SECTION 6

6 WASTE MANAGEMENT

6.1 Introduction

6.1.1 This Section identifies the potential waste arising from the construction of the WCR and assesses the potential environmental impacts resulting from the handling and disposal of these wastes.

6.1.2 The options for waste minimisation, recycling, storage, collection, and disposal of waste arising from the construction of the WCR have been examined. Procedures for waste reduction and management are considered and mitigation measures for minimising the environmental impacts due to handling and disposal of wastes are recommended.

6.1.3 The operation of the WCR will generate minimal amounts of waste associated with littering and road maintenance activities. The handling and disposal of this small amount of waste will have negligible environmental impacts and thus have not been evaluated further in this EIA Report.

6.2 Government Legislation and Standards

6.2.1 The criteria for evaluating potential waste management implications are laid out in the Annex 7 of the *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM). The following legislation covers or has some bearing upon the handling, treatment and disposal of wastes in Hong Kong SAR, and will also be used as assessment criteria:

General Legislation

- *Waste Disposal Ordinance (Cap 354);*
- *Waste Disposal (Chemical Waste) (General) Regulation (Cap 354);*
- *Crown Land Ordinance (Cap 28)*
- *Public Health and Municipal Services Ordinance (Cap 132) Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws*; and
- *Dumping at Sea Ordinance* (1995).

Waste Disposal Ordinance

6.2.2 The *Waste Disposal Ordinance* (WDO) prohibits the unauthorised disposal of wastes, with waste defined as any substance or article which is abandoned. Construction and demolition (C&D) waste is not directly defined in the WDO but is considered to fall within the category of "trade waste". Trade waste is defined as waste from any trade, manufacturer or business, or any waste building, or civil engineering materials, but does not include animal waste.

6.2.3 Under the WDO, wastes can only be disposed of at a licensed site. A breach of these regulations can lead to the imposition of a fine and/or a prison sentence. The WDO also provides for the issuing of licences for the collection and transport of wastes. Licences are not, however, currently required to be issued for the collection and transport of C&D Waste and/or trade waste.

Waste Disposal (Chemical Waste) (General) Regulation

6.2.4 Chemical waste as defined under the *Waste Disposal (Chemical Waste) (General) Regulation* includes any substance being scrap material, or unwanted substances specified under *Schedule 1* of the Regulation if such substance or chemical occurs in such a form, quantity or concentration so as to cause pollution or constitute a danger to health or risk of pollution to the environment.

6.2.5 A person should not produce, or cause to be produced, chemical wastes unless he is registered with the EPD. Any person who contravenes this requirement commits an offence and is liable, upon conviction for a first offence, to a fine of up to HK$200,000 and to imprisonment for up to 6 months. The current fee for registration is HK$240.

6.2.6 Producers of chemical wastes must treat their wastes, utilising on-site plant licensed by the EPD, or have a licensed collector take the wastes to a licensed facility. For each consignment of wastes, the waste producer, collector and disposer of the wastes must sign all relevant parts of a computerised trip ticket. This system is designed to allow the transfer of wastes to be traced from cradle to grave.

6.2.7 The Regulation prescribes the storage facilities to be provided on site including labelling and warning signs. To minimise the risks of pollution and danger to human health or life, the waste producer is required to prepare and make available written procedures to be observed in the case of emergencies due to spillage, leakage or accidents arising from the storage of chemical wastes. He must also provide employees with training in such procedures.

Crown Land Ordinance

6.2.8 Construction and demolition material which are wholly inert may be taken to public filling areas. Public filling areas usually form part of land reclamation schemes and are operated by the Civil Engineering Department (CED). The *Crown Land Ordinance* requires that public filling licences are obtained by individuals or companies who deliver inert C&D material (or public fill) to public filling areas. The licences are issued by the CED under delegated powers from the Director of Lands.

6.2.9 Individual licences and windscreen stickers are issued for each vehicle involved. Under the licence conditions public filling areas will accept only inert building debris, soil, rock and broken concrete. There is no size limitation on the rock and broken concrete, and a small amount of timber mixed with other suitable materials is permissible. The material should, however, be free from marine mud,

household refuse, plastic, metal, industrial and chemical wastes, animal and vegetable matter and any other materials considered unsuitable by the public filling supervisor.

Public Cleansing and Prevention of Nuisances Bylaws

6.2.10 These Bylaws provide a further control on the illegal tipping of wastes on unauthorised (unlicensed) sites. The illegal dumping of wastes can lead to fines of up to HK$10,000 and imprisonment for up to 6 months.

