000</p>



LEGEND:



SEASONAL WETLAND
(MONITORING LOCATION)

YUEN LONG, KAM TIN,
NGAU TAM MEI AND TIN SHUIWAI
DRAINAGE IMPROVEMENT, STAGE1, PHASE 2B

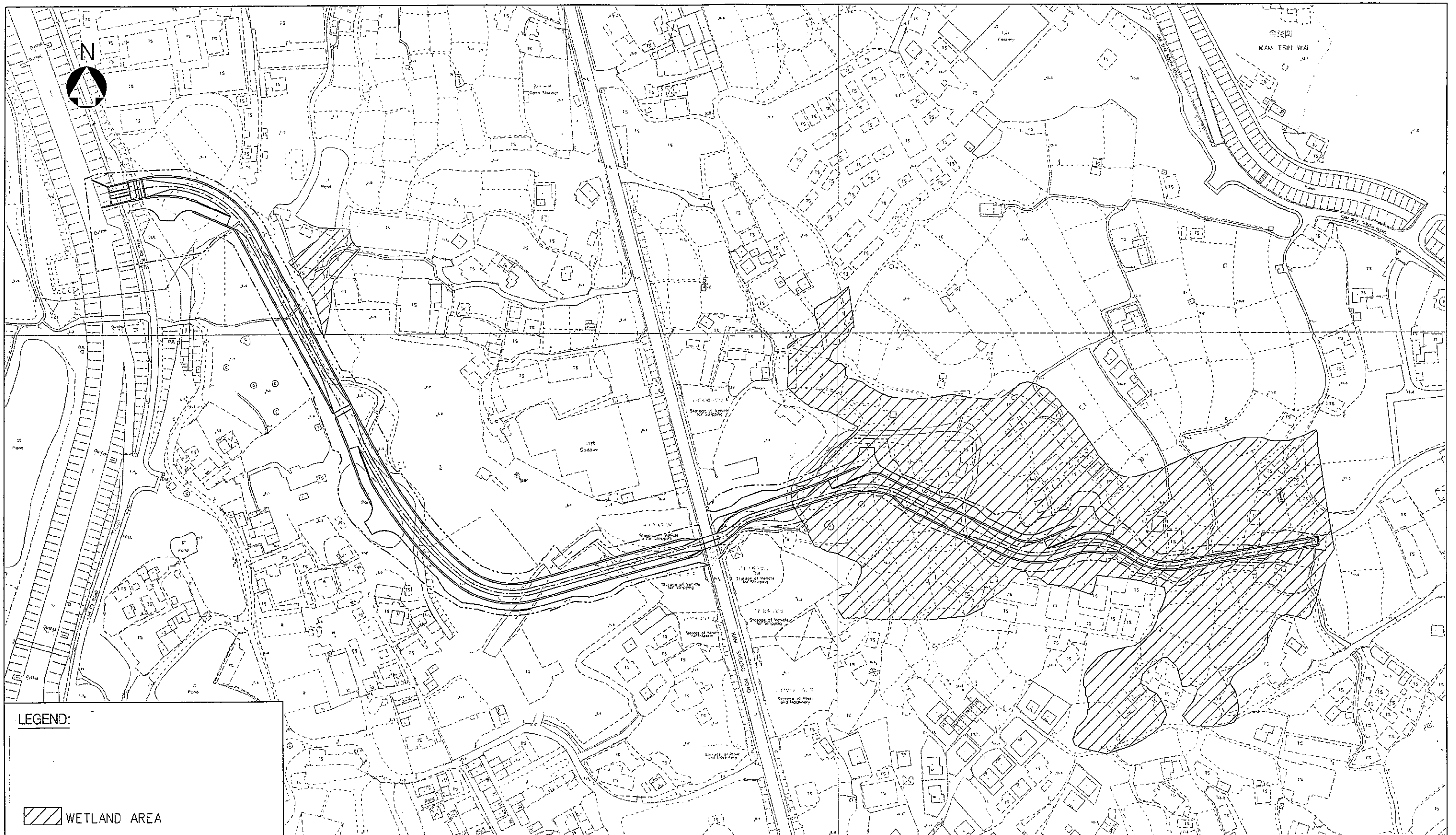


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Title :

ECOLOGICAL MONITORING AREA KT14

Figure No. ATT4-7.1	Revision 0
Reference -	File Name 3820470201-142.DGN
Prepared AEC	Checked WYC
Date MAR. 2003	Scale N.T.S.



LEGEND:

 WETLAND AREA

YUEN LONG, KAM TIN,
NGAU TAM MEI AND TIN SHUI WAI
DRAINAGE IMPROVEMENT, STAGE 1, PHASE 2B



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Title :

ECOLOGICAL MONITORING AREA KT15

Figure No. ATT4-7.2	Revision 0
Reference -	File Name 3820470201-114.DGN
Prepared AEC	Checked WYC
Date MAR. 2003	Scale 1 : 2000

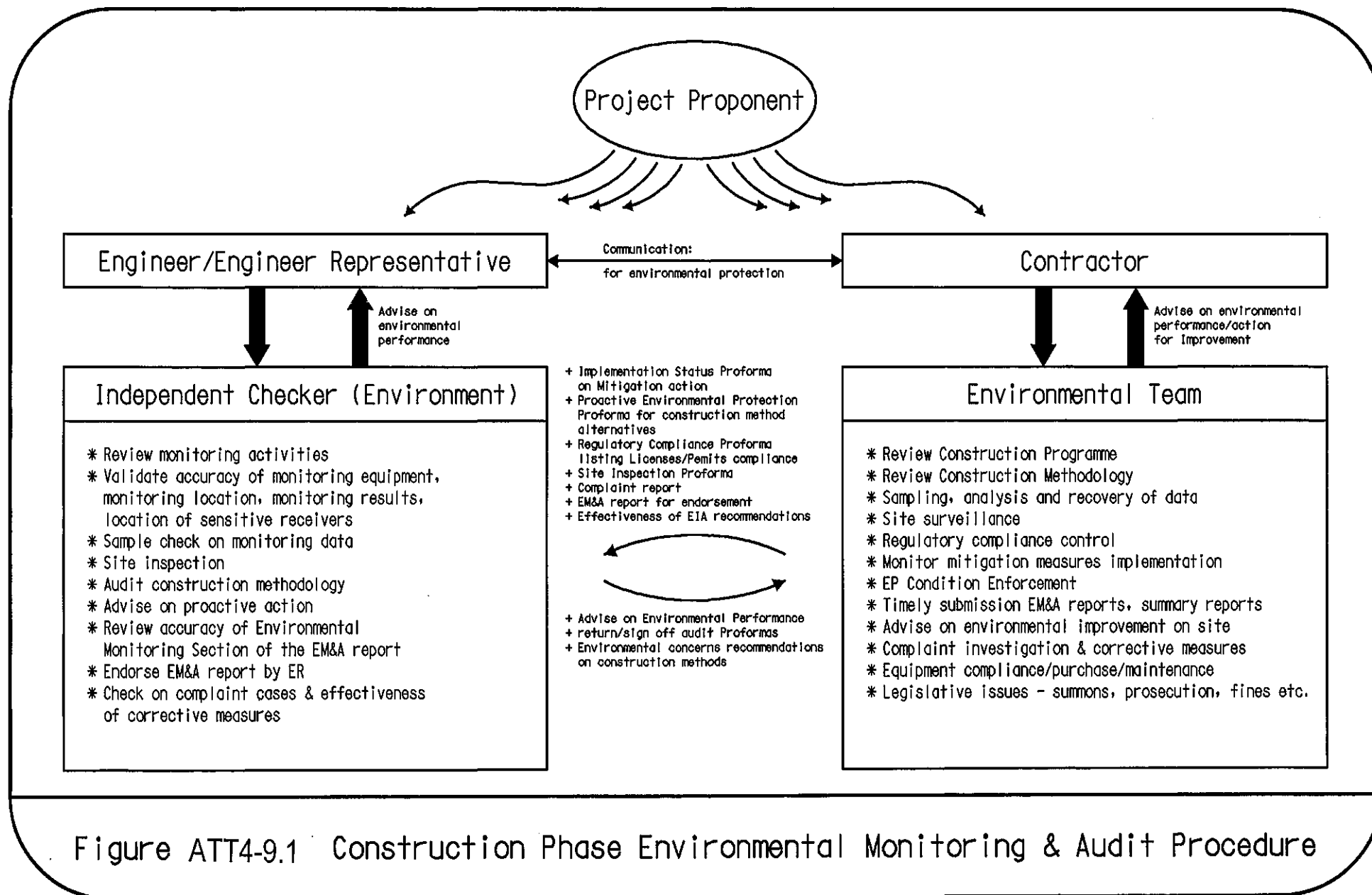
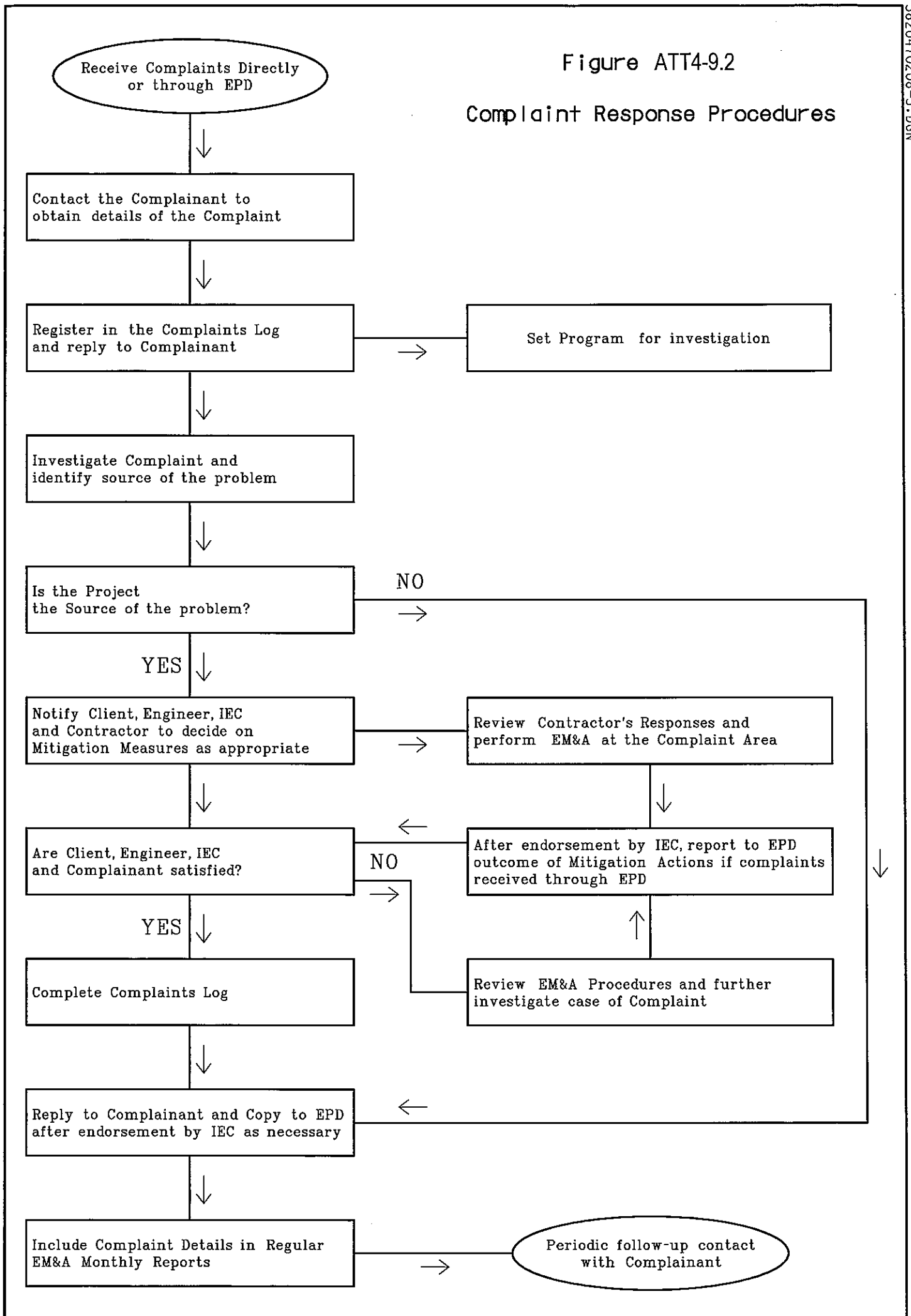


Figure ATT4-9.2

Complaint Response Procedures



Annex A

Mitigation Measures Implementation Schedule

ANNEX A

Mitigation Measures Implementation Schedule

Ecological Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
ECO.1	Channels with no side weep holes and with wide base slab to counter uplift designed to sustain groundwater levels will be constructed where the KT14 channel passes through the seasonal wetland areas shown on Figure 3.2. Design of channels without side weep holes is detailed in Figures 5.1 and 5.3. For KT14 channel, the base will have gabion mattress while the banks will have bricks (e.g. bat bricks) up to 0.75 m high for stream enhancement.	Prevent draining the seasonal wetlands through which KT14 will be excavated - The KT14 channels are used for conveying floodwater only. To provide shelter for small fishes and other aquatic organisms.	Design and Construction Stage for KT14	Detailed Design Engineer, Construction Contractor	✓	✓		EIAO
ECO.2	The proposed channel linings and banks for typical sections of KT15 channel will have gabion banks and base, except at CH+686 to CH+796 where the design is similar to KT14 (see Figures 5.2 and 5.3).	Maintain stream and streamside environment for aquatic and wetland-dependent fauna and permit re-establishment of wetland flora at all sections except CH+686 to CH+796, where stream environment for aquatic fauna is maintained and draining of seasonal wetlands along upper section of stream channel is prevented.	Design and Construction Stage for KT15	Detailed Design Engineer, Construction Contractor	✓	✓		EIAO

Ecological Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
ECO.3	During the construction phase, works or disturbances to areas of seasonal wetlands adjacent to the construction site boundary shown on Figures 3.2 and 3.3 are not allowed. In particular, any discharge of site effluent to the seasonal wetlands, upstream stockpiling or disposal of materials, and any dredging or construction activities at these areas are prohibited. Site runoff is not allowed to be discharged to these wetland areas.	Prevent disturbance to wildlife in seasonal wetlands; prevent contamination in the form of dredged sediments or site runoff entering seasonal wetland habitats.	Construction Stage at KT14 and KT15 sites	Construction Contractor		✓		EIAO

Noise Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Noise 1	<p>The Contractor is required to adopt Levels 1 and 2 site-specific direct technical measures as specified below during the construction phase.</p> <p><i>Level 1 Mitigation Measures</i></p> <ul style="list-style-type: none"> The use of equipment with sound power level lower than that stipulated in the Technical Memorandum on Noise from Construction Works Other Than Percussive Piling is recommended as the first level mitigation (Level 1 mitigation) for all construction works under this Project. Quiet plant is defined as PME whose actual sound power level is less than the value specified in the Technical Memorandum on Noise from Construction Works Other Than Percussive Piling for the same piece of equipment. BS 5228 also provides examples of quiet construction plant and their sound power level. The quiet plant used in the noise calculation including the BS5228 reference number is shown in Attachment 1 for reference. 	Prevent noise impact at sensitive receivers	<p>To be implemented at the works sites of KT14 and KT15 during the Construction Phase (Figures 5.4 to 5.6 show locations of proposed temporary noise barriers.)</p> <p>Figure 5.7 shows the typical vertical section of proposed temporary noise barrier established for KT15. Where the construction equipment has to be operated at a distance where the temporary noise barrier located at the site boundary cannot intercept the line of sight from affected noise sensitive receiver, mobile temporary noise barriers shall be placed near the noisy equipment to intercept line of sight.</p>	Construction Contractor		✓		EIAO

Noise Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Noise 1 (cont'd)	<p><i>Level 2 Mitigation Measures</i></p> <ul style="list-style-type: none"> In addition to the use of quiet plant, purpose-built site noise barriers shall be used as hoarding where construction works would be undertaken close (about 30m or less) to the NSRs (Figures 5.4 to 5.6). Temporary noise barrier with a minimum height of 3m shall be erected along the part of site boundary closest to the NSRs. Notwithstanding the required minimum height these barriers shall be constructed in a way such that no construction works and PME can be visible from the NSRs nearby. The minimum height is estimated assuming the construction equipment/activities will be located on the channel bed 2 m below the surrounding ground level. Stationary equipment shall be placed on the channel bed during construction works. 							

