

8. WASTE MANAGEMENT

8.1 Introduction

- 8.1.1 This waste assessment examines the quantity, quality and timing of potential sources of solid wastes that will arise from the proposed drainage tunnel. It identifies potential environmental impacts associated with their handling and disposal. Options for reuse, minimization, recycling, treatment, storage, collection, transport and disposal of such wastes are examined.
- 8.1.2 Where unacceptable impacts are identified, appropriate mitigation measures and good site practice are recommended. Disposal options will be outlined for each type of waste, and the responsibilities for disposal or recycling discussed.
- 8.1.3 Types of solid wastes that arise during construction phase include chemically inert excavated material, a relatively small quantity of demolished material such as pipes and broken concrete, municipal waste generated by site staff during the construction phase, and a small quantity of chemical waste such as detergents, lubricants and engine oil for equipment maintenance.

8.2 Environmental Legislation, Policies, Plans, Standards and Criteria

- 8.2.1 The following legislation relates to the handling, treatment and disposal of wastes in the Hong Kong SAR and will be used in assessing potential impacts:
- Environmental Impact Assessment Ordinance (Cap 499)
 - Waste Disposal Ordinance (Cap 354)
 - Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354)
 - Land (Miscellaneous Provisions) Ordinance (Cap 28)
 - Public Health and Municipal Services Ordinance (Cap. 132) – Public Cleansing and Prevention of Nuisances Regulation
 - Dumping at Sea Ordinance (Cap 466)
- 8.2.2 The following documents, circulars and guidelines which relate to waste management and disposal in Hong Kong SAR will also be referred to during this study:
- Technical Memorandum on Environmental Impact Assessment Process, Annex 15 - Guidelines for Assessment of Waste Management Implications, and Annex 7 - Criteria for Evaluating Waste Management Implications
 - Hong Kong Planning Standards and Guidelines (HKPSG), Chapter 9 – Environment
 - New Disposal Arrangements for Construction Waste, EPD & Civil Engineering Department (1992)
 - Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes, EPD (1992)
 - WBTC No. 2/93 - Public Dumps
 - WBTC No. 2/93B - Public Filling Facilities
 - Practice Note for Professional Persons - Construction Site Drainage (ProPECC PN 1/94), Professional Persons Consultative Committee (1994)
 - WBTC No. 16/96 - Wet Soil in Public Dumps
 - Waste Reduction Framework Plan, 1998 - 2007, Planning Environment and Lands Branch, Government Secretariat (5 November 1998)

- WBTC No. 4/98 - Use of Public Fill in Reclamation and Earth Filling Projects
- WBTC No. 4/98A - Use of Public Fill in Reclamation and Earth Filling Projects
- WBTC No. 25/99 - Incorporation of Information on Construction and Demolition Material Management in Public Works Subcommittee Papers
- WBTC No. 25/99A - Incorporation of Information on Construction and Demolition Material Management in Public Works Subcommittee Papers (Amendment 1)
- WBTC No. 25/99C - Incorporation of Information on Construction and Demolition Material Management in Public Works Subcommittee Papers
- WBTC No. 19/2001 - Metallic Site Hoardings and Signboards
- WBTC No. 12/2000 - Fill Management
- WBTC No. 12/2002 - Specifications Facilitating the Use of Recycled Aggregates
- 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

8.3 Assessment Methodology

8.3.1 The methodology follows the criteria laid out in the *Technical Memorandum on EIA Process* (Annexes 7 and 15). The principal legislation regulating waste is the *Waste Disposal Ordinance*.

8.3.2 The main objectives of the waste assessment are to:

- (i) identify the sources, volumes, quality and timing of wastes arising from the construction activities;
- (ii) recommend construction waste management requirements in terms of minimisation through project design, construction method, and site location, identification of re-use and recycling opportunities and the responsible party for each step of the waste management process;
- (iii) recommend disposal sites and routes for different types of wastes unsuitable for re-use or recycling.

