



**CCECC & CRWJ Joint Venture**

***Detailed Design of Temporary  
Drainage Works***

**Contract No.HY/2003/19  
Improvement to Tung Chung Road  
between Lung Tseng Tau and Cheung Sha**

## **CONTEXT**

<b>1.0</b>	<b>Introduction</b> .....	<b>2</b>
<b>2.0</b>	<b>Background</b> .....	<b>3</b>
<b>3.0</b>	<b>The Site and Road Improvement Proposals</b> .....	<b>6</b>
<b>4.0</b>	<b>Engineer's Requirements For the Drainage System</b> .....	<b>6</b>
<b>5.0</b>	<b>Drainage Design Parameters</b> .....	<b>7</b>
<b>6.0</b>	<b>The Proposed Drainage Scheme</b> .....	<b>7</b>
<b>7.0</b>	<b>Detailed Construction Considerations</b> .....	<b>8</b>
7.1	Hinterland drainage .....	9
7.2	Pipe .....	9
7.3	Temporary surface drainage .....	9
7.4	Protection of existing streams .....	9
7.5	Haul road sections .....	10

## **APPENDIX**

Appendix A	EPD's Comments dated 21 Dec 2004 and Response to Comment Table
Appendix B	Calculation for Hinterland Drainage in Northern Section
Appendix C	Calculation for Temporary Drainage for Collection of Site Runoff in Northern Section
Appendix D	Calculation for Temporary Drainage Pipe (Including support) Design in Northern Section
Appendix E	Calculation for Hinterland Drainage in Southern Section
Appendix F	Calculation for Temporary Drainage for Collection of Site Runoff in Southern Section
Appendix G	Flooding Plan
Appendix H	Calculations for Filter Tank and Oil Interceptor
Appendix I	Outfall Detail

## 1.0 INTRODUCTION

CCECC and CRWJ Joint Venture (CCJV) has been awarded the Highways Department Contract No. HY/2003/19 for the Improvement to Tung Chung Road between Lung Tseng Tau and Cheung Sha. CCJV has employed ESA Consulting Engineers Ltd. to the temporary drainage designer to carry out the necessary design and calculations.

*According to Condition 2.4 of the EP-170/2003 “A drainage system shall be constructed and operated before the commencement of widening and realigning works for the section of Tung Chung Road between Lung Tseng Tau and Pak Kung Au. The drainage system shall be effectively designed, constructed and operated to avoid discharging construction site runoff into the streams and to transfer all runoff during construction and operation to the Wong Lung Hang nullah in Tung Chung for discharge. No runoff during construction and operation shall be discharged into Tung Chung Stream as shown in Figure 1 of this Permit. The Permit Holder shall, no later than one month before the commencement of construction of the section of Tung Chung Road between Lung Tseng Tau and Pak Kung Au, deposit with the Director three hard copies and one electronic copy of the drainage proposal(s) showing the detailed design, layout and capacity of the drainage system, the discharge location(s) and the treatment method(s) before discharge. Before submission to the Director, the proposal(s) shall be certified by the ET Leader and verified by the IEC as conforming to the information and recommendations contained in the approved EIA Report (Register No. AEIAR-061/2002) to mitigate environmental impacts of water quality and ecology.”*

*According to Condition 2.5 of the EP-170/2003 “The section of Tung Chung Road between Pak Kung Au and Cheung Sha shall be divided into small catchments for carrying out the works of the Project. A temporary drainage system shall be constructed and operated for each catchment to collect construction site run-off for treatment before discharge. The temporary drainage system shall be constructed in advance of haul road formation. Sedimentation or filter tanks and oil interceptors shall be effectively designed, constructed and operated to treat the construction site run-off before discharge into streams or via the Pui O Wan outfall. To avoid discharging runoff during operation into the streams within the country parks, an operational drainage system shall be constructed and operated to convey the runoff during operation to the sea. The Permit Holder shall, no later than one month before the commencement of construction of the section of Tung Chung Road between Pak Kung Au and Cheung Sha, deposit with the Director three hard copies and one electronic copy of drainage proposal(s) showing the detailed design of the catchments, drainage systems, sedimentation or filter tanks, oil interceptors and discharge locations. Before submission to the Director, the proposal(s)*

*shall be certified by the ET Leader and verified by the IEC as conforming to the information and recommendations contained in the approved EIA Report (Register No. AEIAR-061/2002) to mitigate environmental impacts of water quality and ecology.”*

## **2.0 BACKGROUND**

In accordance with the E.P. condition 2.4 and 2.5, Temporary Drainage Proposal comprising the following document and drawings were deposited to Environmental Protection Department on 28 September 2004 by The Engineer:

- Detailed Design of Temporary Drainage Works (Issue 4); and
- ET’s Certification Document;
- IEC’s Verification Document; and
- Drawing Nos:
  - ESA/041270/General/GB001 (RevB)
  - ESA/041270/North/DN001 to DN008 (Rev B)
  - ESA/041270/South/DN001 & DN002 (Rev B)
  - ESA/041270/South/DN003 (Rev C)
  - ESA/041270/South/DN004 to DN007 (Rev B)
  - ESA/041270/DETAILS/DT001 (Rev B)
  - ESA/041270/DETAILS/DT002 (Rev C)
  - ESA/041270/DETAILS/DT003 (Rev B)

EPD’s comments (Appendix A) dated 21 Dec 2004 regarding the submitted Temporary Drainage Proposal was received on 3 Jan 2005. This revised proposal has incorporated the EPD’s comments as well as some technical changes on the previously submitted temporary drainage proposal as stipulated as below:

1. According to EIA section 6.3.3.6, “For the northern section of the new road, it is proposed that a drainage system be constructed ahead of the main roadworks such that it may be used to discharge the construction site runoff, thus avoid discharging construction site runoff into the streams. The same system will remain in place and form the permanent operational drainage system which will avoid discharging carriageway runoff into the streams together.” According to EIA section 6.3.3.13(i), “Ch1000 to 32000 - it is necessary to construct the connection to the nullah to allow for the discharge of run-off to be undertaken in the first instance.....This section of the drainage system is off-line, running along the west side of the road.”

Therefore, Permanent 1200 dia. pipe along the Maintenance Access Track (approx.

Ch1100 to 1700) would be installed according to the recommendation in the EIA instead of the temporary 225/ 300 u-channel and Type 1/ 2 pipe from Lung Tseng Tau to Shek Mun Kap Road for the temporary drainage design purpose. As 1200 dia. pipe is permanent drainage works, Sedimentation tank NFT1 would then be installed at Shek Mun Kap for filtering the construction runoff before the water discharge into the 1200 dia. pipe. During the construction of 1200 dia. pipe, temporary earth bund/ channel would be formed peripherally at the edge of site boundary and sump pits/ sand trap would be erected at the local low points to collect the construction runoff so as to prevent the construction runoff directly discharged outside the Project site. This can prevent the untreated construction runoff going into the Tung Chung Stream during construction stage and reduce possible construction wastes and contamination to the surroundings during the removal of intended temporary drainage works in the previous submission. Moreover, this can minimize the conflict in construction between the permanent works (1200 dia. pipe and maintenance access) and intended temporary drainage works in the previous submission because of the limited working space. Making use of the 1200 dia. pipe as a temporary drainage measure is a more practical solution to suit the actual site conditions.

2. Sedimentation tank NFT2 would be installed at approx. Ch1010, the downstream of the temporary drainage system, to filter the water collected within the site from Ch1000 to Ch1630 before discharging to the existing manhole S19\* through the crossroad pipe.
3. Minor amendment in the alignment of 600 U-channel from Ch1120 to Ch 1145 to suit actual site condition.
4. Minor amendment in the alignment of 300 U-channel at Ch1250 to cater for the existing bus bay.
5. From Ch2000 to Ch2200, temporary 225 U-channel should follow the existing Tung Chung Road rather than following the alignment in the previous submission because of the difficulty in accessibility.
6. Alignment of temporary 600 U-channel from Ch2325 to Ch2350 is revised in order not to avoid the existing uphill access during construction. This is beneficial to the user of the existing access and no reinstatement of the existing access is required.
7. From Ch3210 to Ch3380, type 4 pipes should follow the existing Tung Chung Road rather than following the alignment in the previous submission because of the

difficulty in accessibility. If the alignment of previous submission is followed, huge excavation works shall be required before the laying of the pipe. This would definitely lengthen the time of construction of temporary drainage and is considered not practical.

8. Minor amendment in the hinterland drainage at approx. Ch3400 so as to follow the original hinterland drainage design.
9. Temporary 225 U-channel is removed from Ch3220 to Ch 3950 as this would be a local high point during the construction of off-road section. It cannot effectively collect runoff within the site during construction and should be deleted. The site runoff in that area will be intercepted by a temporary 300 u-channel downhill at Ch3220 before the site runoff going to the existing stream and diverted to the temporary drainage pipe. The alignment of type 4 pipe from Ch3500 to Ch3630 is slightly changed because of the same reason as per point 7.
10. Part of the 600 U-channel is removed from the temporary drainage system from Ch4020 to Ch4120 as a proposed retaining wall would be constructed at that location which would be in conflict with the 600 U-channel if it is constructed in advance. If this U-channel is constructed as part of the temporary drainage system, it would inevitably be demolished before the construction of retaining wall and produce unnecessary construction wastes.
11. Temporary 225 U-channel from Ch4000 to Ch4300 would be formed inside hinterland drainage by mean of sand bags. It separates hinterland drainage from temporary drainage for runoff inside the site.
12. General amendment for drawing legend, “Proposed Open Channel” changed to “Proposed Permanent Drainage Channel”,