Noise Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Noise 1 (cont'd)	<ul style="list-style-type: none"> For the construction works which are predicted to exceed 75dB(A) (Leq 30min) at nearby NSR and whose line of sight cannot be blocked by the temporary noise barrier (i.e. further away from the hoarding), movable (mobile) noise barrier of more than 3 m high shall be provided. A typical example is shown in Figure 5.7. The noise barriers or screens shall be constructed of appropriate material with a minimum surface density of 10 kg/m². Generators and compressors, shall be completely screened by construction barriers giving a total noise reduction of 10 dB(A) or more. The locations of the proposed temporary noise barriers for KT14 and KT15 are shown on Figures 5.4 to 5.6 respectively. 							

Air Quality Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines)
					Design	Construction	Operation	
Air 1	The Contractor shall prevent dust nuisance arising from the construction activities. The Contractor is required to follow all the requirements for dust control stipulated in the Air Pollution Control (Construction Dust) Regulation.	Prevent dust nuisance	To be implemented at all works area of KT14 and KT15 sites during the Construction Phase.	Construction Contractor		✓		Air Pollution Control Ordinance [Air Pollution Control (Construction Dust) Regulation]
Air 2	<p>The following dust suppression measures shall be installed as part of construction practice, and these shall be incorporated in the Contract Specification and implemented to minimize dust nuisance to within acceptable levels.</p> <p>(i) The Contractor shall frequently clean and water the site to minimise fugitive dust emissions.</p> <p>(ii) Effective water sprays shall be used during the delivery and handling of aggregate, and other similar materials, when dust is likely to be created and to dampen all stored materials during dry and windy weather.</p> <p>(iii) Watering of exposed surfaces shall be exercised at least three times a day.</p> <p>(iv) Areas within the site where there is a regular movement of vehicles must be regularly watered at minimum three times a day.</p>	Prevent dust nuisance	To be implemented at the works areas of KT14 and KT15 sites during the Construction Phase.	Construction Contractor		✓		Air Pollution Control Ordinance [Air Pollution Control (Construction Dust) Regulation]

Air Quality Impact Mitigation									
Item Ref.	Mitigation Measures		Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines)
						Design	Construction	Operation	
Air 2 (cont'd)	(v)	The Contractor shall restrict all motorised vehicles within the site, excluding those on public roads, to a maximum speed of 15 km per hour and confine haulage and delivery vehicles to designated roadways inside the site.	Prevent dust nuisance	To be implemented at the works areas of KT14 and KT15 sites during the Construction Phase.	Construction Contractor		✓		Air Pollution Control Ordinance [Air Pollution Control (Construction Dust) Regulation]
	(vi)	Any stockpiles of construction materials that are likely to generate fugitive dust shall be covered with tarpaulins, including the materials on lorries or trucks.							
	(vii)	Wheel washing facilities shall be installed and used by all vehicles leaving the site. No earth, mud, debris, dust and the like shall be deposited on public roads. Water in the wheel cleaning facility shall be changed at frequent intervals and sediments shall be removed regularly. The Contractor shall submit details of proposals for the wheel cleaning facility. Such wheel washing facilities shall be usable prior to any earthworks excavating activity on the site. The Contractor shall also provide a hard-surfaced road between any washing facility and the public road.							
	(viii)	Any materials dropped on paved roads will need to be cleaned up immediately to prevent dust nuisance.							
	(ix)	Any odourous excavated material shall not be stockpiled on site, and shall be removed from site on the same day (or within 1 day). The material shall be stored in impermeable skips and must be properly covered at all times while awaiting removal from site. Such material shall be properly covered when delivery to the dumping locations. Any temporary storage areas shall placed remote from the air sensitive receivers.	Prevent odour nuisance during construction phase	To be implemented at the works area of KT15 sites during the Construction Phase (excavation of stream bed)	Construction Contractor		✓		EIAO
Water Quality Impact Mitigation									

Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Water 1	<p>Wash facilities for workers and wheel wash waste result in muddy construction site runoff. Temporary earth bunds and sand barriers shall be used to direct such runoff to a designated settlement area within the site.</p> <p>For KT15, the settlement area is located on the streambed, as the existing flow will be diverted to keep the working area dry. The sedimentation area shall be around 1 - 2m deep with a length of approximately 12m. The volume shall be approximately 50m³ (with a channel width of 3.5m).</p> <p>For KT14 the settlement area shall be located within the temporary works area.</p> <p>Construction site runoff shall be settled in this settlement area, while runoff from the surface should be channeled through a local site drainage system into the settlement area. When solids build up in the settlement area, and certainly before the onset of the wet season (Apr-Oct) solids shall be excavated from the base of the settlement area. No excavation shall be allowed in rainy weather.</p>	Prevent additional pollution load being added to stream due to KT14 and 15 works	To be implemented at the works sites of KT14 and 15 during the Construction Phase.	Construction Contractor		✓		WPCO & ProPECC PN 1/94
Water 2	Any concrete particles in site runoff shall be settled out before the runoff being released to any water bodies. In case the pH levels of the settled effluent exceed Action or Trigger Levels specified under the EM&A programme the settled effluent must be neutralized to within the limits of the Action Levels before it is allowed to be released to any water bodies.	Prevent introduction of pH and free ammonia to water quality sensitive receivers to avoid fish kill.	To be implemented at the KT15 works sites during the Construction Phase.	Construction Contractor		✓		WPCO & ProPECC PN 1/94

Water Quality Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Water 3	<p>All discharged waters, including sewage and site runoff, should comply with the appropriate standards in the Technical Memorandum on Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters, prior to discharge.</p> <p>Facilities such as mobile toilets should be provided for the site workers. These facilities shall be installed, removed and regularly maintained by licensed contractors. Such facilities shall be located away from KT15 stream course to prevent inadvertent discharge of sewage to stream during storm conditions.</p> <p>Licensed contractors shall dispose the collected sewage to the government sewers. No sewage shall be allowed to enter wash facilities or sediment settling area.</p>	Prevent discharge of sewage and site runoff to stream due to KT14 and KT15 works	To be implemented at the KT14 and KT15 during the Construction Phase	Construction Contractor		✓		WPCO & ProPECC PN 1/94

Waste Management								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
	<p><i>Waste Management Plan</i></p> <p>Upon appointment, the main contractor of each construction contract should submit a Waste Management Plan (WMP) to the Engineer for approval. The WMP shall describe the arrangements for avoidance, reuse, recovery and recycling, storage, collection, treatment and disposal of different categories of waste to be generated from the construction activities and shall take into account the recommended mitigation measures in the Project Profile report. Such a management plan shall incorporate site specific factors, such as the designation of areas for segregation and temporary storage of reusable and recyclable materials. All mitigation measures numbered Waste 1 to 7 shall be included in the WMP.</p>	Planning for waste reduction, re-use, recycling and proper disposal and for compliance with Waste Disposal Ordinance and other guideline.	To be implemented at the works sites of KT14 and KT15 during the Construction Phase.	Construction Contractor		✓		<p>Works Branch Technical Circulars No. 2/93 2/93B 16/96 4/98 4/98A 25/99 25/99A 25/99C 12/2000 19/2001</p>
Waste 1	<p>(i) Trip-ticket system - In order to monitor the disposal of C&D and solid wastes at public filling facilities and landfills, and control fly-tipping, a trip-ticket system shall be included.</p> <p>(ii) Records of wastes - A recording system for the amount of wastes generated, recycled and disposed (including the disposal sites) shall be proposed.</p> <p>(iii) Training - Training should be provided to workers about the concepts of site cleanliness and appropriate waste management procedure, including waste reduction, reuse and recycling.</p>	Planning for waste reduction, re-use, recycling and proper disposal and for compliance with Waste Disposal Ordinance and other guideline.	To be implemented at the works sites of KT14 and KT15 during the Construction Phase.	Construction Contractor		✓		<p>Environment, Transport, and Works Bureau Technical Circulars No. 33/2002 34/2002 15/2003 31/2004</p>

Waste Management								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Waste 2	<p><u>Site Clearance Waste/Demolition Waste</u></p> <p>All construction wastes shall be sorted on site into inert and non-inert components. Non-inert materials (wood, glass, metals, and plastics) shall be recycled or reused and disposed to landfill only as a last resort. Inert materials (soil, rubble, sand, rock, brick and concrete) shall be separated and reused on site prior to final disposal at public filling facilities. The final disposal site for public fill shall be the Public Filling Facility at Tuen Mun Area 38. The final disposal site for construction and demolition waste shall be the North East New Territories (NENT) Landfill.</p>	Planning for waste reduction, re-use, recycling and proper disposal, and for compliance with Waste Disposal Ordinance and other guideline.	To be implemented at the works sites of KT14 and KT15 during the Construction Phase.	Construction Contractor		✓		<p>Works Branch Technical Circulars No. 2/93 2/93B 16/96 4/98 4/98A 25/99 25/99A 25/99C 12/2000 19/2001</p> <p>ETWB TCW 33/2002 34/2002 15/2003 31/2004</p>
Waste 3	<p><u>Excavated Material</u></p> <p>Any excavated material from the stream shall not be stockpiled, and shall be removed from site on the same day. The material shall be stored in covered impermeable skips while awaiting removal from site.</p> <p>The excavated sediments shall be managed in accordance with ETWB TCW No. 34/2002 and WBTC No. 12/2000. Characterization and quantification shall be carried out during detailed design stage to determine the sediment quality and the quantity of contaminated sediment. If the material is found to be uncontaminated, it should be drained and reused on site. Measures to control dust pollution and runoff from stockpiles are given respectively in Air and Water sections of this Attachment.</p> <p>Any leachate from skips shall be treated to meet discharge standard for Government sewers before being collected along with toilet waste by licensed contractor.</p>	<p>Planning for waste reduction, re-use, recycling and proper disposal, and for compliance with Waste Disposal Ordinance and other guidelines.</p> <p>To determine sediment quality and the quantity of contaminated sediment.</p>	<p>To be implemented at the works sites of KT14 and KT15 during the Construction Stage.</p> <p>To be implemented at the works sites of KT15 during Detailed Design Stage</p>	<p>Construction Contractor during Construction Stage</p> <p>Detailed Design Engineer during Design Stage</p>		✓		<p>ETWB(TC)(W) 34/2002 WBTC 12/2000</p>

Waste Management								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Waste 4	<p><i>Contaminated Sediment</i></p> <p>Contaminated sediments will be managed according to WBTC No. 12/2000 and ETWB TC (W) No. 34/2002. In order to reduce flooding risks the proposed drainage works of Secondary Channel KT15 may require removal of contaminated sediments from the stream, depending on the findings of the Sediment Quality Report to be prepared during detailed design stage. Liaison with Marine Fill Committee (MFC) to locate suitable sediment disposal space will be carried out at detailed design stage.</p>	<p>Planning for waste reduction, re-use, recycling and proper disposal, and for compliance with Waste Disposal Ordinance and other guidelines.</p> <p>To determine sediment quality and the quantity of contaminated sediment as well as final disposal site.</p>	To be implemented at the works sites of KT15 during the Detailed Design Stage and Construction Stage.	<p>Detailed Design Engineer to carry out sediment quality report</p> <p>Construction Contractor to dispose the sediment according to the approved sediment quality report</p>	✓	✓		<p>ETWB(TC)(W) 34/2002</p> <p>WBTC 12/2000</p> <p>Dumping at Sea Ordinance</p>
Waste 5	<p><i>Reducing the Use of Non-Reusable Materials on Site</i></p> <p>Hoarding, shutters, form works and false works made of reusable materials such as steel or plastic / concrete panels shall be used as a preferred alternative to non-reusable materials such as wood and timber, with reference to WBTC No. 19/2001 - Metallic Site Hoarding and Signboards.</p>	Planning for waste reduction, re-use, recycling and proper disposal, and for compliance with Waste Disposal Ordinance and other guidelines.	To be implemented at the works sites of KT14 and KT15 during the Construction Phase.	Construction Contractor		✓		Works Branch Technical Circulars No. 19/2001

Waste Management								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Waste 6	<p><i>Chemical Waste</i></p> <p>Any Contractor generating waste oil, lubricants, paints or other chemicals as a result of his activities should register as a chemical waste producer. Storage, handling, transport and disposal of chemical waste should be arranged in accordance with the <i>Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes</i> published by EPD. Chemical waste should be collected by licensed collectors.</p> <p>The Contractor shall provide a storage area with hard standing, impermeable surface for storing chemicals on site to prevent inadvertent release of waste oil or other chemicals into nearby water bodies. Oil and fuel bunkers should be bunded and/or enclosed on three sides to prevent discharge due to accidental spillages or breaches of tanks. Bunded area should be of sufficient capacity to accommodate 110% of the volume of the largest container or 20% of the total volume of waste, whichever is largest. For construction plant that is likely to leak oil, absorbent inert material e.g. sand, shall be placed beneath it. This material should be replaced on a regular basis and the contaminated material disposed as chemical wastes. Storage areas should have adequate ventilation and be covered to prevent rain entering.</p> <p>Grease traps shall be installed for site drains. These traps shall be cleared at least one a week. A licensed contractor shall regularly clear the traps and dispose waste oils. No chemicals should be allowed to discharge into water courses, either by direct discharge, or as contaminants carried in surface water runoff from the construction site.</p> <p>Training on safety codes and relevant manuals related to the chemicals stored on site should be obligatory for the personnel who handle the chemicals on site.</p>	Planning for waste reduction, re-use, recycling and proper disposal, and for compliance with Waste Disposal Ordinance and other guidelines.	To be implemented at the maintenance areas of KT14 and KT15 sites during the Construction Phase.	Construction Contractor		✓		WDO Waste Disposal (Chemical Waste) (General Regulation)

Waste Management								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Waste 7	Domestic garbage generated by site staff shall be stored at dry locations in covered, impermeable skips. It should be collected daily and disposed to the nearest Refuse Collection Point or arranged for collection by licensed contractors. The Engineer is responsible for checking that no chemical waste, sewage, excavated material or sorted reusable material is disposed as domestic garbage.	Planning for waste reduction, re-use, recycling and proper disposal, and for compliance with Waste Disposal Ordinance and other guideline.	To be implemented at all of the KT14 and KT15 Construction Site.	Construction Contractor		✓		Public Health and Municipal Services Ordinance

Landscape/Visual Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives for Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Land 1	A survey of existing trees shall be completed in accordance with Works Branch Technical Circular No. 14/2002, Management and Maintenance of Natural Vegetation and Landscape Works, and Tree Preservation during detailed design stage. The results of the survey shall form consideration in the detail design for the proposed Secondary Channels KT14 & 15, in order that any significant trees shall be protected during both the design and construction periods. Parameters assessed in the survey shall include species, health, form, transplant-ability and amenity value (assessed according to form, size, age, condition and situation of the tree). All surveyed trees should be checked with species listed under the “Animals and Plants (Protection of Endangered Species) Ordinance (CAP. 187)” and “Forestry and Countryside Ordinance (CAP. 96)” to ensure that no endangered species are affected. Where tree felling is unavoidable, compensatory planting proposal shall be prepared and submitted to EPD, LCSD and LandsD for approval.	Protect visual quality of project area and proposed works. Ensure protection of trees.	To be implemented along KT14 and KT15 during the Detailed Design Phase and Construction Phase.	Design Engineer to conduct tree survey during detailed design stage Construction Contractor to follow the results during construction	✓	✓		Works Bureau Technical Circular No. 14/2002

Notes:

EIAO: Environmental Impact Assessment Ordinance

WDO: Waste Disposal Ordinance

WPCO: Water Pollution Control Ordinance

TMEIA: Technical Memorandum on Environmental Impact Assessment Process

Operational Phase Mitigation								
Item Ref.	Mitigation Measures	Objectives for Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
OPS 1	<p>Before proceeding with any desilting or maintenance works, except for emergency works, the maintenance engineer should check to ascertain if any of the proposed works will be located in or near an environmentally sensitive and/or ecologically important watercourses. In case of doubt, advice from EPD and AFCD or other relevant departments should be sought.</p> <p>Depending on the extent of the maintenance works, AFCD and EPD should be notified and/or consulted as appropriate on the proposed method and mitigation measures for executing the works. Their comments on necessary mitigation measures should be considered and incorporated.</p> <p>The following considerations should be included in planning for the maintenance works:</p> <p>(a) Desilting or maintenance works should be carried out within the dry season when flow in the watercourse is low.</p> <p>(b) Phasing of the works should be considered to better control and minimize any impacts caused, and to provide refuges for aquatic animals. Works should be carried out along half width of the watercourse section by section (in small section). A free passage along the watercourse is necessary to avoid forming stagnant water in any phase of the works and to maintain the integrity of aquatic communities.</p> <p>(c) Containment structures (such as sand bags barrier) should be provided for the active desilting works area to facilitate a dry or at least confined working area within the watercourses.</p>	Recommendations to be considered in planning future maintenance works to avoid environmental nuisance	KT14 and KT15 during Operation Phase	DSD (or DSD's maintenance contractor)			✓	EIAO

Operational Phase Mitigation								
Item Ref.	Mitigation Measures	Objectives for Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
	<p>(d) Temporary access to the works site should be carefully planned and located to minimize disturbance caused to the watercourse, adjacent vegetation and nearby sensitive receivers by construction plants.</p> <p>(e) The use of lesser or smaller construction plants should be considered to reduce disturbance to the riverbed where fish habitats are located and to the nearby sensitive receivers. Quiet construction plants should be used.</p> <p>(f) The use of concrete or the like should be avoided or minimized.</p> <p>(g) In the event odourous materials are encountered, the odourous material should not be stockpiled on site, and should be removed from site on the same day (or within 1 day). The material should be stored in impermeable skips and must be properly covered at all times. Such material should be properly covered when delivery to the dumping locations. Any temporary storage areas should be located away from the air sensitive receivers.</p> <p>(h) The locations for the disposal of the removed materials should be identified and agreement sought with the relevant departments before commencement of the maintenance works. Temporary stockpile of these materials should be located away from watercourses and properly covered to prevent inadvertent wash away into the watercourses during storm conditions.</p>							

Annex B

Sample Record Forms

Annex B
Data Sheet for TSP Monitoring

Monitoring Location		
Details of Location		
Sampler Identification		
Date (dd/mm/yy) & Time of Sampling		
Elapsed-time	Start (min.)	
Meter Reading	Stop (min.)	
Total Sampling Time (min.)		
Weather Conditions		
Site Conditions		
Initial Flow	Pi (mmHg)	
Rate, Qsi	Ti (°C)	
	Hi (in.)	
	Qsi (Std. m ³)	
Final Flow	Pf (mmHg)	
Rate, Qsf	Tf (°C)	
	Hf (in.)	
	Qsf (Std. m ³)	
Average Flow Rate (Std. m ³)		
Total Volume (Std. m ³)		
Filter Identification No.		
Initial Wt. of Filter (g)		
Final Wt. of Filter (g)		
Measured TSP Level (µg/m ³)		

	<u>Name & Designation</u>	<u>Signature</u>	<u>Date (dd/mm/yy)</u>
Field Operator	_____	_____	_____
Laboratory Staff	_____	_____	_____
Checked by	_____	_____	_____

Annex B
Construction Noise Monitoring Field Record Sheet

Monitoring Location		
Description of Location		
Date (dd/mm/yy) of Monitoring		
Measurement Start Time(hh:mm)		
Measurement Time Length (min.)		
Noise Meter Model/Identification		
Calibrator Model/Identification		
Measurement	L ₉₀ (dB(A))	
Results	L ₁₀ (dB(A))	
	Leq (dB(A))	
Major Construction Noise Source(s) During Monitoring		
Other Noise Source(s) During Monitoring		
Remarks		

Name & Designation

Signature

Date (dd/mm/yy)

Recorded By _____

Checked By _____

Annex B
Water Quality Monitoring Data Record Sheet

Monitoring Location				
Date (dd/mm/yy)				
Start Time (hh:mm)				
Weather				
Sea Conditions				
Tidal Mode				
Water Depth (m)				
Monitoring Depth		Surface	Middle	Bottom
Salinity				
Temperature (°C)				
DO Saturation (%)				
DO (mg/l)				
Turbidity (NTU)				
Suspended Solids (SS)				
Sample Identification				
SS Laboratory Results* (mg/l)				
Observed Construction Activities	<100m from location			
	>100m from location			
Other Observations				

* The SS results are to be filled up once they are available from the laboratory.

(dd/mm/yy) Name & Designation Signature Date

Recorded By _____ _____ _____

Checked By _____ _____ _____

Annex B
Complaint Log

Log. Ref.	Date / Location	Complaint	Details of Complaint	Investigation / Mitigation Action	File Closed

Signed by Environmental Team Leader: _____

Date: _____

Annex B
Sample Template for Interim Notifications of Environmental Quality Limits Exceedances

Incident Report on Action Level or Limit Level Non-compliance

Project	
Date	
Time	
Monitoring Location	
Parameter	
Action & Limit Levels	
Measured Level	
Possible reason for Action or Limit Level Non-compliance	
Actions taken / to be taken	
Remarks	

Location Plan

Prepared by _____

Designation _____

Signature _____

Date (dd/mm/yy) _____

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Attachment 5

Mitigation Measures Implementation Schedule

ATTACHMENT 5

Mitigation Measures Implementation Schedule

Ecological Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
ECO.1	Channels with no side weep holes and with wide base slab to counter uplift designed to sustain groundwater levels will be constructed where the KT14 channel passes through the seasonal wetland areas shown on Figure 3.2. Design of channels without side weep holes is detailed in Figures 5.1 and 5.3. For KT14 channel, the base will have gabion mattress while the banks will have bricks (e.g. bat bricks) up to 0.75 m high for stream enhancement.	Prevent draining the seasonal wetlands through which KT14 will be excavated - The KT14 channels are used for conveying floodwater only. To provide shelter for small fishes and other aquatic organisms.	Design and Construction Stage for KT14	Detailed Design Engineer, Construction Contractor	✓	✓		EIAO
ECO.2	The proposed channel linings and banks for typical sections of KT15 channel will have gabion banks and base, except at CH+686 to CH+796 where the design is similar to KT14 (see Figures 5.2 and 5.3).	Maintain stream and streamside environment for aquatic and wetland-dependent fauna and permit re-establishment of wetland flora at all sections except CH+686 to CH+796, where stream environment for aquatic fauna is maintained and draining of seasonal wetlands along upper section of stream channel is prevented.	Design and Construction Stage for KT15	Detailed Design Engineer, Construction Contractor	✓	✓		EIAO

Ecological Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
ECO.3	During the construction phase, works or disturbances to areas of seasonal wetlands adjacent to the construction site boundary shown on Figures 3.2 and 3.3 are not allowed. In particular, any discharge of site effluent to the seasonal wetlands, upstream stockpiling or disposal of materials, and any dredging or construction activities at these areas are prohibited. Site runoff is not allowed to be discharged to these wetland areas.	Prevent disturbance to wildlife in seasonal wetlands; prevent contamination in the form of dredged sediments or site runoff entering seasonal wetland habitats.	Construction Stage at KT14 and KT15 sites	Construction Contractor		✓		EIAO

Noise Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Noise 1	<p>The Contractor is required to adopt Levels 1 and 2 site-specific direct technical measures as specified below during the construction phase.</p> <p><i>Level 1 Mitigation Measures</i></p> <ul style="list-style-type: none"> The use of equipment with sound power level lower than that stipulated in the Technical Memorandum on Noise from Construction Works Other Than Percussive Piling is recommended as the first level mitigation (Level 1 mitigation) for all construction works under this Project. Quiet plant is defined as PME whose actual sound power level is less than the value specified in the Technical Memorandum on Noise from Construction Works Other Than Percussive Piling for the same piece of equipment. BS 5228 also provides examples of quiet construction plant and their sound power level. The quiet plant used in the noise calculation including the BS5228 reference number is shown in Attachment 1 for reference. 	Prevent noise impact at sensitive receivers	<p>To be implemented at the works sites of KT14 and KT15 during the Construction Phase (Figures 5.4 to 5.6 show locations of proposed temporary noise barriers.)</p> <p>Figure 5.7 shows the typical vertical section of proposed temporary noise barrier established for KT15. Where the construction equipment has to be operated at a distance where the temporary noise barrier located at the site boundary cannot intercept the line of sight from affected noise sensitive receiver, mobile temporary noise barriers shall be placed near the noisy equipment to intercept line of sight.</p>	Construction Contractor		✓		EIAO

Noise Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Noise 1 (cont'd)	<p><i>Level 2 Mitigation Measures</i></p> <ul style="list-style-type: none"> In addition to the use of quiet plant, purpose-built site noise barriers shall be used as hoarding where construction works would be undertaken close (about 30m or less) to the NSRs (Figures 5.4 to 5.6). Temporary noise barrier with a minimum height of 3m shall be erected along the part of site boundary closest to the NSRs. Notwithstanding the required minimum height these barriers shall be constructed in a way such that no construction works and PME can be visible from the NSRs nearby. The minimum height is estimated assuming the construction equipment/activities will be located on the channel bed 2 m below the surrounding ground level. Stationary equipment shall be placed on the channel bed during construction works. 							

Noise Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Noise 1 (cont'd)	<ul style="list-style-type: none"> For the construction works which are predicted to exceed 75dB(A) (Leq 30min) at nearby NSR and whose line of sight cannot be blocked by the temporary noise barrier (i.e. further away from the hoarding), movable (mobile) noise barrier of more than 3 m high shall be provided. A typical example is shown in Figure 5.7. The noise barriers or screens shall be constructed of appropriate material with a minimum surface density of 10 kg/m². Generators and compressors, shall be completely screened by construction barriers giving a total noise reduction of 10 dB(A) or more. The locations of the proposed temporary noise barriers for KT14 and KT15 are shown on Figures 5.4 to 5.6 respectively. 							

Air Quality Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines)
					Design	Construction	Operation	
Air 1	The Contractor shall prevent dust nuisance arising from the construction activities. The Contractor is required to follow all the requirements for dust control stipulated in the Air Pollution Control (Construction Dust) Regulation.	Prevent dust nuisance	To be implemented at all works area of KT14 and KT15 sites during the Construction Phase.	Construction Contractor		✓		Air Pollution Control Ordinance [Air Pollution Control (Construction Dust) Regulation]
Air 2	<p>The following dust suppression measures shall be installed as part of construction practice, and these shall be incorporated in the Contract Specification and implemented to minimize dust nuisance to within acceptable levels.</p> <p>(i) The Contractor shall frequently clean and water the site to minimise fugitive dust emissions.</p> <p>(ii) Effective water sprays shall be used during the delivery and handling of aggregate, and other similar materials, when dust is likely to be created and to dampen all stored materials during dry and windy weather.</p> <p>(iii) Watering of exposed surfaces shall be exercised at least three times a day.</p> <p>(iv) Areas within the site where there is a regular movement of vehicles must be regularly watered at minimum three times a day.</p>	Prevent dust nuisance	To be implemented at the works areas of KT14 and KT15 sites during the Construction Phase.	Construction Contractor		✓		Air Pollution Control Ordinance [Air Pollution Control (Construction Dust) Regulation]

Air Quality Impact Mitigation									
Item Ref.	Mitigation Measures		Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines)
						Design	Construction	Operation	
Air 2 (cont'd)	(v)	The Contractor shall restrict all motorised vehicles within the site, excluding those on public roads, to a maximum speed of 15 km per hour and confine haulage and delivery vehicles to designated roadways inside the site.	Prevent dust nuisance	To be implemented at the works areas of KT14 and KT15 sites during the Construction Phase.	Construction Contractor		✓		Air Pollution Control Ordinance [Air Pollution Control (Construction Dust) Regulation]
	(vi)	Any stockpiles of construction materials that are likely to generate fugitive dust shall be covered with tarpaulins, including the materials on lorries or trucks.							
	(vii)	Wheel washing facilities shall be installed and used by all vehicles leaving the site. No earth, mud, debris, dust and the like shall be deposited on public roads. Water in the wheel cleaning facility shall be changed at frequent intervals and sediments shall be removed regularly. The Contractor shall submit details of proposals for the wheel cleaning facility. Such wheel washing facilities shall be usable prior to any earthworks excavating activity on the site. The Contractor shall also provide a hard-surfaced road between any washing facility and the public road.							
	(viii)	Any materials dropped on paved roads will need to be cleaned up immediately to prevent dust nuisance.							
	(ix)	Any odourous excavated material shall not be stockpiled on site, and shall be removed from site on the same day (or within 1 day). The material shall be stored in impermeable skips and must be properly covered at all times while awaiting removal from site. Such material shall be properly covered when delivery to the dumping locations. Any temporary storage areas shall placed remote from the air sensitive receivers.	Prevent odour nuisance during construction phase	To be implemented at the works area of KT15 sites during the Construction Phase (excavation of stream bed)	Construction Contractor		✓		EIAO
Water Quality Impact Mitigation									

Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Water 1	<p>Wash facilities for workers and wheel wash waste result in muddy construction site runoff. Temporary earth bunds and sand barriers shall be used to direct such runoff to a designated settlement area within the site.</p> <p>For KT15, the settlement area is located on the streambed, as the existing flow will be diverted to keep the working area dry. The sedimentation area shall be around 1 - 2m deep with a length of approximately 12m. The volume shall be approximately 50m³ (with a channel width of 3.5m).</p> <p>For KT14 the settlement area shall be located within the temporary works area.</p> <p>Construction site runoff shall be settled in this settlement area, while runoff from the surface should be channeled through a local site drainage system into the settlement area. When solids build up in the settlement area, and certainly before the onset of the wet season (Apr-Oct) solids shall be excavated from the base of the settlement area. No excavation shall be allowed in rainy weather.</p>	Prevent additional pollution load being added to stream due to KT14 and 15 works	To be implemented at the works sites of KT14 and 15 during the Construction Phase.	Construction Contractor		✓		WPCO & ProPECC PN 1/94
Water 2	Any concrete particles in site runoff shall be settled out before the runoff being released to any water bodies. In case the pH levels of the settled effluent exceed Action or Trigger Levels specified under the EM&A programme the settled effluent must be neutralized to within the limits of the Action Levels before it is allowed to be released to any water bodies.	Prevent introduction of pH and free ammonia to water quality sensitive receivers to avoid fish kill.	To be implemented at the KT15 works sites during the Construction Phase.	Construction Contractor		✓		WPCO & ProPECC PN 1/94

Water Quality Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Water 3	<p>All discharged waters, including sewage and site runoff, should comply with the appropriate standards in the Technical Memorandum on Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters, prior to discharge.</p> <p>Facilities such as mobile toilets should be provided for the site workers. These facilities shall be installed, removed and regularly maintained by licensed contractors. Such facilities shall be located away from KT15 stream course to prevent inadvertent discharge of sewage to stream during storm conditions.</p> <p>Licensed contractors shall dispose the collected sewage to the government sewers. No sewage shall be allowed to enter wash facilities or sediment settling area.</p>	Prevent discharge of sewage and site runoff to stream due to KT14 and KT15 works	To be implemented at the KT14 and KT15 during the Construction Phase	Construction Contractor		✓		WPCO & ProPECC PN 1/94

Waste Management								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
	<p><i>Waste Management Plan</i></p> <p>Upon appointment, the main contractor of each construction contract should submit a Waste Management Plan (WMP) to the Engineer for approval. The WMP shall describe the arrangements for avoidance, reuse, recovery and recycling, storage, collection, treatment and disposal of different categories of waste to be generated from the construction activities and shall take into account the recommended mitigation measures in the Project Profile report. Such a management plan shall incorporate site specific factors, such as the designation of areas for segregation and temporary storage of reusable and recyclable materials. All mitigation measures numbered Waste 1 to 7 shall be included in the WMP.</p>	Planning for waste reduction, re-use, recycling and proper disposal and for compliance with Waste Disposal Ordinance and other guideline.	To be implemented at the works sites of KT14 and KT15 during the Construction Phase.	Construction Contractor		✓		<p>Works Branch Technical Circulars No. 2/93 2/93B 16/96 4/98 4/98A 25/99 25/99A 25/99C 12/2000 19/2001</p>
Waste 1	<p>(i) Trip-ticket system - In order to monitor the disposal of C&D and solid wastes at public filling facilities and landfills, and control fly-tipping, a trip-ticket system shall be included.</p> <p>(ii) Records of wastes - A recording system for the amount of wastes generated, recycled and disposed (including the disposal sites) shall be proposed.</p> <p>(iii) Training - Training should be provided to workers about the concepts of site cleanliness and appropriate waste management procedure, including waste reduction, reuse and recycling.</p>	Planning for waste reduction, re-use, recycling and proper disposal and for compliance with Waste Disposal Ordinance and other guideline.	To be implemented at the works sites of KT14 and KT15 during the Construction Phase.	Construction Contractor		✓		<p>Environment, Transport, and Works Bureau Technical Circulars No. 33/2002 34/2002 15/2003 31/2004</p>