These recommendations will be carried out in accordance with the current legal and administrative requirements for waste management.

8.4 Identification of Environmental Impacts

8.4.1 Activities during the construction phase of the proposed tunnel will result in the generation of a variety of wastes that can be separated into 3 distinct categories based on their nature and the options of disposal:

- Construction and demolition material (including excavated material)
- Chemical Waste
- General refuse

- 8.4.2 Handling and disposal of these wastes may cause environmental impacts and nuisance during the construction phase if potential impacts are not properly managed and mitigated.
- 8.4.3 No wastes are anticipated to be generated during operation except for minor quantities of material collected during maintenance inspections.

8.5 Prediction and Evaluation of Environmental Impacts

Introduction

- 8.5.1 The main works will involve tunnelling 10.5 km length of drainage tunnel and intake shafts formation. The main construction work and demolition will involve:
- Site clearance and Site formation;
 - Excavation of drainage tunnel, adits and intake shafts using tunnel boring and raise boring machines; and
 - Construction of tunnel portals and intake structures on top of the intake shafts.

Sources and Types of Wastes arising from this Project

- 8.5.2 Types of construction and demolition material generated from the activities will be:
- Broken concrete and soil during site formation.
 - Granite, volcanic rock, and soil from TBM tunnel, adits and intake shafts during excavation.
 - Concrete tailings, scrap steel and wooden formwork from portals and intake shaft construction.
 - Engine oil, lubricants, paint and detergent from construction plant maintenance.
 - Municipal waste from construction site staff activities.
 - Slurry produced during the construction of intakes.

Construction and Demolition (C&D) Material

Excavated material from tunnel

- 8.5.3 The majority of excavated material will arise from constructing the drainage tunnel, adits and intake shafts using a tunnel boring machine (TBM) and raise boring machines (RBM). The excavated material is largely composed of granite and volcanic rocks from both drainage tunnel portals, with limited amount of soil.
- 8.5.4 The excavation of the vertical intake shafts will mainly be carried out from the tunnel upwards (raise boring method) and therefore, those excavated spoil will be transported (drop down) via the intake shafts and then to either ends of drainage tunnel. Approximate negligible amount of excavated material (1,000 m³) will require transport on the ground surface from six (W8, W5, RR1, THR(2), WO and HR1) intake shafts only and disposed by trucks. Estimated total quantity of spoil generated during construction at both portals will be approximately 522,040 m³ for granite and volcanic rock (including 1,491 m³ for soil).
- 8.5.5 As most the majority of excavated material will be comprised of rocks, it is not required for re-use on-site and will require off-site disposal either at suitable public fill areas or

designated landfills or for re-use on other construction projects where good quality fill material is required. Estimated quantity will be 185,073 m³ at Eastern portal (Table 8.1a) which will be transported by trucks and 336,967 m³ at Western portal (Table 8.1b) which will be transported by barge respectively.

**Table 8.1a Estimated Spoil Generated Breakdown from Eastern Portal
 for 24 hours TBM operation resume**

Eastern Portal	Construction Period & Duration	Total volume, m ³	m ³ /month	m ³ / day by truck
Bored tunnel (Tai Hang Road to Aberdeen Tunnel) (Granite & Volcanic Rock)	June 2008 to July 2010 (26 months)	167,707	6,450	215
Adits (Granite & Volcanic Rock)	September 2008 to April 2011 (31.5 months)	13,741	436	15
Adits (Soil)		-	-	-
Intake Shafts & Ventilation Pipes (Granite & Volcanic Rock)	August 2008 to May 2011 (33.5 months)	3,165	95	3
Intake Shafts & Ventilation Pipes (Soils)		460	14	0.5
Total		185,073	6,995	233.5