Additional Guidelines

6.2.11 Other 'guideline' documents which detail how the Contractor should comply with the regulations are as follows:

- *Waste Disposal Plan for Hong Kong (December 1989), Planning, Environment and Lands Branch Government Secretariat;*
- *Environmental Guidelines for Planning In Hong Kong (1990), Hong Kong Planning and Standards Guidelines, Hong Kong Government;*
- *New Disposal Arrangements for Construction Waste (1992), Environmental Protection Department & Civil Engineering Department;*
- *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992), Environmental Protection Department;*
- *Works Branch Technical Circular No. 2/93, Public Dumps;*
- *Works Branch Technical Circular No. 16/96, Wet Soil in Public Dumps;*
- *Technical Circular No. 11/92 Classification of Dredged Sediments for Marine Disposal, Environmental Protection Department;*
- *Works Branch Technical Circular No. 6/92, Fill Management;* and
- *Works Branch Technical Circular 22/92, Hong Kong Government.*

6.3 Construction Waste Impacts

Potential Sources of Impact

6.3.1 The construction of the WCR will involve the following construction works:

- demolition and site clearance;
- dredging/excavation;
- permanent and temporary seawall construction;
- reclamation/filling;

- roadworks; and
- landscape works.

6.3.2 The Project is phased such that all the works will be completed over a period of 5 years starting from the end of 2002.

General

6.3.3 Construction activities will result in the generation of a variety of wastes which can be divided into distinct categories based on their constituents, as follows:

- dredged material;
- excavated material;
- construction and demolition waste;
- chemical waste; and
- general refuse.

6.3.4 The nature and quantity of each of these waste types arising from the construction of the WCR are identified below.

Dredged Material

6.3.5 Dredged material is generated during the formation of reclamation or seawall where soft marine sediment needs to be removed and replaced with marine sand. Dredged material is classified according to the level of contamination under the *EPD Technical Circular* (EPDTC) *No. 1-1-92, Classification of Dredged Sediments for Marine Disposal.* The quantities and level of contamination will be determined as part of the Dredging of Contaminated Material Report for this Study.

6.3.6 Marine disposal of dredged materials is controlled under the *Dumping at Sea Ordinance 1995*, which has recently replaced the *Dumping at Sea Act 1974 (Overseas Territories) Order 1975 (App. III, p.DK1)* in its application to Hong Kong SAR.

6.3.7 Dredged sediments destined for marine disposal are classified according to their level of contamination by seven toxic metals as stipulated in the EPDTC 1-1-92. The seven metals are cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn). Definition of the classification is as follows:

Class A - Uncontaminated material, for which no special dredging, transport or disposal methods are required beyond those which would normally be applied for the purpose of ensuring compliance with EPD's Water Quality Objectives (WQO), or for protection of sensitive receptors near the dredging or disposal areas.

Class B - Moderately contaminated material, which requires special care during dredging and transport, and which must be disposed of in a manner which minimizes the loss of pollutants either into solution or

by resuspension.

Class C - Seriously contaminated material, which must be dredged and transported with great care, which cannot be dumped in the gazetted marine disposal grounds and which must be effectively isolated from the environment upon final disposal.

Table 6.3a Classification of Sediments by Metal Content (mg kg dry weight)

Class	Cd	Cr	Cu	Hg	Ni	Ph	Zn
Class A	0.0-0.9	0-49	0-54	0.0-0.7	0-34	0-64	0-149
Class B	1.0-1.4	50-79	55-64	0.8-0.9	35-39	65-74	150-199
Class C	1.5 or more	80 or more	65 or more	1.0 or more	40 or more	75 or more	200 or more

6.3.8 It should be noted that for sediments to be identified within a particular class, the concentration of only one metallic species needs to be exceeded. In the case of both Class B and Class C contamination, the final determination of appropriate disposal options, routing and the allocation of a permit to dispose of material at the designated disposal site will be made by the EPD and Fill Management Committee (FMC) in accordance with *WBTC 22/92*.

6.3.9 It should be noted that *Appendix 1 Item (c)* of *WBTC 22/92* stipulates that the concentrations of organic pollutants such as polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), and tributyl tin (TBT) should also be tested, if suspected to be present. However, EPD has not specified the criteria for any of these parameters.

6.3.10 In addition, in accordance with *WBTC Nos 6/92* and *22/92* and *Building Ordinance Office Practice Note for Authorized Persons and Registered Structural Engineers No 155*, any proposal to remove more than 500,000 m^3 of clean mud or any quantity of contaminated mud must be justified on both cost and environmental grounds and the rationale for such removal should be provided to enable an allocation for disposal to be considered. It is desirable therefore to demonstrate that the proposed mud dredging is the minimum necessary, and to obtain in principle agreement from the GEO at the early stage.

6.3.11 A new set of regulatory guidelines for contaminated sediments will be promulgated by the EPD and CED in 1998 and these will include a new set of sediment quality criteria which may include organic pollutants and other toxic substances, as well as a new class of contamination level for highly contaminated sediment which is not suitable for marine disposal. However, it is agreed that the existing *EPDTC 11/92* will be used as the assessment criteria for this Study.