Waste Management								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Waste 2	<p><u>Site Clearance Waste/Demolition Waste</u></p> <p>All construction wastes shall be sorted on site into inert and non-inert components. Non-inert materials (wood, glass, metals, and plastics) shall be recycled or reused and disposed to landfill only as a last resort. Inert materials (soil, rubble, sand, rock, brick and concrete) shall be separated and reused on site prior to final disposal at public filling facilities. The final disposal site for public fill shall be the Public Filling Facility at Tuen Mun Area 38. The final disposal site for construction and demolition waste shall be the North East New Territories (NENT) Landfill.</p>	Planning for waste reduction, re-use, recycling and proper disposal, and for compliance with Waste Disposal Ordinance and other guideline.	To be implemented at the works sites of KT14 and KT15 during the Construction Phase.	Construction Contractor		✓		<p>Works Branch Technical Circulars No. 2/93 2/93B 16/96 4/98 4/98A 25/99 25/99A 25/99C 12/2000 19/2001</p> <p>ETWB TCW 33/2002 34/2002 15/2003 31/2004</p>
Waste 3	<p><u>Excavated Material</u></p> <p>Any excavated material from the stream shall not be stockpiled, and shall be removed from site on the same day. The material shall be stored in covered impermeable skips while awaiting removal from site.</p> <p>The excavated sediments shall be managed in accordance with ETWB TCW No. 34/2002 and WBTC No. 12/2000. Characterization and quantification shall be carried out during detailed design stage to determine the sediment quality and the quantity of contaminated sediment. If the material is found to be uncontaminated, it should be drained and reused on site. Measures to control dust pollution and runoff from stockpiles are given respectively in Air and Water sections of this Attachment.</p> <p>Any leachate from skips shall be treated to meet discharge standard for Government sewers before being collected along with toilet waste by licensed contractor.</p>	<p>Planning for waste reduction, re-use, recycling and proper disposal, and for compliance with Waste Disposal Ordinance and other guidelines.</p> <p>To determine sediment quality and the quantity of contaminated sediment.</p>	<p>To be implemented at the works sites of KT14 and KT15 during the Construction Stage.</p> <p>To be implemented at the works sites of KT15 during Detailed Design Stage</p>	<p>Construction Contractor during Construction Stage</p> <p>Detailed Design Engineer during Design Stage</p>		✓		<p>ETWB(TC)(W) 34/2002 WBTC 12/2000</p>

Waste Management								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Waste 4	<p><i>Contaminated Sediment</i></p> <p>Contaminated sediments will be managed according to WBTC No. 12/2000 and ETWB TC (W) No. 34/2002. In order to reduce flooding risks the proposed drainage works of Secondary Channel KT15 may require removal of contaminated sediments from the stream, depending on the findings of the Sediment Quality Report to be prepared during detailed design stage. Liaison with Marine Fill Committee (MFC) to locate suitable sediment disposal space will be carried out at detailed design stage.</p>	<p>Planning for waste reduction, re-use, recycling and proper disposal, and for compliance with Waste Disposal Ordinance and other guidelines.</p> <p>To determine sediment quality and the quantity of contaminated sediment as well as final disposal site.</p>	To be implemented at the works sites of KT15 during the Detailed Design Stage and Construction Stage.	<p>Detailed Design Engineer to carry out sediment quality report.</p> <p>Construction Contractor to dispose the sediment according to the approved sediment quality report.</p>	✓	✓		<p>ETWB(TC)(W) 34/2002</p> <p>WBTC 12/2000</p> <p>Dumping at Sea Ordinance</p>
Waste 5	<p><i>Reducing the Use of Non-Reusable Materials on Site</i></p> <p>Hoarding, shutters, form works and false works made of reusable materials such as steel or plastic / concrete panels shall be used as a preferred alternative to non-reusable materials such as wood and timber, with reference to WBTC No. 19/2001 - Metallic Site Hoarding and Signboards.</p>	Planning for waste reduction, re-use, recycling and proper disposal, and for compliance with Waste Disposal Ordinance and other guidelines.	To be implemented at the works sites of KT14 and KT15 during the Construction Phase.	Construction Contractor		✓		Works Branch Technical Circulars No. 19/2001

Waste Management								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Waste 6	<p><i>Chemical Waste</i></p> <p>Any Contractor generating waste oil, lubricants, paints or other chemicals as a result of his activities should register as a chemical waste producer. Storage, handling, transport and disposal of chemical waste should be arranged in accordance with the <i>Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes</i> published by EPD. Chemical waste should be collected by licensed collectors.</p> <p>The Contractor shall provide a storage area with hard standing, impermeable surface for storing chemicals on site to prevent inadvertent release of waste oil or other chemicals into nearby water bodies. Oil and fuel bunkers should be bunded and/or enclosed on three sides to prevent discharge due to accidental spillages or breaches of tanks. Bunded area should be of sufficient capacity to accommodate 110% of the volume of the largest container or 20% of the total volume of waste, whichever is largest. For construction plant that is likely to leak oil, absorbent inert material e.g. sand, shall be placed beneath it. This material should be replaced on a regular basis and the contaminated material disposed as chemical wastes. Storage areas should have adequate ventilation and be covered to prevent rain entering.</p> <p>Grease traps shall be installed for site drains. These traps shall be cleared at least one a week. A licensed contractor shall regularly clear the traps and dispose waste oils. No chemicals should be allowed to discharge into water courses, either by direct discharge, or as contaminants carried in surface water runoff from the construction site.</p> <p>Training on safety codes and relevant manuals related to the chemicals stored on site should be obligatory for the personnel who handle the chemicals on site.</p>	Planning for waste reduction, re-use, recycling and proper disposal, and for compliance with Waste Disposal Ordinance and other guidelines.	To be implemented at the maintenance areas of KT14 and KT15 sites during the Construction Phase.	Construction Contractor		✓		WDO Waste Disposal (Chemical Waste) (General Regulation)

Waste Management								
Item Ref.	Mitigation Measures	Objectives of Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Waste 7	Domestic garbage generated by site staff shall be stored at dry locations in covered, impermeable skips. It should be collected daily and disposed to the nearest Refuse Collection Point or arranged for collection by licensed contractors. The Engineer is responsible for checking that no chemical waste, sewage, excavated material or sorted reusable material is disposed as domestic garbage.	Planning for waste reduction, re-use, recycling and proper disposal, and for compliance with Waste Disposal Ordinance and other guideline.	To be implemented at all of the KT14 and KT15 Construction Site.	Construction Contractor		✓		Public Health and Municipal Services Ordinance

Landscape/Visual Impact Mitigation								
Item Ref.	Mitigation Measures	Objectives for Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
Land 1	A survey of existing trees shall be completed in accordance with Works Branch Technical Circular No. 14/2002, Management and Maintenance of Natural Vegetation and Landscape Works, and Tree Preservation during detailed design stage. The results of the survey shall form consideration in the detail design for the proposed Secondary Channels KT14 & 15, in order that any significant trees shall be protected during both the design and construction periods. Parameters assessed in the survey shall include species, health, form, transplant-ability and amenity value (assessed according to form, size, age, condition and situation of the tree). All surveyed trees should be checked with species listed under the “Animals and Plants (Protection of Endangered Species) Ordinance (CAP. 187)” and “Forestry and Countryside Ordinance (CAP. 96)” to ensure that no endangered species are affected. Where tree felling is unavoidable, compensatory planting proposal shall be prepared and submitted to EPD, LCSD and LandsD for approval.	Protect visual quality of project area and proposed works. Ensure protection of trees.	To be implemented along KT14 and KT15 during the Detailed Design Phase and Construction Phase.	Design Engineer to conduct tree survey during detailed design stage Construction Contractor to follow the results during construction	✓	✓		Works Bureau Technical Circular No. 14/2002

Notes:

EIAO: Environmental Impact Assessment Ordinance

WDO: Waste Disposal Ordinance

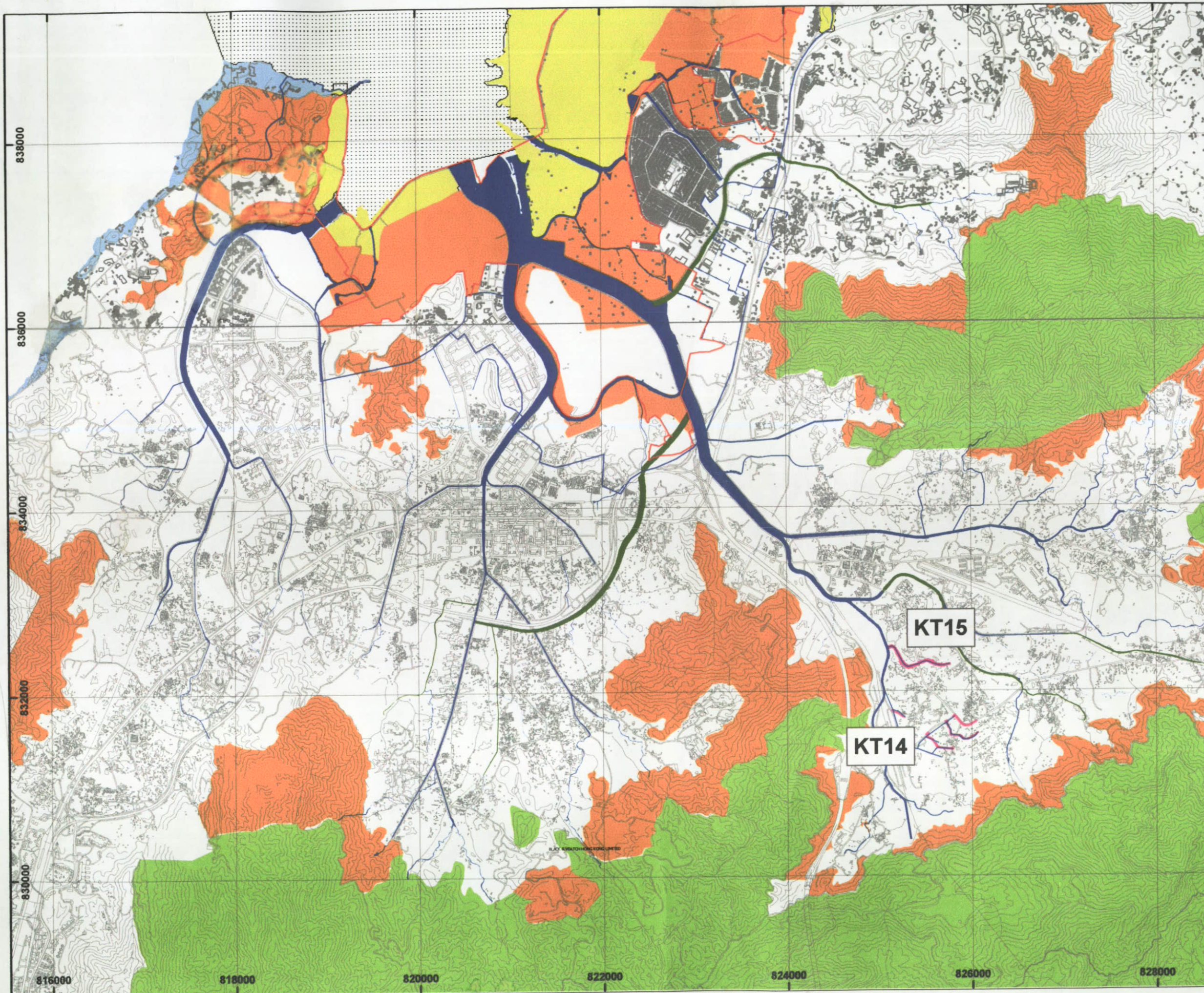
WPCO: Water Pollution Control Ordinance

TMEIA: Technical Memorandum on Environmental Impact Assessment Process

Operational Phase Mitigation								
Item Ref.	Mitigation Measures	Objectives for Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
OPS 1	<p>Before proceeding with any desilting or maintenance works, except for emergency works, the maintenance engineer should check to ascertain if any of the proposed works will be located in or near an environmentally sensitive and/or ecologically important watercourses. In case of doubt, advice from EPD and AFCD or other relevant departments should be sought.</p> <p>Depending on the extent of the maintenance works, AFCD and EPD should be notified and/or consulted as appropriate on the proposed method and mitigation measures for executing the works. Their comments on necessary mitigation measures should be considered and incorporated.</p> <p>The following considerations should be included in planning for the maintenance works:</p> <p>(a) Desilting or maintenance works should be carried out within the dry season when flow in the watercourse is low.</p> <p>(b) Phasing of the works should be considered to better control and minimize any impacts caused, and to provide refuges for aquatic animals. Works should be carried out along half width of the watercourse section by section (in small section). A free passage along the watercourse is necessary to avoid forming stagnant water in any phase of the works and to maintain the integrity of aquatic communities.</p> <p>(c) Containment structures (such as sand bags barrier) should be provided for the active desilting works area to facilitate a dry or at least confined working area within the watercourses.</p>	Recommendations to be considered in planning future maintenance works to avoid environmental nuisance	KT14 and KT15 during Operation Phase	DSD (or DSD's maintenance contractor)			✓	EIAO

Operational Phase Mitigation								
Item Ref.	Mitigation Measures	Objectives for Proposed Measures	Location/Duration of Measures/Timing of Completion of Measures	Implementation Agent(s)	Implementation Stage			Relevant Legislation & Guidelines
					Design	Construction	Operation	
	<p>(d) Temporary access to the works site should be carefully planned and located to minimize disturbance caused to the watercourse, adjacent vegetation and nearby sensitive receivers by construction plants.</p> <p>(e) The use of lesser or smaller construction plants should be considered to reduce disturbance to the riverbed where fish habitats are located and to the nearby sensitive receivers. Quiet construction plants should be used.</p> <p>(f) The use of concrete or the like should be avoided or minimized.</p> <p>(g) In the event odourous materials are encountered, the odourous material should not be stockpiled on site, and should be removed from site on the same day (or within 1 day). The material should be stored in impermeable skips and must be properly covered at all times. Such material should be properly covered when delivery to the dumping locations. Any temporary storage areas should be located away from the air sensitive receivers.</p> <p>(h) The locations for the disposal of the removed materials should be identified and agreement sought with the relevant departments before commencement of the maintenance works. Temporary stockpile of these materials should be located away from watercourses and properly covered to prevent inadvertent wash away into the watercourses during storm conditions.</p>							

FIGURES



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- Legend**
- Works proposed under this Study
 - Existing River Channel
 - Future River Channels (by others)
 - Sites of Special Scientific Interest
 - Wetland Buffer Area
 - Wetland Conservation Area
- Sites of Conservation Importance Under OZP**
- Conservation Area
 - Country Park
 - Coastal Protection Area
 - Sites of Special Scientific Interest

Revision	Date	Description	Initial
Initial	Design	Check	Drawn
MC	KIL	CWYC	KIL
Date	01/05	01/05	01/05