**Table 8.1b Estimated Spoil Generated Breakdown from Western Portal
 for 24 hours TBM operation resume**

Eastern Portal	Construction Period & Duration	Total volume, m ³	m ³ /month	m ³ / day by barge
Bored tunnel (Aberdeen Tunnel to Pok Fu Lam) (Granite & Volcanic Rock)	June 2008 to August 2010 (26.5 months)	308,674	11,648	388
Adits (Granite & Volcanic Rock)	September 2008 to April 2011 (31 months)	17,636	569	19
Adits (Soil)		-	-	-
Intake Shafts & Ventilation Pipes (Granite & Volcanic Rock)	August 2008 to June 2011 (34 months)	9,625	283	10
Intake Shafts & Ventilation Pipes (Soils)		1,032	30	1
Total		336,967	12,530	418

8.5.6 The contractor should be responsible to ensure the waste is collected when appropriate by approved licensed waste collectors and that appropriate measures are taken to minimise adverse impacts such as dust generation. The contractor must ensure that all necessary waste disposal permits are obtained.

8.5.7 No potential hazard is associated with handling and disposal of excavated spoil. The excavated spoil will be temporarily stored in stockpiles on site before final disposal. Mitigation measures such as dampening with fine water spray and covering with tarpaulin should be implemented. Transportation by barge will be adopted at the western portal in part to minimise the dust, emission and noise impacts from road transportation.

Site clearance and formation work

- 8.5.8 Site clearance works will be required, thus generating unwanted material during construction. Construction and Demolition (C&D) material may include:
- Topsoil;
 - Rock;
 - Waste pipe works;
 - Wood from formwork;
 - Material and equipment wrappings;
 - Unusable cement / grouting mixes; and
 - Damaged or contaminated construction material.
- 8.5.9 As few intake shafts are located on roads, little asphalt is expected. Waste of this category is of very small quantity and mostly inert, except that the waste pipe works could be made of metal or plastics.
- 8.5.10 Wood will be used to form the concrete structure at the portals and intakes but not inside the tunnel where the concrete panels will be made of pre-cast units. The wood used for formwork can be reused on-site for a limited number of times before being discarded as wastes. The reusability and quantity of final waste depends on the shape and quality of boards. Timber which cannot be reused should be sorted and stored separately from all inert waste before being disposed of to landfill.
- 8.5.11 Reusable steel shutters should be used as preferred alternative to formwork and falsework where possible.
- 8.5.12 Site fencing may be necessary to separate the construction works from the public and to reduce construction nuisance such as noise to nearby sensitive receivers. In this case metal fencing or building panels to provide site fencing should be used. Specification of the material used for noise barrier is discussed in Noise Chapter. Timber hoarding is prohibited.
- 8.5.13 Sorting is important to recover waste for reuse and recycle. The Contractor shall be required to sort the waste materials and provide temporary storage containers for those sorted materials such as metals, concrete, timber, plastics, glass, excavated spoils, bricks and tiles. If area is limited, all construction wastes should be sorted on site into inert and non-inert component. Non-inert materials is classified as C&D waste (bamboo, timber, vegetation, packaging waste and other organic materials) should be recycled and reused wherever possible and disposed of to landfill only as a last resort, whilst inert materials (debris is mainly composed of rubble (which includes concrete, cinder block, stone, clay brick, and soil) and asphalt which are suitable for land reclamation and site formation) should be separated and disposed of at public filling areas operated by CEDD. Steel and other metals should be recovered from demolition waste and recycled as far as practically possible.
- 8.5.14 The total quantity of C&D material generated during the construction phase will be dependent on the construction methods and site practices adopted, and hence it is difficult to quantify at this stage. The amount of C&D material expected to be generated will be quantified in the Waste Management Plan to be prepared by contractor.