TKO Section Reclamation

6.3.12 The proposed reclamation in the TKO Section will be 80 m wide and 940 m in length, covering an area of approximately 7.5 ha. Dredging will be limited along the seawall to minimise the total volume dredged. It is anticipated that

approximately 299,000 m^3 of marine sediment will be dredged.

Yau Tong Bay Reclamation

6.3.13 Dredging work will be concentrated in Yau Tong Coastal Section and the reclamation is divided into three stages as described in *Section 2.3*. Dredging will be limited along the submerged reef and seawall to minimise the total volume to be dredged.

6.3.14 It is anticipated that approximately 227,000 m^3 of marine sediment will be dredged. Whereas 580,000 m^3 of general fill and 266,000 m^3 of rockfill and armour rock will be required for the reclamation. A summary of the volumes are presented in *Table 2.3c*.

6.3.15 Inert fill materials will be deposited for the formation of the reclamation. Since the fill material used during the reclamation works will meet EPD's criteria for uncontaminated (Class A) material, impacts associated with filling operations will be limited to the release of suspended solids into the water column.

Excavated Material

6.3.16 Excavated material is defined as inert virgin material removed from the ground and sub-surface. Excavated material may be generated during the construction of slip roads in the vicinity of Lei Yue Mun which may require excavation of slopes. The WCR will generate approximately 360,000 m^3 of excavated materials, primary as a result of the excavation of the cut and cover tunnel and slopes.

Construction and Demolition Waste

6.3.17 Surplus construction material comprises unwanted materials generated during construction, including rejected structures and materials, materials which have been over ordered or are surplus to requirements and materials which have been used and discarded. Surplus construction material will arise from a number of construction and maintenance activities and may include:

- wood from formwork and falsework;
- equipment and vehicle maintenance parts;
- materials and equipment wrappings;
- unusable/surplus concrete/grouting mixes; and
- damaged/contaminated construction materials.

6.3.18 The volume of surplus construction material to be generated from the WCR construction will be dependent on the operating procedure and site practices, and cannot be determined at this stage. However, with respect to the nature of construction activities, it is anticipated that the quantity will be small.

6.3.19 The disposal of bentonite slurry generated during construction works should follow the requirements of *Pro PECC Note 1/94 Construction Site Drainage*.

6.3.20 Demolition material may be generated through the demolition of the existing roads and buildings as part of construction. However, a large section of the construction areas along the coastline from TKO to Lei Yue Mun are "greenfield sites" which have had no previous road or building development. The demolition material arisings are likely to be restricted to road demolition at the intersections of the existing road network in the SEK and TKO areas, together with the demolition of the buildings along the WCR alignment, an old WSD Pumping Station and a ferry pier at Yau Tong. The expected volume of demolition material is based on the estimation of gross floor area (GFA) of the buildings which are going to be demolished. This will comprise primarily of crushed concrete, rock fill, steel and general refuse. At this stage no details regarding the land resumption plan is available and the amount of demolition material is estimated by assuming all the buildings within the site boundary will need to be demolished.

6.3.21 To conserve the capacities of landfill sites, C&D materials with more than 20% (by volume) inert material should not be disposed of at landfills. It is therefore good practice to segregate the inert and non-inert materials at the construction sites before disposing of the inert material (or public fill) at public filling areas or other reclamation areas and the degradable waste (C&D waste) at landfills. It should be emphasised that the sorting of C&D materials into public fill and C&D waste should be done onsite as far as possible before disposal.

Chemical Waste

6.3.22 Chemical Waste, as defined under the *Waste Disposal (Chemical Waste)(General) Regulation*, includes any substance being scrap material, or unwanted substances specified under *Schedule 1* of the *Regulation*. A complete list of such substances is provided under the *Regulation*, however substances likely to be generated by construction activities for the WCR will, for the most part, arise from the maintenance of equipment. These may include, but need not be limited to the following:

- 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, some of which may be halogenated, from equipment cleaning activities.

6.3.23 It is difficult to quantify the amount of chemical waste which will arise from the construction activities as it will be highly dependent on the Contractor's onsite maintenance intention and the number of plant and vehicles utilised. However, it is anticipated that the quantity of chemical waste, such as lubricating oil and solvent produced from plant maintenance will be small and in the order of a few hundred litres per month). These types of waste will be readily accepted at the chemical waste treatment Centre at Tsing Yi or other licenced Waste Oil Recycling facilities in Hong Kong.

General Refuse

6.3.24 The presence of a construction site with large numbers of workers and site offices and canteens will result in the generation of a variety of general refuse requiring disposal. General refuse will mainly consist of food wastes, aluminum cans and waste paper.