Approved

AGREEMENT NO. CE 67/98

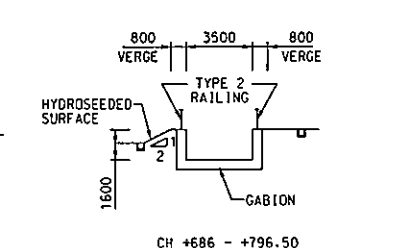
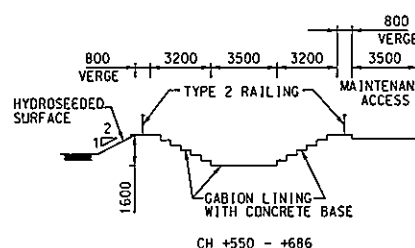
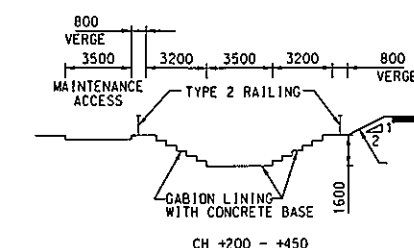
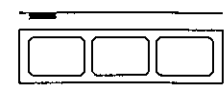
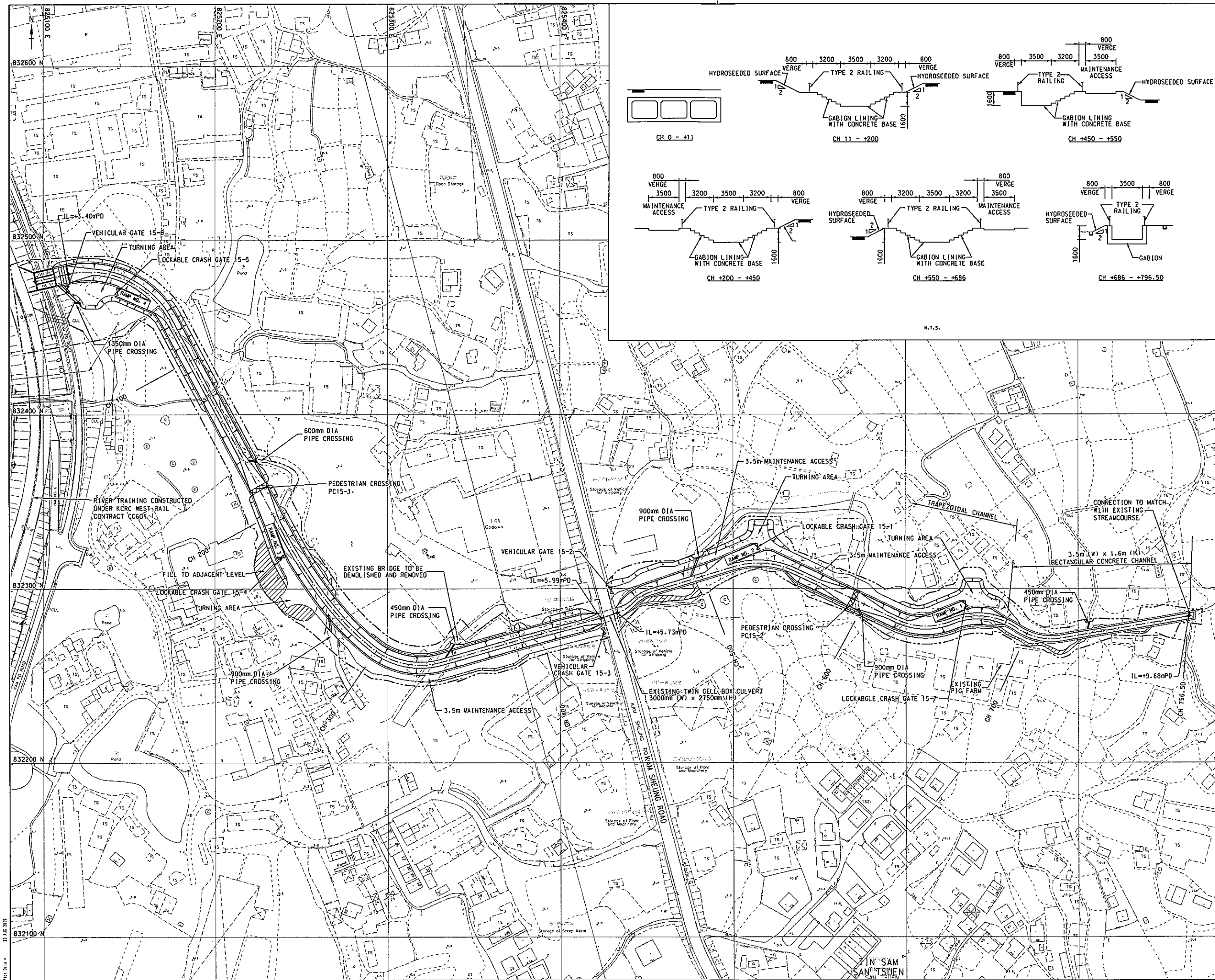
Contract Title
**YUEN LONG, KAM TIN,
NGAU TAM MEI AND
TIN SHUI WAI
DRAINAGE IMPROVEMENT
STAGE 1**

Figure Title
**LOCATIONS OF THE
DESIGNATED PROJECTS
KT14 AND KT15**

Drawing No. **Figure 1.1** Scale **1 : 40000**

Client
 香港特別行政區環境保護署
THE DEPARTMENT OF THE
ENVIRONMENT, GOVERNMENT OF THE
HONG KONG SPECIAL ADMINISTRATIVE REGION

Consultant
 BLACK & VEATCH HONG KONG LIMITED
博施工程顧問有限公司



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- NOTES :
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
 - GRID LINES ARE HONG KONG METRIC GRID 1980.
 - TYPE 2 RAILING WITH DEBRIS TRAP BAR AND GENERAL MESH FILL SHALL BE PROVIDED AT BOTH SIDES OF THE CHANNEL BANKS

- LEGEND :
- SITE BOUNDARY
 - PROPOSED CHANNEL
 - PROPOSED SLOPE
 - AREA TO BE FILLED TO ADJACENT GROUND LEVEL
 - PEDESTRIAN CROSSING/VEHICULAR CROSSING
 - I.L. INVERT LEVEL

Revision	Date	Description	Initial
Designed		Checked	Drawn
Initial			Checked
Date			
Approved			

AGREEMENT NO. CE 67/98

Contract title

YUEN LONG, KAM TIN, NGAU TAM MEI AND TIN SHUI WAI DRAINAGE IMPROVEMENT, STAGE 1, PHASE 2B - KAM TIN

Drawing title

KAM TSIN WAI CHANNEL KT15 PROPOSED LAYOUT PLAN

Drawing no.

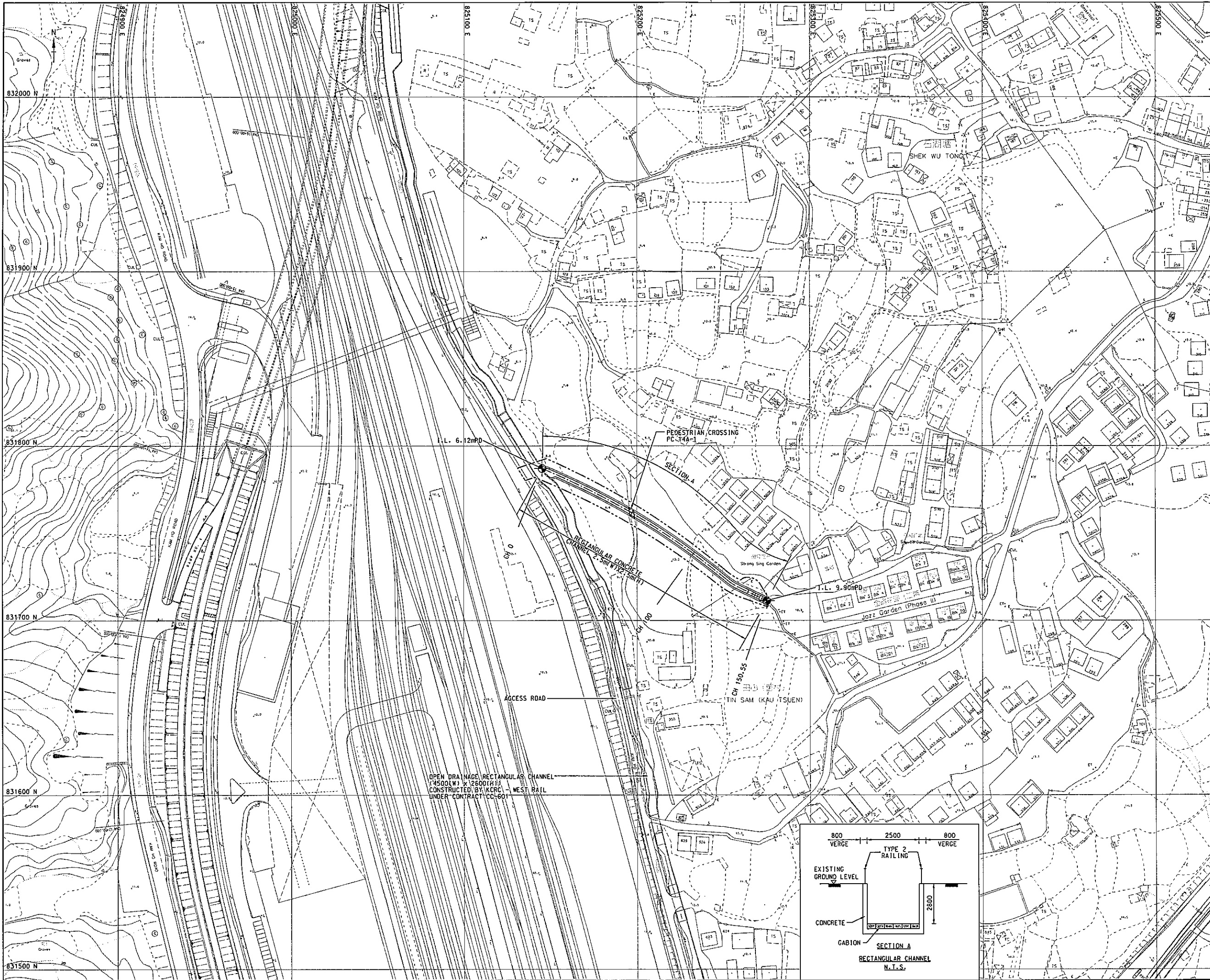
Figure 1.3

Scale

1:1000 A1
1:2000 A3

香港特別行政區政府渠務署
THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION
DRAINAGE SERVICES DEPARTMENT

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2. GRID LINES ARE HONG KONG METRIC GRID 1980.
3. TYPE 2 RAILING WITH DEBRIS TRAP BAR AND GENERAL MESH FILL SHALL BE PROVIDED AT BOTH SIDES OF THE CHANNEL BANKS

LEGEND :

- SITE BOUNDARY
- PROPOSED CHANNEL
- J.L. INVERT LEVEL
- ▨ PEDESTRIAN CROSSING/VEHICULAR CROSSING

Revision	Date	Description	Initial
		Designed	Checked
		Drawn	Checked
Initial			
Date			
Approved			

AGREEMENT NO. CE 67/98

Contract title

YUEN LONG, KAM TIN, NGAU TAM MEI AND TIN SHUI WAI DRAINAGE IMPROVEMENT, STAGE 1, PHASE 2B - KAM TIN

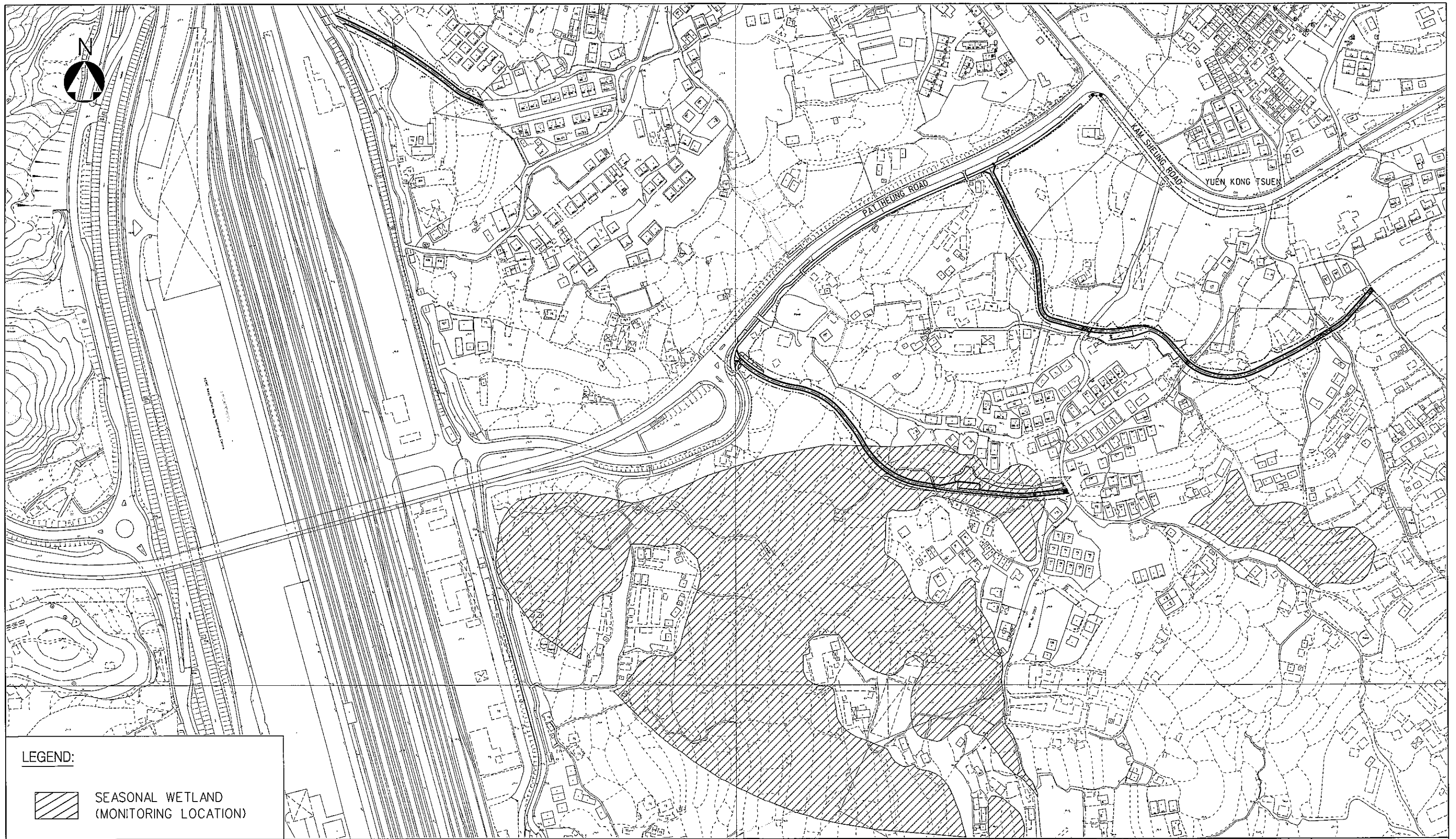
Drawing title

YUEN KONG SAN TSUEN CHANNEL KT14 PROPOSED LAYOUT PLAN (SHEET 1 OF 2)

Drawing no.	Scale
Figure 1.2 (Sheet 1 of 2)	1:1000 A1 1:2000 A3

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

BLACK & VEATCH HONG KONG LIMITED
博威工程顧問有限公司



LEGEND:

 SEASONAL WETLAND
(MONITORING LOCATION)