Chemical Waste

- 8.5.15 Where the construction processes produce chemical waste, the contractor must register with EPD as a Chemical Waste Producer. Wastes classified as chemical wastes are listed in the *Waste Disposal (Chemical Waste) (General) Regulation* (CWR). Substances likely to be generated by construction activities would mainly arise from maintenance of equipment. These may include the following items:
- Scrap batteries or spent acid/alkali from their maintenance;
 - Used engine oils, hydraulic fluids and waste fuel;
 - Spent mineral oils/cleaning fluids from mechanical machinery; and
 - Spent solvents/solutions from equipment cleaning activities.
- 8.5.16 Chemical wastes pose serious environmental and health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the Chemical Waste Regulations. These hazards include:
- Toxic effects to works;
 - Adverse effects on water quality from spills; and
 - Fire hazards.
- 8.5.17 The amount of (spent solvents, lubrication oil, fuel and oil spill) wastes cannot be accurately predicted at this stage since it largely depends on the contractor's housekeeping measure. The amount is anticipated to be small and it is recommended that the contractors should implement good housekeeping measures to minimise the amount of waste generated.
- 8.5.18 The registered chemical waste producer has to arrange for the chemical waste to be collected by licensed collectors. Types of chemical waste likely to arise include engine oil, lubricants, paint and some detergent from the maintenance of construction equipment. A licensed collector shall regularly take chemical waste to the waste treatment facility such as Chemical Waste Treatment Centre in Tsing Yi. The quantity of this waste is limited. These wastes cannot be reused or recycled at this or other construction site.

General Refuse

- 8.5.19 Solid and liquid wastes will be generated by the construction workers during the clearance/construction period. The quantity of municipal waste generated is estimated to be 1.39 kg/employee/day (EPD, 2002). A temporary refuse collection station should be set up by the contractor. Municipal waste should be collected regularly in black refuse bags and delivered to an approved Refuse Transfer Station or landfill as required. The amount that may be produced is dependent on size of workforce at site.
- 8.5.20 The storage of general refuse has the potential give rise to a variety of adverse environmental impacts. These include odour if waste is not collected frequently, windblown litter, water quality impacts if water enters water bodies and visual impact. The refuse may attract pests and vermin if the storage areas are not well maintained and cleaned regularly. In addition, disposal of waste at sites other than approved waste transfer or disposal facilities can also lead to environmental impacts.
- 8.5.21 Handling and disposal of general refuse should cope with the presence of peak workforce during the construction period. Provided that the refuse is stored and transported in accordance with proper practices and disposed at licensed landfills, the potential environmental would be minimal.

8.5.22 A summary of the types of solid waste expected to arise from this Project and the proposed management strategy for each type of waste is presented in Table 8.2.

Table 8.2 Construction Wastes Generated by the Proposed Works

Area	Major Activities	Waste Type	Disposal
Temporary works area at both portals and intake shafts	Site clearance	Vegetation Topsoil Concrete	Landfill Used for landscaping Used for landscaping
Tunnel, intake shafts, drop shafts	Excavation	Spoil	Public Filling Area or re-use as construction material
Eastern and Western Portals	Construction of structures	Concrete tailings Scrap metal Wooden and other non-inert waste	Public Filling Area Recycle Landfill
All	General site activities	Sewage wastes Municipal wastes Chemical waste Waste Oil	Treatment Landfill Chemical waste treatment facilities Licensed Contractor

8.6 Recycling, Treatment, Storage and Disposal Options

Construction and Demolition Material

- 8.6.1 A number of measures can be introduced during the construction period relating to a high standard of design and management that will minimise the generation of C&D material.
- 8.6.2 Reusable steel or concrete panel shutters, fencing and hoarding and signboard shall be used as a preferred alternative to items made of wood, to minimise wastage of wood.
- 8.6.3 Recycling reduces the collection, transportation and disposal of construction waste. Recycling construction on-site also assist in reduction of import additional materials requirement.
- 8.6.4 Good planning and site management practice could be employed to minimise the over ordering or mixing of concrete, mortars and cement grouts. Proper storage and site practices will minimise the damage or contamination of construction materials. Used bentonite slurries should be reconditioned and reused on-site as far as possible. The residual bentonite slurry should be mixed with dry excavated material for disposal at the designated public filling facilities.
- 8.6.5 Effective from 1 February 2005, the contractor must comply with the trip-ticket system for the disposal of Construction and Demolition (C&D) material at public filling facilities or landfills in order to minimise the incidence of illegal dumping (ETWB TCW No. 31/2004).
- 8.6.6 Confirmation has to be sought from Public Fill Committee (PFC) and EPD regarding the availability of public filling facilities and landfill respectively, for inert C&D waste and non-inert C&D waste respectively.