The revised Temporary Drainage Proposal will include this Detailed Design of Temporary Drainage Works, ET’s Certification Document, IEC’s Verification Document and following drawings:

- ESA/041270/General/GB001 (RevB)
- ESA/041270/North/DN001 to DN002 (Rev G)
- ESA/041270/North/DN003 to DN006 (Rev F)
- ESA/041270/North/DN007 to DN008 (Rev D)
- ESA/041270/North/DN009 to DN0010 (Rev B)
- ESA/041270/North/DN0011

- ESA/041270/North/DN0012 to DN0013 (Rev A)
- ESA/041270/North/DN0014
- ESA/041270/South/DN001 & DN002 (Rev C)
- ESA/041270/South/DN003 (Rev D)
- ESA/041270/South/DN004 to DN005 (Rev C)
- ESA/041270/South/DN006 to DN007 (Rev B)
- ESA/041270/DETAILS/DT001 (Rev E)
- ESA/041270/DETAILS/DT002 (Rev G)
- ESA/041270/DETAILS/DT001 (Rev D)

### **3.0 THE SITE AND ROAD IMPROVEMENT PROPOSALS**

Tung Chung Road can be divided by its highest point at Pak Kung Au into the northern and southern sections. The northern section is approximately 4.7 km long; it starts from its lowest point at Lung Tseng Tau, and rises 300m to Pak Kung Au. The first half of the northern section will be widened along the existing alignment of the road but, from the Tai Tung Shan Service Reservoir the proposed alignment will be taken east of the existing road. The southern section then continues from Pak Kung Au and will be relatively shorter at 2.5 km. It will be aligned completely east of the existing road, taking the newly formed Tung Chung Road to South Lantau Road at Pui O.

### **4.0 ENGINEER'S REQUIREMENTS FOR THE DRAINAGE SYSTEM**

The design of the temporary drainage (as detailed in Particular Specification Clause 1.107) and the associated works must strictly comply with the requirements of the Environmental Permit No. EP-170/2003 (EP) and any further Environmental Permit, General Specifications, Particular Specifications, Contract Drawings as well as the approved EIA Report (Register No. AEIAR-061/2002) and the latest version of the Environmental Monitoring and Audit Manual (EM&A Manual).

This requires the identification of the affected drainage catchments and the design of the temporary drainage system must compensate for any reduction in flow capacities of these existing drainage systems / stream courses / flow paths when affected by the construction activities.

Surface runoff in the northern section that might be contaminated by the road and associated earthworks is not allowed to be discharged into any of the eighteen existing streams running across the road. This runoff will instead need to be treated by

sedimentation or filtering before being discharged by pipe into existing Wong Lung Hang nullah in Lung Tseng Tau.

In the southern section, however, contaminated surface runoff may be discharged into existing streams or the Pui O Wan outfall but only after treatment (by sedimentation/filter tanks and oil interceptors). However no discharge into the water gathering grounds above the catchwater is allowed. Treatment using filter/sedimentation tanks and oil interceptors will therefore be required above the catchwater while filter/sedimentation-only will suffice below the catchwater.

However, surface runoff that has not been contaminated may be carefully discharged into existing streams. This applies to both the northern and southern sections.

## 5.0 DRAINAGE DESIGN PARAMETERS

The temporary drainage has been designed for 1 in 10 years storms as indicated in the Contract Specifications. Other major design parameters adopted are given in Table 1.0.

Runoff coefficient for flat grassland (heavy soil)	0.25
Pipe friction for steel, galvanized iron, coated cast iron, precast concrete and spun precast concrete	0.15

Ref: Stormwater Drainage Manual – Drainage Services Department 2000, Table 1.0, Major design parameters

## 6.0 THE PROPOSED DRAINAGE SCHEME

The proposed system, designed to meet the Engineer's requirements, can be separated into two.

Firstly, it is proposed to install open channels as the hinterland drainage, to intercept runoff from the natural hillside before it gets into the works area. Such runoff will therefore not be contaminated by the works and can be directly discharged into any existing stream. The peak total quantity of runoff is estimated to be about 1,178,000 litres per minute. Relevant calculations for northern and southern sections are given in Appendix B and E respectively.

Secondly, temporary surface channels will be installed to intercept the contaminated runoff from the works areas. These will typically be localized systems to suit the

construction sequence and the type of works. The total quantity of surface runoff from these areas is estimated to be 53,000 litres per minute for the northern section and 45,000 litres per minute for the southern. In the northern section, all the runoff collected from the site areas will be ultimately diverted to Wong Lung Hang nullah by means of pipe which has the advantage of being flexible in its route (e.g. crossing existing streams) and of containing the contaminated runoff. The runoff will be filtered before being discharged into the nullah. Detailed calculations are given Appendices C and D. In the southern section, the specification allows discharge directly into the existing streams provided that suitable sedimentation/filtering and oil/grease interception are conducted prior to discharge. There will consequently be relatively more discharge points and the routes will be shorter when compared to the northern section. Detailed calculations are given in Appendix F.