YUEN LONG, KAM TIN,
NGAU TAM MEI AND TIN SHUI WAI
DRAINAGE IMPROVEMENT, STAGE1, PHASE 2B

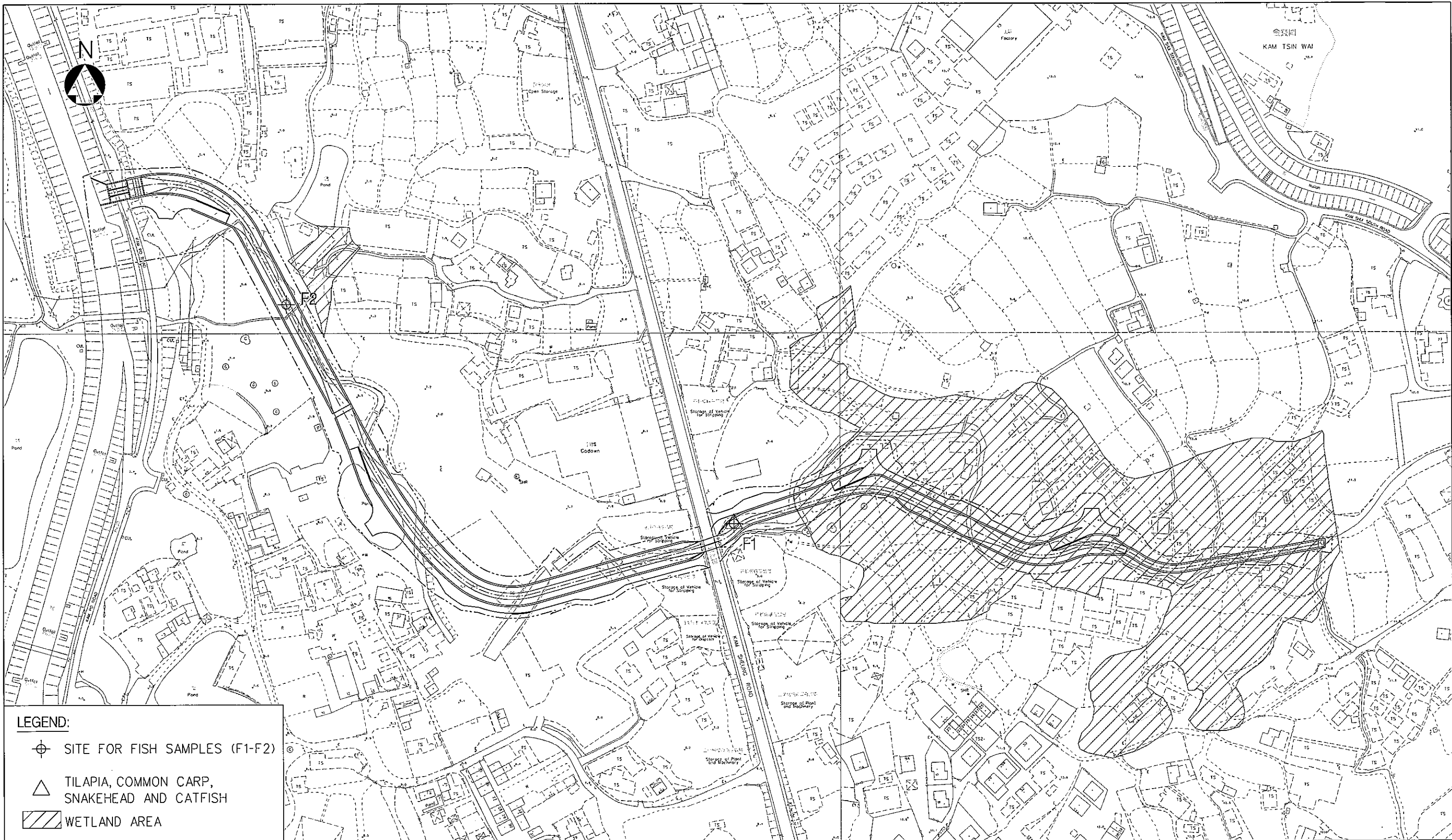


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Title :

ECOLOGICAL MONITORING AREA KT14

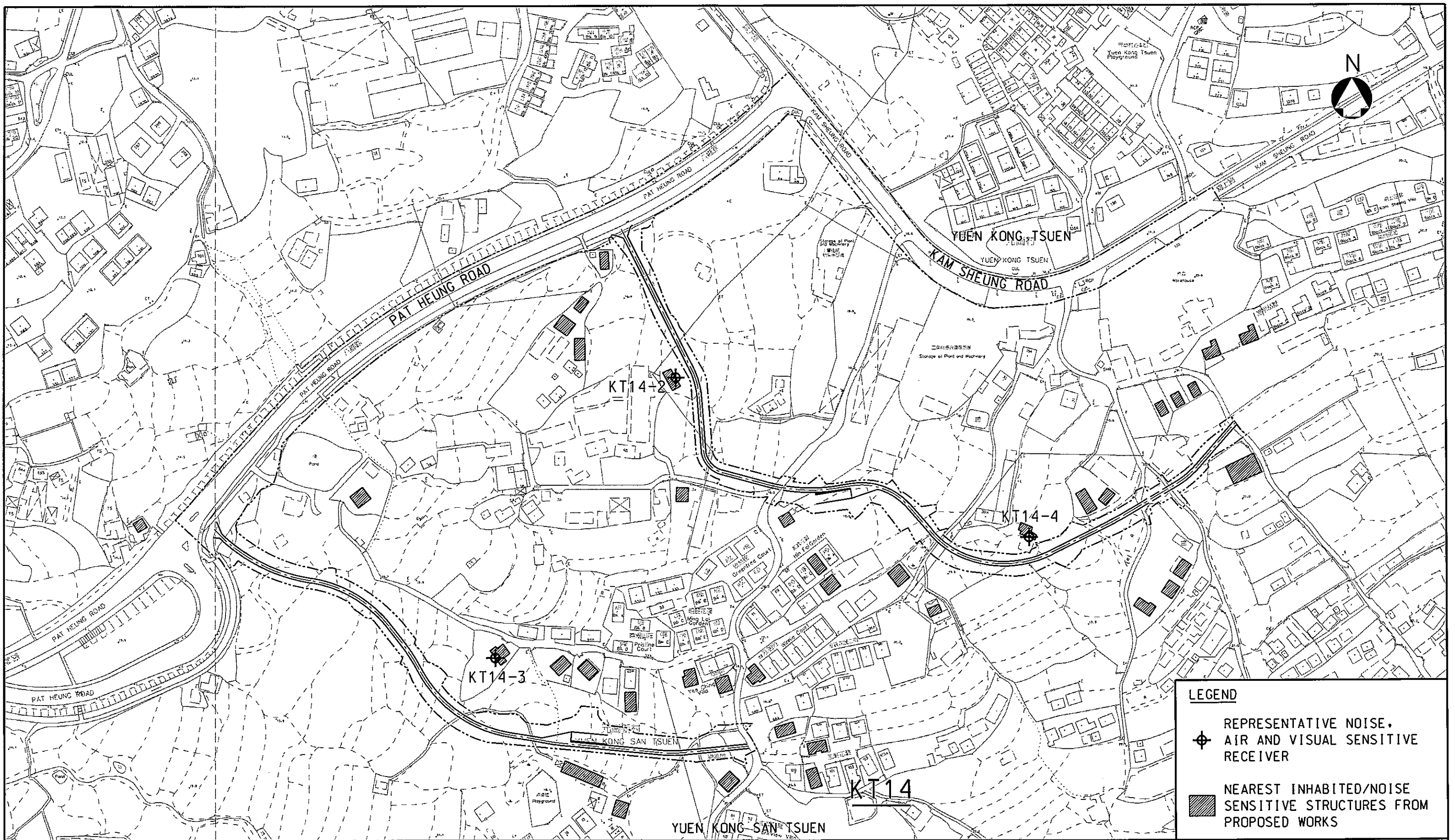
Figure No. 3.2	Revision 0
Reference -	File Name 3820470201-142.DGN
Prepared AEC	Checked WYC
Date MAR. 2003	Scale N.T.S.



LEGEND:

- ⊕ SITE FOR FISH SAMPLES (F1-F2)
- △ TILAPIA, COMMON CARP, SNAKEHEAD AND CATFISH
- ▨ WETLAND AREA

YUEN LONG, KAM TIN, NGAU TAM MEI AND TIN SHUI WAI DRAINAGE IMPROVEMENT, STAGE1, PHASE 2B		Title :		Figure No. 3.3	Revision 0
 BLACK & VEATCH HONG KONG LIMITED 博威工程顧問有限公司		ECOLOGICAL MONITORING AREA KT15		Reference -	File Name 3820470201-114.DGN
				Prepared AEC	Checked WYC
				Date MAR. 2003	Scale 1 : 2000



YUEN LONG, KAM TIN,
NGAU TAM MEI AND TIN SHUI WAI
DRAINAGE IMPROVEMENT, STAGE 1, PHASE 2B

Title :

LOCATIONS OF REPRESENTATIVE NOISE, AIR AND VISUAL SENSITIVE RECEIVERS AT KT14



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Figure No. 4.1	Revision -
Reference -	File Name 3820470201-132.DGN
Prepared MC	Checked WYC
Date DEC. 2002	Scale 1 : 2000



LEGEND

REPRESENTATIVE NOISE, AIR AND VISUAL SENSITIVE RECEIVER

NEAREST INHABITED/NOISE SENSITIVE STRUCTURES FROM PROPOSED WORKS

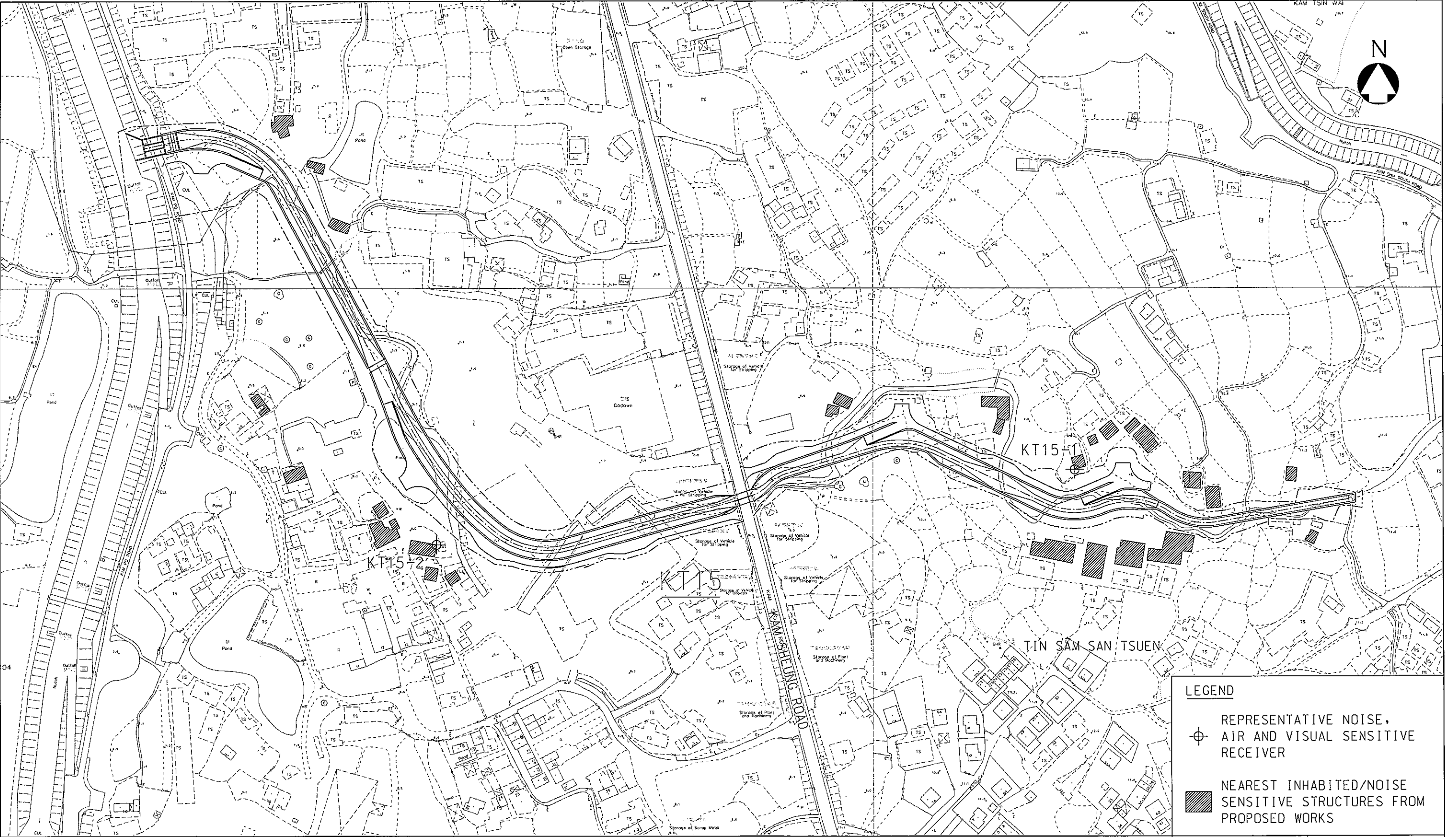
YUEN LONG, KAM TIN,
NGAU TAM MEI AND TIN SHUI WAI
DRAINAGE IMPROVEMENT, STAGE I, PHASE 2B

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Title :

LOCATIONS OF REPRESENTATIVE NOISE, AIR
AND VISUAL SENSITIVE RECEIVER AT KT14

Figure No. 4.2	Revision -
Reference -	File Name 3820470201-133.DGN
Prepared MC	Checked WYC
Date DEC. 2002	Scale 1 : 1000



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NGAU TAM MEI AND TIN SHUI WAI
DRAINAGE IMPROVEMENT, STAGE1, PHASE 2B

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Title :

LOCATIONS OF REPRESENTATIVE NOISE, AIR
AND VISUAL SENSITIVE RECEIVERS AT KT15

Figure No. 4.3	Revision -
Reference -	File Name 3820470201-134.DGN
Prepared MC	Checked WYC
Date DEC. 2002	Scale 1 : 2000



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- Legend**
- Bare Ground/Works in progress
 - Agricultural land
 - Drainage channel
 - Fishpond
 - Low-lying grassland/fallow land
 - Marsh
 - Orchard/Garden
 - Open storage
 - Plantation
 - River / Stream
 - Urban/Industrial Area
 - Woodland
 - Hillside grassland
 - Wetland adjacent to the Proposed Alignment
 - Alignments of KT14 and KT15

Revision	Date	Description	Initial
	Design	Check	Drawn
Initial	MC	KIL	CWYC
Date	01/05	01/05	01/05

Approved

AGREEMENT NO. CE 67/98

Contract Title
**YUEN LONG, KAM TIN,
NGAU TAM MEI AND
TIN SHUI WAI
DRAINAGE IMPROVEMENT
STAGE 1**

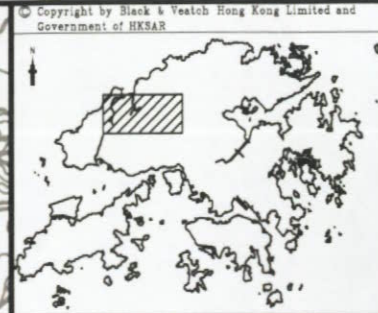
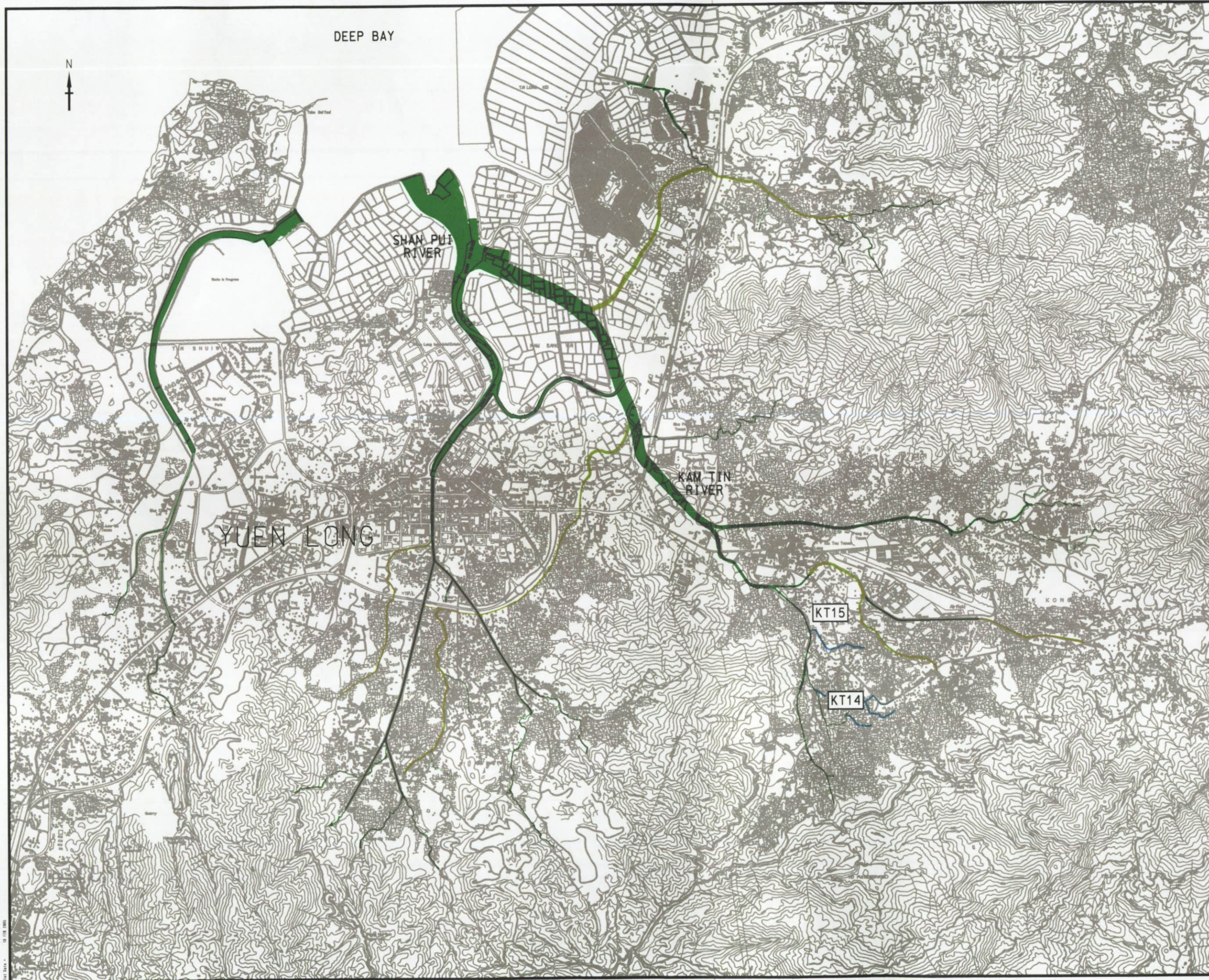
Figure Title
**Habitat Map for
KT14 and KT15**

Drawing No. **4.4** Scale **1 : 10000**

Client


Consultant

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KEY PLAN SCALE : N.T.S.