Chemical Wastes

- 8.6.7 Chemical wastes will arise principally as a result of maintenance activities. Quantity depends mainly on the contractor's on-site maintenance requirement and number of plant and vehicles utilised.
- 8.6.8 If the chemical do arise from construction works, contractor should contact an approved operator to collect the wastes for disposal such as Chemical Waste Treatment Centre in Tsing Yi, or other facility. Chemical Waste Regulations governing the storage and disposal of chemical wastes.
- 8.6.9 Suitable containers should be used for specific types of chemical wastes, containers should be properly label (English and Chinese in accordance with instructions prescribed in Schedule 2 of the Regulations), resistance to corrosion, stored safely and closely secure. Stored volume should keep not more than 450 litres unless the specification has been approved by the EPD. Storage area should be enclosed by three sides by a wall, partition of fence that is at least 2 m height or height of tallest container with adequate ventilation and space.

General Refuse

- 8.6.10 General refuse generated on-site should be stored and collected separately from other construction and chemical wastes. The removal of waste from the site should be arranged on a daily or at least on every second day by the contractor to minimise any potential odour impacts, minimise the presence of pests, vermin and other scavengers and prevent unsightly accumulation of waste.
- 8.6.11 General refuse should be stored in enclosed bins or compaction units (not suitable relatively small volumes of waste). The recyclable component of the municipal waste generated by the activities of site staff, such as aluminium cans, paper and cleansed plastic containers should be separated from other municipal waste. Collection points shall be set up for these materials and the contractor shall be responsible for arranging recycling companies to collect these materials.

Disposal Options

- 8.6.12 For this Project, there is little opportunity for reuse and recycling of excavated rock or soil on site (estimated total quantity is around 100m³ for the maintenance access road at both portals), since this is a tunnelling project that requires very little fill material (mainly for construction of small road/pavement for maintenance).
- 8.6.13 Excavated material which cannot be re-used on site requires disposal to public filling areas, reclamation or site formation projects if available and required. Disposal excavated spoil is expected during the construction period of proposed tunnel at 2007 to 2011. With insufficient reclamation projects in Hong Kong by the end of 2002 to accommodate public fill, it has to temporarily stockpile the public fill in the two fill banks for later reuse. The public filing facilities include reclamation, barging points as transfer stations and stockpiling areas. Existing public filling facilities available to the public are as follows:
- Quarry Bay and Sai Ying Pun Public Filling Barging Point (for reclamation in

- Tuen Mun Area 38)
- Mui Wo Public Fill Stockpiling Area
- Kai Tak Public Filling Barging Point (to fill bank in Tseung Kwan O)
- Tseung Kwan O Area 137 Fill Bank
- Tuen Mun Area 38 Fill Bank

8.6.14 Dumping licences are issued by PFC to lorry owners for delivering public fill to public filling facilities. The licences are valid to the date as specified on the dumping licences and the licensees need to apply a new licence.

8.6.15 Any scrap metal and plastic components of the demolition wastes shall be separated from other wastes. The contractor shall be required to arrange for recycling firms to collect the material. The material should only be disposed to landfill if its quality is unsuitable for recycling. For this project, there is no opportunity for reusing the scrap metal and plastic on site.

8.6.16 A variety of wastes which will be generated during the construction of the proposed project, the establishment of an efficient collection system is required to achieve environmental objectives. Table 8.3 shows the potential for re-use/ recycling and disposal option.