The construction sequence of the drainage system will be:

1. Carry out site clearance within limit of work area to allow the initial survey of the limit of work area, actual ground condition and profile.
2. Provide temporary construction runoff control measures (sand bags, earth bund, sand trap, sump pit etc.) at site perimeters to control site runoff during construction of drainage system. In addition, tarpaulin will be used to cover exposed surface to minimize construction runoff, wherever practicable.
3. Construct temporary haul road to extend the construction of temporary drainage. This initial access for construction of temporary drainage system will be well within the limit of work area.
4. Protect the existing streams with sand bags to avoid contamination by site runoff. The design of the channel is conservative in estimation both of surface runoff and of the capacity of the channel. The channel can therefore carry rainwater from a 1 in 10 year storm event without overtopping. As a prudent measure, sand bags will be provided to further prevent overtopped incident, wherever necessary and practicable. In addition, a flooding plan detailed the emergency response has been prepared and given in Appendix G.
5. Repeat steps 1 to 4 as above until the completion of drainage system.

## **7.0 DETAILED CONSTRUCTION CONSIDERATIONS**

The design has considered the following details:

- i. Hinterland drainage
- ii. Pipes
- iii. Temporary surface drainage

- iv. Protection of existing streams/ catchwater
- v. Haul road sections

### **7.1 Hinterland drainage**

The proposed drainage will be constructed above all earth works (including that of the temporary haul roads). Its alignment and size will basically be the same as the permanent channels already proposed by the Engineer in order to minimize abortive work and disturbance to the natural hillside. However additional temporary sections will be required to maintain a smooth and effective system.

### **7.2 Pipe**

The proposed pipe will be installed just outside the existing pedestrian footpath along most of its length. Such an alignment will minimize interference with the construction and public traffic on the road. The pipe location and levels (being slightly lower than the existing road level) will facilitate discharge (into the pipe). The pipe will be either be in a trench or will be supported at intervals to suit the ground conditions. The works sequence will be planned to minimize the required capacity of the pipe since smaller pipes will ease transportation and installation.

### **7.3 Temporary surface drainage**

The temporary drainage will be installed strategically to encompass the works areas, thereby containing the contaminated runoff. Cross-road channels (when necessary) will be constructed in two parts in order to allow continuous traffic flow, and will also be carefully protected against traffic damage. The runoff will be discharged directly into the pipe where possible, but other methods such as pumping will be used where required.

In the southern section, runoff will be treated prior to discharge into the streams. Treatment of surface run-off will make use of filter tanks and oil interception and detailed calculations are given in Appendix H.

### **7.4 Protection of existing streams**

The existing streams will be monitored against erosion that may be caused by discharge

from the hinterland drainage and, in the case of the southern section, from the temporary drainage as well. Mitigation will include directional flows to match the orientation of the streams and also the use of riprap and/or plastic sheeting to protect the streambed.

The temporary drainage will intercept all contaminated runoff before it enters the streams; its design capacity will be adequate against the design rainfall of 1 in 10 years.

Although the design of the channel is conservative in estimation both of surface runoff and of the capacity of the channel, it is proposed that sandbags (or similar) be laid along the embankments of the stream and/ or site boundary as a precautionary measure against severe rainstorms.

So as to protect the catchwater in Southern Section, all construction runoff discharge points located at upstream of catchwater will be treated by filter tank as well as oil interceptor prior to discharge. As a prudent measure, the design maximum capacity is 200% of flow capacity to allow partial blockage of the filter during service and the fine particles to pass the filter tank must be finer than 0.06mm.

## **7.5 Haul road sections**

The offline sections of the proposed road will be constructed either in a downhill or an uphill manner. It is the former that is of concern since any contaminated runoff will tend to flow away from the area prior to completion of drainage installation. In such cases, clearance and formation of a minimal width of an access will be the initial action. All initial access will be in line with the alignment of New Tung Chung Road and proposed haul road (Deposited Haul Road Proposal for Zone E & F for Northern Section and Zone 1 and Zone 6 for Southern Section) and kept to minimal after take into account of workers safety and transportation of equipment and materials.

The proposed temporary drainage will then be constructed prior to any further major earthworks. However work must stop as it approaches any existing stream and stream protection will be put in place before proceeding further.

To comply fully with the EP Conditions 2.4 and 2.5 the permanent drawings arrangements for the operational phase of the project will be identified and submitted separately.