- LEGEND**
- WORKS PROPOSED UNDER THE STUDY
 - EXISTING RIVER CHANNELS
 - FUTURE RIVER CHANNELS (BY OTHERS)

Revision	Date	Description	Initial
Initial	Designed	Checked	Drawn
			YLL
			PKL
Date		08/00	08/00

Approved

AGREEMENT NO. CE 67/98

Contract title
YUEN LONG, KAM TIN, NGAU TAM MEI AND TIN SHUI WAI DRAINAGE IMPROVEMENT, STAGE 1, PHASE 2B - KAM TIN

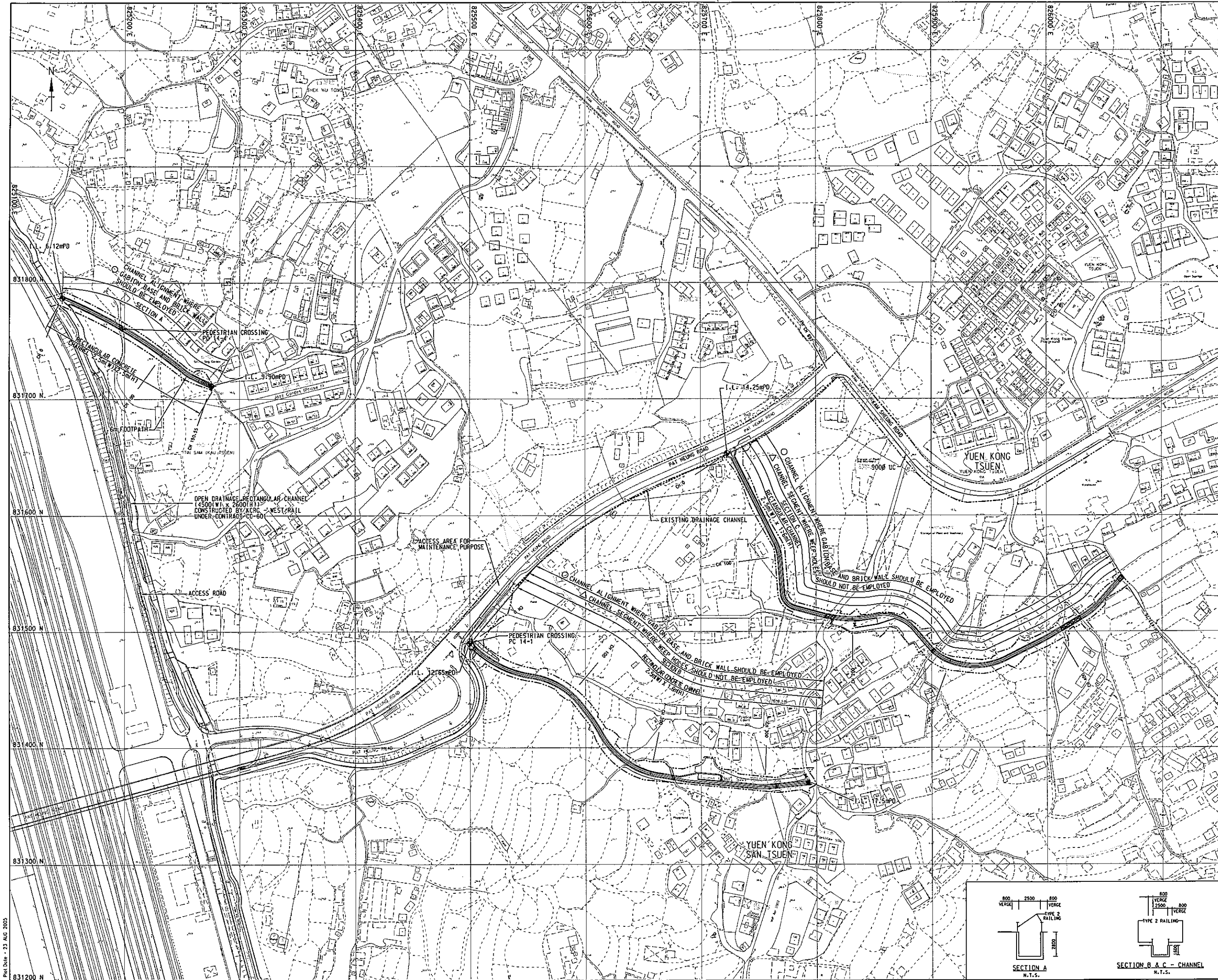
Drawing title
WATER QUALITY SENSITIVE RECEIVERS OF PROPOSED WORKS KT14 AND KT15

Drawing no.
Figure 4.5

Scale
1:20000 A1
1:40000 A3

香港特別行政區政府渠務署
THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION
DRAINAGE SERVICES DEPARTMENT

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- NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
 2. GRID LINES ARE HONG KONG METRIC GRID 1980.
 3. TYPE 2 RAILING WITH DEBRIS TRAP BAR AND GENERAL MESH FILL SHALL BE PROVIDED AT BOTH SIDES OF THE CHANNEL BANKS

- LEGEND :
- SITE BOUNDARY
 - PROPOSED CHANNEL
 - PROPOSED SLOPE
 - I.L. INVERT LEVEL
 - CHAMBER
 - MANHOLE
 - △ CHANNEL SEGMENT WHERE WEEP HOLES SHOULD NOT BE EMPLOYED
 - CHANNEL ALIGNMENT WHERE GABION BASE AND BRICK WALL SHOULD BE EMPLOYED

Revision	Date	Description	Initial
	Designed	Checked	Drawn
Initial	WHL	PKL	YLL
Date	10/02	10/02	10/02
Approved			

AGREEMENT NO. CE 67/98

Contract title
YUEN LONG, KAM TIN,
NGAU TAM MEI AND TIN SHUI WAI
DRAINAGE IMPROVEMENT, STAGE 1,
PHASE 2B - KAM TIN

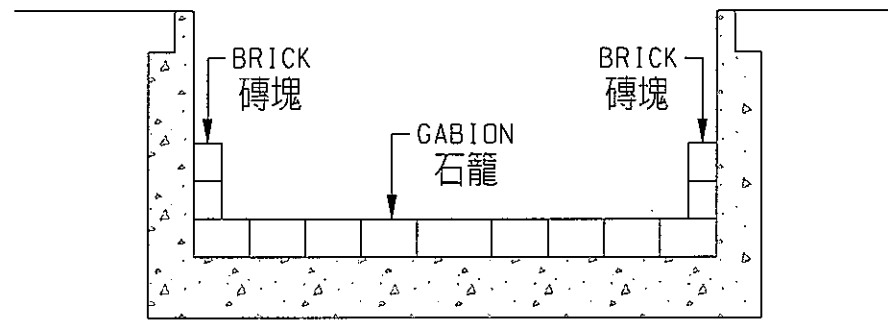
Drawing title
LOCATIONS OF ECOLOGICAL
MITIGATION MEASURES AT KT14

Drawing no.
FIGURE 5.1

Scale
1:1500 A1
1:3000 A3

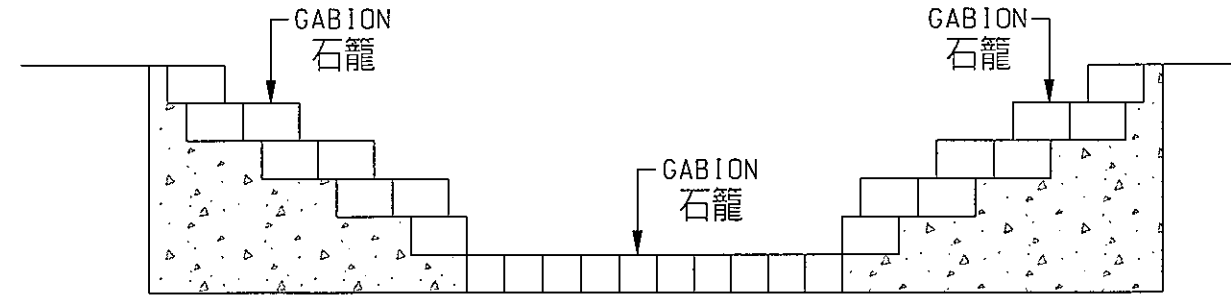
香港特別行政區政府渠務署
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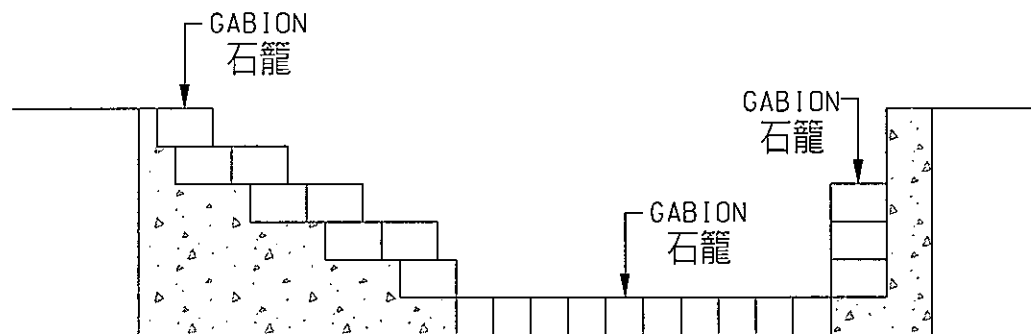
**RECTANGULAR CHANNEL
WITH GABION BASE AND BRICK WALL
N.T.S.**

KT14 : SECTION A, B & C
(REFERENCE TYPE 8 CHANNEL)
KT15 : CH +686 - CH +796.5



**TRAPEZOIDAL CHANNEL WITH GABION BASE AND WALL
N.T.S.**

KT15 : CH +0 - CH +450 & CH +550 - CH +686



**TRAPEZOIDAL CHANNEL
WITH GABION BASE AND WALL
N.T.S.**

KT15 : CH +450 - CH +550

NOTES:

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH FIGURES 1.2 AND 1.3 INCLUSIVE WHICH DETAIL TO SPECIFIED CHAINAGES FOR EACH CHANNEL LINING SOLUTION.

Revision	Date	Description			Initial
		Designed	Checked	Drawn	Checked
Initial		WHL	PKL	WK	PKL
Date	12/02	12/02	12/02	12/02	12/02

Approved

AGREEMENT NO. CE 67/98

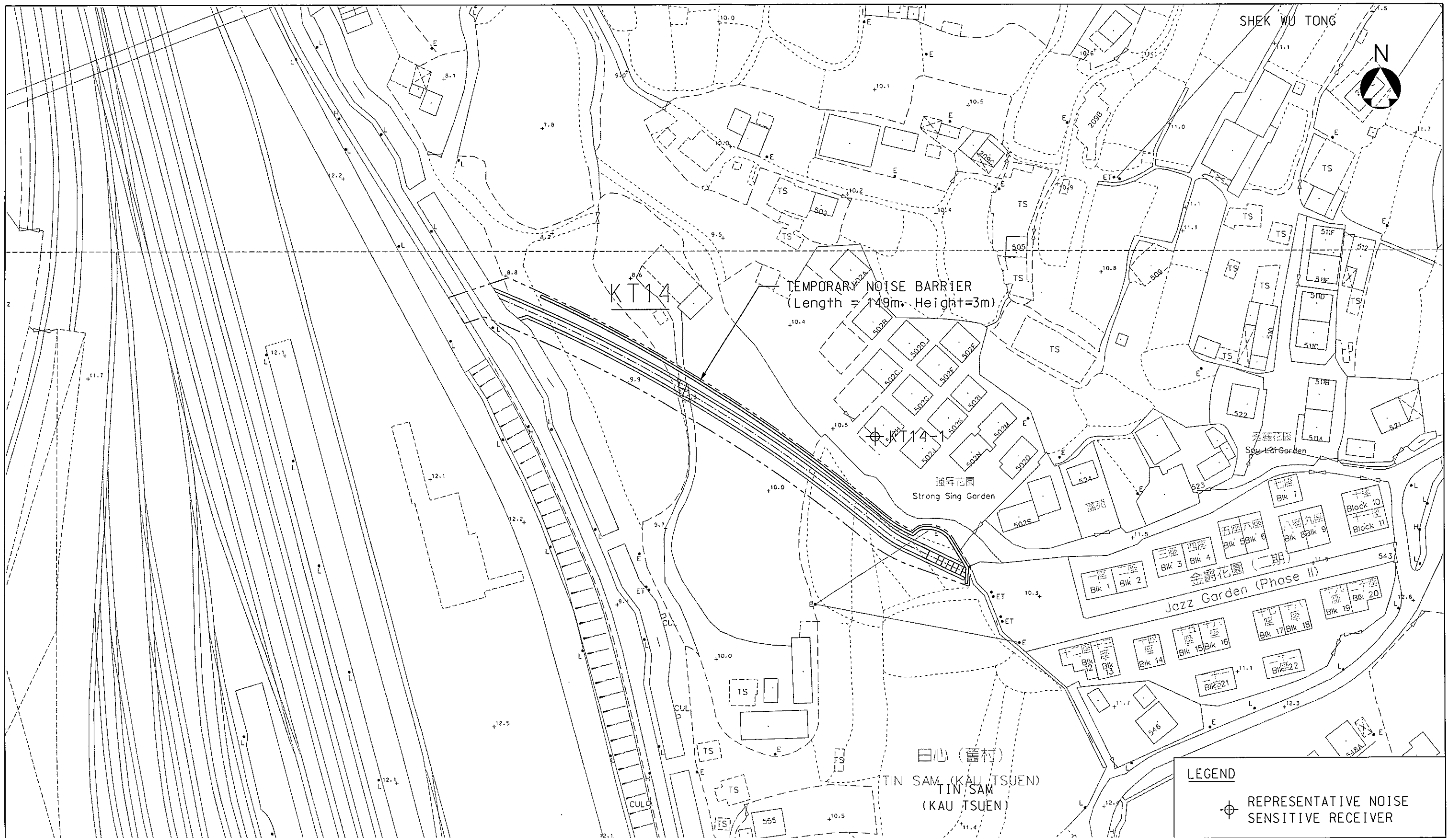
Contract title
YUEN LONG, KAM TIN,
NGAU TAM MEI AND TIN SHUI WAI
DRAINAGE IMPROVEMENT, STAGE 1,
PHASE 2B - KAM TIN