Table 8.3
Construction Waste Types and Potential for Re-Use / Recycling and Disposal Options

Waste Type	Works Generating Waste	Volumes Lost as Waste	Potential Re-Use or Recycling	Disposal Options
Spoil (Granite, Volcanic Rock and soil)	Tunnel and intake shafts excavation	Most of material cannot be reused on site	Low quantity will be re-used for access road.	Majority of tunnel spoil to public filling area or re-use on other construction sites
Wood Formwork, Fencing	Construction	Most of the material will be degraded after reusing for a few times	Can be reused on site for a few times.	Non reusable material to refuse collection points or landfill.
Reinforcing steel	Construction of both portals and intake shafts	Small amounts	Most material can be reused- after cleaning Reinforcement off cuts to be scrapped/recycled.	
Chemical Waste	Lubricants and oil from cleaning/ maintenance of site machinery	Small amounts	Recycling/disposal firms will collect chemicals or waste oil, or refill oil containers	Chemical waste, including paints disposed of to EPD chemical waste treatment facility by licensed collector.

Waste Type	Works Generating Waste	Volumes Lost as Waste	Potential Re-Use or Recycling	Disposal Options
Oil Waste Grease trap waste				Oil can be removed from recycling or soaked up by sand for disposal to landfill. Grease trap waste collected and disposed by licensed contractor.
Municipal Waste	General site activities	Putrecible waste, wet paper, fabrics	Aluminium cans, dry paper, plastic containers and bottles	Arrange for recycling companies to collect recyclable material (aluminium, paper and plastics). Non recyclable material to refuse collection points or landfill.

Responsibilities for Construction Waste Management

- 8.6.17 Upon appointment, the main contractor of each construction contract shall be required to submit a Waste Management Plan (WMP) which 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 EIA 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 WMP should be submitted to the Engineer for approval. The contractor shall refer to the Construction and Demolition Material Management Plan (C&DMMP) in the Appendix F when preparing the WMP.
- 8.6.18 Where waste generation is unavoidable, the potential for recycling or reuse should be explored and opportunities taken. If wastes cannot be recycled, disposal routes described in the WMP should be followed.
- 8.6.19 Training and instruction of construction staff shall be undertaken by the contractor in order to increase awareness of waste management issues. Requirements for staff training should be included in the contractor's site Waste Management Plan.
- 8.6.20 Training shall be provided to workers on the concepts of the site cleanliness and appropriate waste management procedure, including waste reduction, reuse and recycling.

8.7 Mitigation of Adverse Environmental Impacts

Construction Phase

- 8.7.1 It is proposed that the following mitigation measures be implemented during the construction phase to minimise the potential environmental impact resulting from the

handling and disposal of construction waste:

General

- 8.7.2 A proper waste management plan should be implemented to promote waste minimisation at source. Where waste generation is unavoidable then the potential for recycling or reuse should be explored and opportunities taken. If wastes cannot be recycled then the recommended disposal routes should be followed.
- 8.7.3 All waste materials shall be segregated into categories covering:
- Excavated material or construction waste suitable for reuse on-site
 - Excavated material or construction waste suitable for public filling areas
 - Remaining C&D waste for landfill
 - Chemical waste, and
 - General refuse
- 8.7.4 Proper segregation and disposal of construction waste should be implemented. Separate containers for inert and non-inert wastes should be provided. The inert waste should be taken to public filling area and the non-inert waste should be transported to strategic landfills.
- 8.7.5 A trip-ticket system on the solid waste transfer/disposal operations should be included as one of the contractual requirements (ETWB TCW No. 31/2004). The Independent Environmental Checker (IEC) will be responsible for auditing this system.
- 8.7.6 IEC should also responsible for auditing the well-documented record system which includes: (i) quantity of waste generation; (ii) quantity of recycled; (iii) quantity of disposed; (iv) disposal methods; and (v) sites should be implemented during construction phase.
- 8.7.7 Regular cleaning and maintenance of the waste storage area should be conducted throughout the construction stage.