Drawing title
TYPICAL SECTIONS OF
DRAINAGE CHANNEL LININGS
FOR KT14 AND KT15

Drawing no.	Scale
FIGURE 5.3	AS SHOWN


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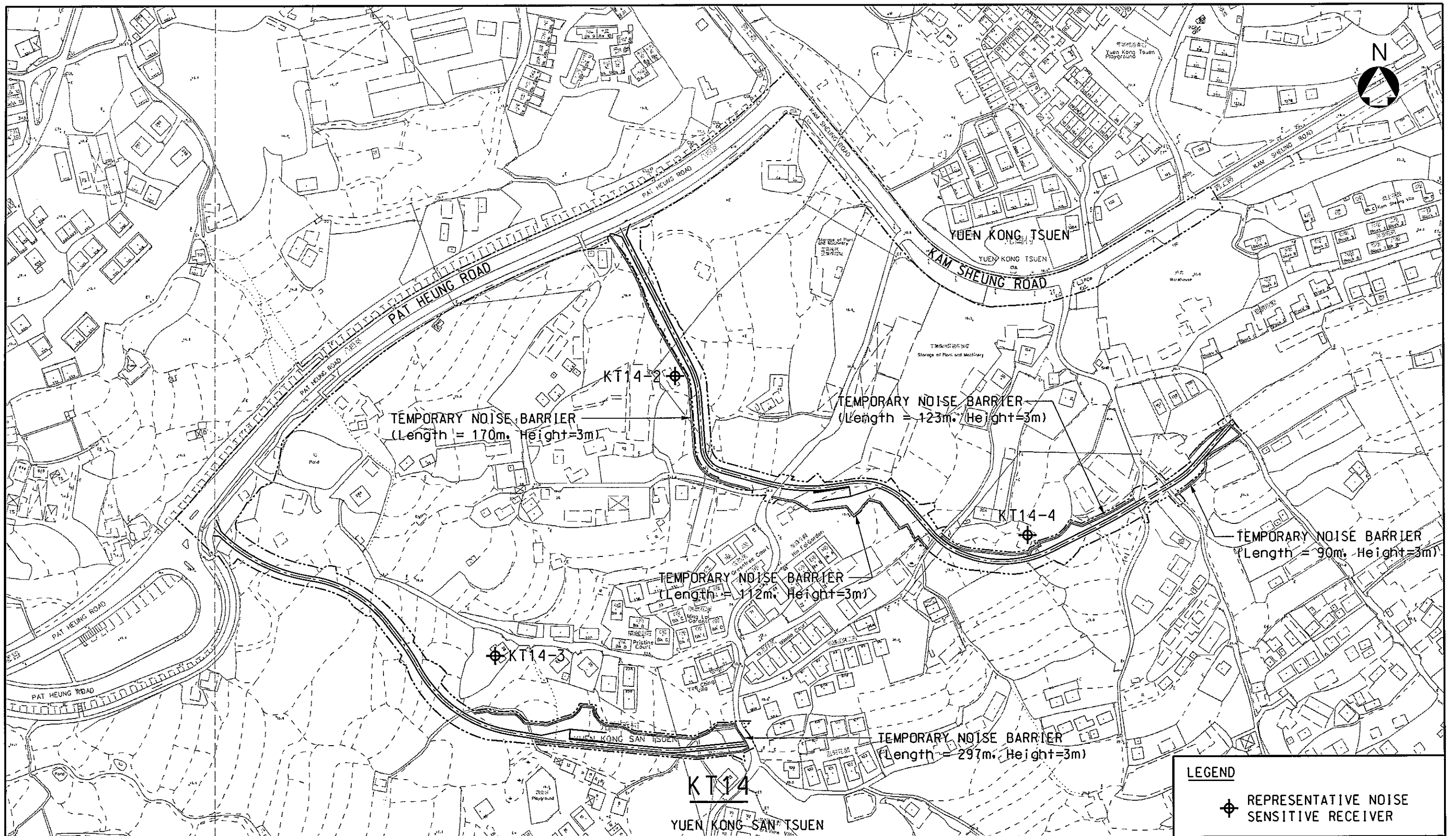
LEGEND	
	REPRESENTATIVE NOISE SENSITIVE RECEIVER
Figure No. 5.4	Revision -
Reference -	File Name 3820470201-138.DGN
Prepared WYC	Checked MC
Date DEC. 2002	Scale 1 : 1000

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DRAINAGE IMPROVEMENT, STAGE1, PHASE 2B


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Title :

LOCATIONS OF PROPOSED TEMPORARY
NOISE BARRIERS AT KT14



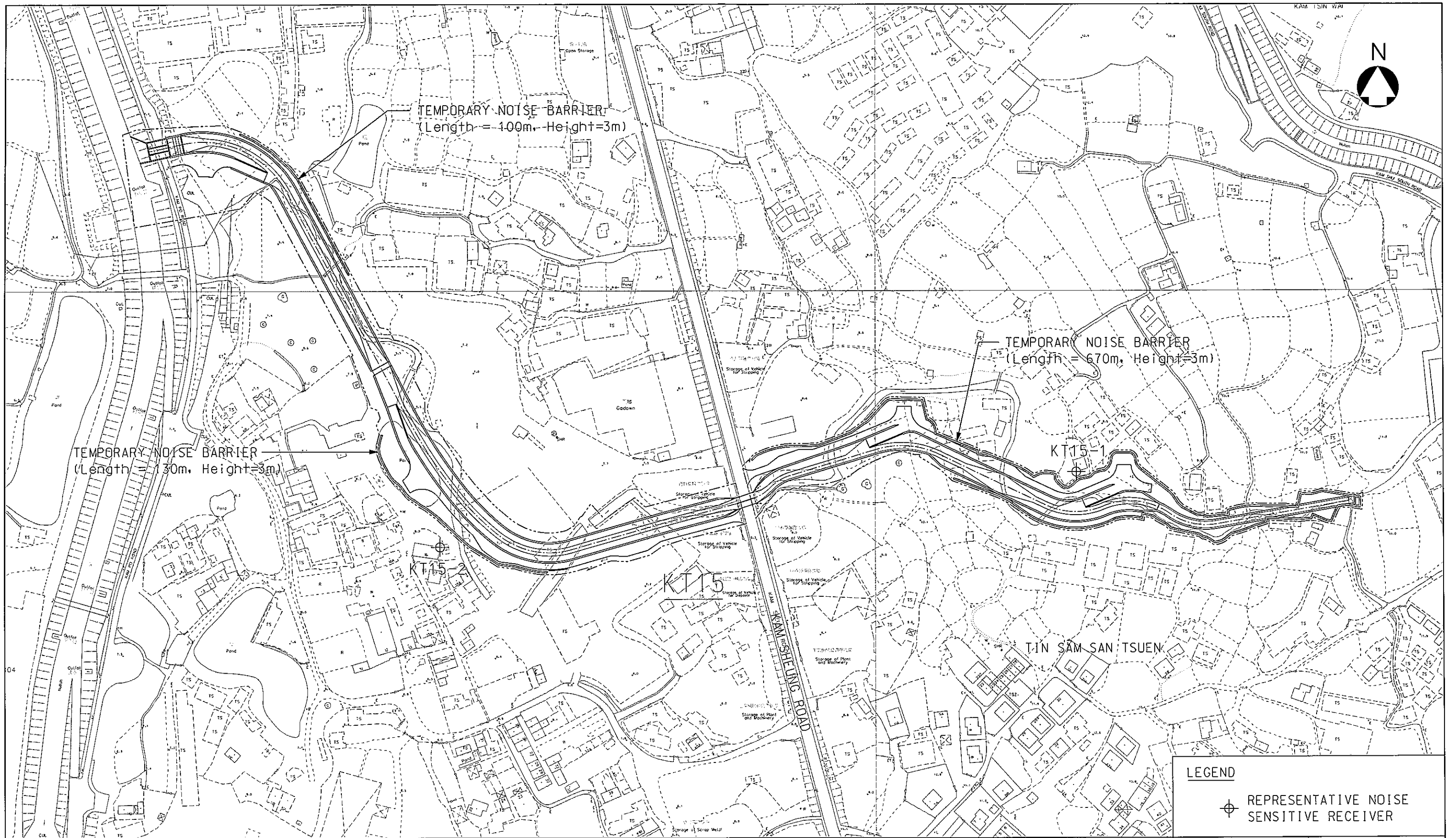
LEGEND	
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Figure No. 5.5	Revision -
Reference -	File Name 3820470201-139.DGN
Prepared WYC	Checked MC
Date DEC. 2002	Scale 1 : 2000

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NGAU TAM MEI AND TIN SHUIWAI
DRAINAGE IMPROVEMENT, STAGE1, PHASE 2B


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Title :

LOCATIONS OF PROPOSED TEMPORARY
NOISE BARRIERS AT KT14



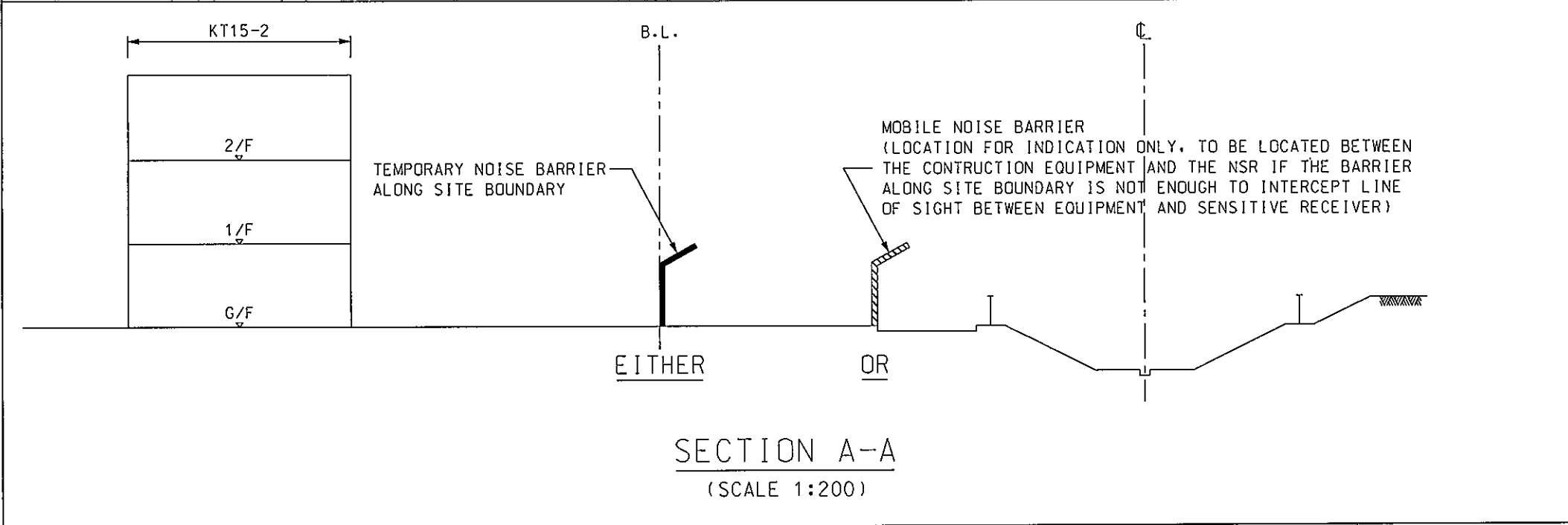
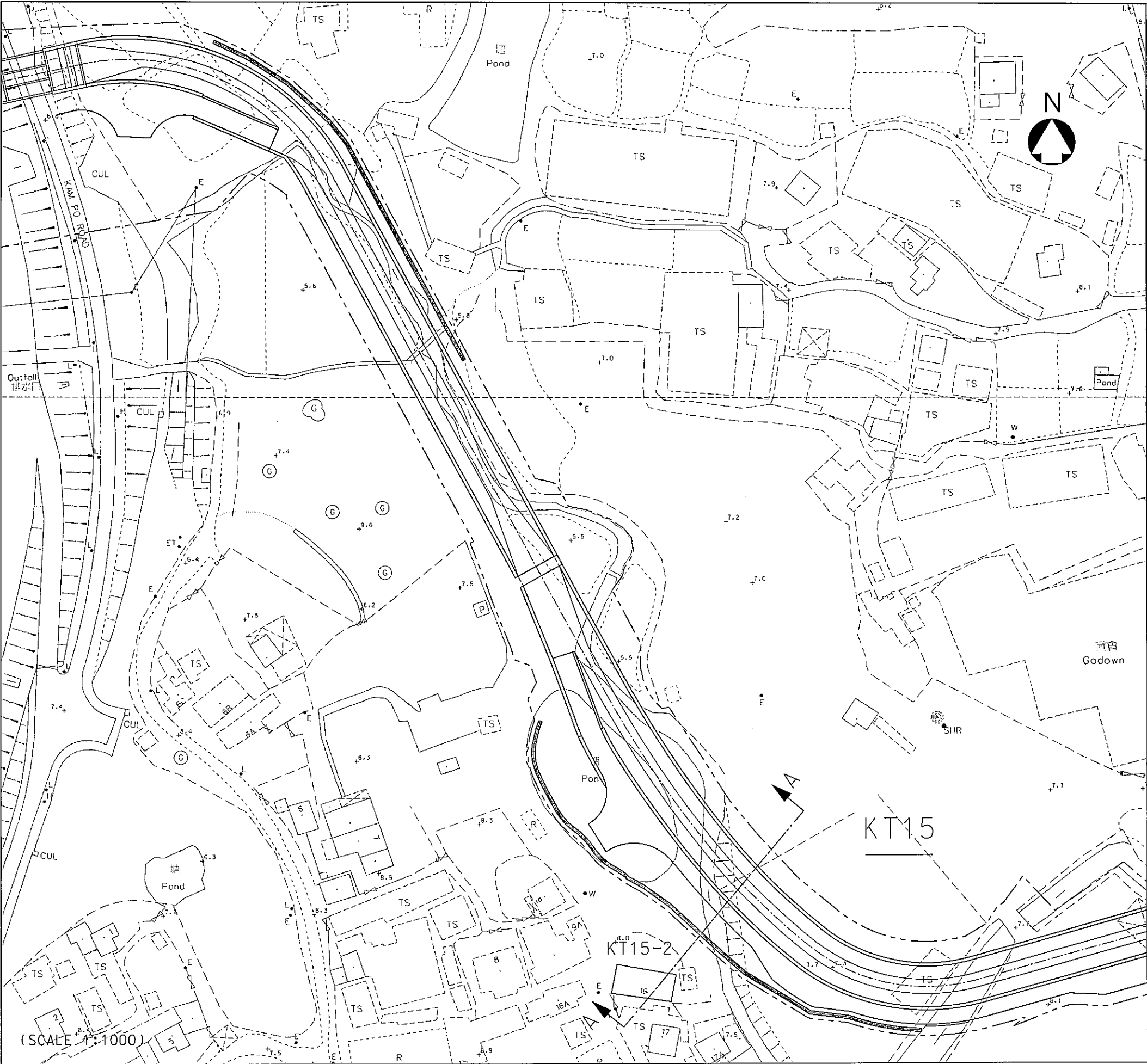
LEGEND	
	REPRESENTATIVE NOISE SENSITIVE RECEIVER
Figure No. 5.6	Revision -
Reference -	File Name 3820470201-140.DGN
Prepared WYC	Checked MC
Date DEC. 2002	Scale 1 : 2000


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DRAINAGE IMPROVEMENT, STAGE 1, PHASE 2B


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Title :

LOCATIONS OF PROPOSED TEMPORARY
NOISE BARRIERS AT KT15



YUEN LONG, KAM TIN, NGAU TAM MEI AND TIN SHUIWAI DRAINAGE IMPROVEMENT, STAGE1, PHASE 2B	Title : INDICATIVE CROSS SECTION VIEW OF CONSTRUCTION SITE AND PROPOSED TEMPORARY NOISE BARRIERS (KT15)	Figure No. 5.7	Revision -
 BLACK & VEATCH HONG KONG LIMITED 博威工程顧問有限公司		Reference -	File Name 3820470201-141.DGN
		Prepared WYC	Checked MC
		Date DEC. 2002	Scale AS SHOWN