Excavated spoil

- 8.7.8 Control measures for temporary stockpiled on-site should be taken in order to minimize the noise, generation of dust, pollution of water and visual impact. Key impacts include:
- Surface of stockpiled soil should be wetted with water when necessary especially during dry season
 - Disturbance of stockpiled soil should be minimized
 - Stockpiled soil should be properly covered with tarpaulins especially heavy rain storms
 - Stockpiling areas should be enclosed if possible
 - Stockpiling location should be away from the shoreline
 - An independent surface water drainage system equipped with silt traps should be installed at the stockpiling area.

Chemical wastes

- 8.7.9 For those processes that generate chemical waste, it may be possible to find alternatives

which generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste.

- 8.7.10 Construction processes produce chemical waste, the contractor must register with EPD as a Chemical Waste Producer. Wastes classified as chemical wastes are listed in the Waste Disposal (Chemical Waste) (General) Regulation (CWR). It should be handled in accordance with the *Code of Practice on the Packaging, Handling and Storage of Chemical Waste* published by the EPD. A producer of chemical wastes should be registered as chemical waste producer and registered with EPD.
- 8.7.11 The chemical waste generated shall be properly labelled, stored and disposed of according to the CWR. Proper storage area shall be allocated on site for storage of chemical waste. The chemical waste should only be collected by a licensed collector. An updated list of licensed chemical waste collector can be obtained from EPD.
- 8.7.12 In case of spillage, spill absorbent material and emulsifiers should be available on site. This material should be replaced on a regular basis and the contaminated material stored in a designated, secure place.

General refuse

- 8.7.13 A reputable waste collector should be employed by the contractor to remove general refuse from the site, separate from C&DM and chemical wastes, and on regular basis in order to minimize odour, pest and litter impacts. The burning of refuse at site is not permitted under the Air Pollution Control Ordinance (Cap 311).
- 8.7.14 Office waste can be reduced through recycling of paper if volumes are large enough to warrant collection.
- 8.7.15 Good management practices should be implemented to ensure that refuse is properly stored and is transported for disposal of at licensed landfills.

8.8 Operation Waste

- 8.8.1 Although the tunnel system is designed with minimum maintenance, accumulation of leafs, debris and sediments inside the tunnel system is unavoidable. The volume of waste is expected to be minimal and general cleaning will be carried out before the onset of rainy season in each year. The collected waste will be disposed of at designated landfill by a reputable waste collector. .

8.9 Evaluation of Residual Impacts

- 8.9.1 With the implementation of mitigation measures for handling, transportations and disposal of identified waste arisings, the residual impacts are expected to be minimal during the construction phase.

8.10 Environmental Audit

- 8.10.1 Auditing should be carried out periodically to determine if waste is being managed in accordance with prescribed procedures and the Waste Management Plan. The audits should examine all aspects of waste management including waste generation, storage, recycling, treatment, transportation, and disposal. The general site inspections including waste management issues will be undertaken weekly by the Environmental Team to

check all construction activities for compliance with all appropriate environmental protection and pollution control measures, including those set up in the WMP. Meanwhile, waste management audit will be carried out on monthly basis by the IEC. Details of waste audit are further described in Environmental Monitoring and Audit Manual.

8.11 Conclusion

- 8.11.1 Waste types and quantities have been estimated as far as possible and mitigation measures evaluated in terms of avoidance-minimisation-recycling-disposal hierarchy recommended by Government.
- 8.11.2 A large quantity of the C&D material to be generated from the project cannot be re-used on site. However, it is likely to be beneficially re-used in public filling areas, reclamation or site formation sites, reuse on other construction sites, subject to the conclusion of discussions of CEDD.
- 8.11.3 The contractor shall be required to update the WMP and report the quantity, disposal method and responsibility for handling the surplus C&D material in their construction progress reports.
- 8.11.4 The mitigation measures recommended in this section should be incorporated into contract specifications to ensure that environmental nuisance does not arise from the construction of proposed project. These recommendations should form the basis of Waste Management Plan to be developed by the contractor at the construction stage.
- 8.11.5 Operation impact on the proposed route is not expected to be a key concern and no detailed assessment will be required.