6.3.25 No information regarding the number of worker onsite is available at this stage. However, it is expected that about 100 workers may could be working onsite at any one time. Based on a waste generation rate of about 0.6 kg per person, it is estimated that the amount of general refuse to be generated will be in the order of 60 kg per day.

Biogas

6.3.26 For all reclamations that sediments are left in place, biogas (mainly consisting of methane and carbon dioxide) may be generated due to anaerobic degradation of organic materials within the sediment. This gas can endanger the safety of construction/maintenance workers and occupants of future developments on reclamations, as the flammable gas (methane) it contains can have explosive potential once it is mixed with air. Other components of the gas have the potential to cause asphyxiation or toxic effects under appropriate conditions. The degradation process is generally characterised by high gas generation rates at the early stage of the process, shortly after reclamation work is completed, followed by an exponential decrease over time.

Evaluation of Impacts

General

6.3.27 The nature of the waste arising from the construction of the WCR and the potential environmental impacts which may arise from their handling, storage, transport and disposal are discussed under the headings of each waste type below.

6.3.28 The assessment of environmental impacts from waste generation is based on three factors:

- the type of waste generated;
- the amount of principal waste types generated; and
- the proposed recycling, storage, transport, and disposal methods, and the impacts of these methods.

Dredged Materials - TKO Section Reclamation

6.3.29 The estimated volumes of dredged and fill materials for the TKO Section Reclamation are provided in *Table 6.3b*.

Table 6.3b Estimated Volumes of Dredged and Fill Materials for TKO Section Reclamation

Activity	Volume of Dredged Material (m^3)(1)	Volume of Fill Required (m^3)(2)
Sloping Seawall	299,150	594,440
General Reclamation	0	536,145
Total	299,150	1,130,585

Note:
(1) Assumed seabed level at 12.0 mPD with the bottom of Marine Deposit at 15.0 mPD
(2) General fill to replace dredged material. Top of reclamation level to be at +4.5 mPD

6.3.30 The quantities and level of contamination have been determined as part of the Area 131 Study. The Area 131 Study Final Laboratory Testing Report is presented in *Annex F*. The estimated quantities of contaminated and uncontaminated materials for the TKO Section reclamation are summarised in *Table 6.3c*.

Table 6.3c Approximate Quantities of the Contaminated and Uncontaminated Material for TKO Section

	Class A	Class B	Class C
Quantity (m^3)	227,200	23,900	47,800

Dredged Materials-Yau Tong Bay Coastal Reclamation

6.3.31 The dredging work is expected to result in the production of over 228,000 m^3 of dredged materials (see *Table 6.3d*). Most of the dredging will be carried out during Stage 1 reclamation at Yau Tong Coastal Section. Sediment testing in accordance with *EPDTC No. 1-1-92* was undertaken at two vitro core samples (WCVC2 and WCVC3) to determine the level of contamination of the dredged materials. The sample locations and testing results are presented in *Annex F*.

Table 6.3d Estimated Volumes of Dredged and Fill Materials from Yau Tong Bay Coastal Reclamation

Item	Volume of Dredging (m^3)	Volume of Fill Materials (m^3)	
		General	Fill Rockfill and Armour
Submerged Reef	60,000	60,000	83,000
Reclamation Seawall			
- Sloping	58,650	75,210	114,000
- Vertical	24,800	26,800	69,000
General Reclamation	83,600	418,000	
Total	227,050	580,010	266,000

6.3.32 The maximum depth to be dredged under the submerged reef will be 7.5 m below the existing seabed. The dredged sediments in the reclamation area are generally contaminated with heavy metals, commonly with copper, lead and chromium. The contaminated sediment is generally limited to the top 4 m of seabed material.

6.3.33 The estimated quantities of contaminated and uncontaminated materials for the Yau Tong Bay reclamation are presented in *Table 6.3e*.

Table 6.3e Summary of Quantities of Dredged Material

	Class A	Class B	Class C
Quantity (m^3)	28,381	0	198,669

6.3.34 When contaminated sediments are disturbed by dredging, the toxic heavy metals previously bound to the sediment particles may be mobilised into the water column. To minimise the potential impacts on water quality, seriously contaminated (class C) sediments must be dredged with great care. Details of recommended mitigation measures are discussed in *Section 5.5.52-61*.

6.3.35 The potential environmental impacts of marine disposal of sediments will vary according to their level of contamination. In general, the associated water quality impacts may include:

- suspension of solids in the water column during sediment dumping with the likely consequence of reducing the dissolved oxygen level and increasing the organic and inorganic pollutants levels of the marine water column;
- disturbance and suspension of previously dissolved organic and inorganic materials such as ammonia, sulphides and heavy metals; and
- release of suspended solids due to any leakages or overflowing from barges during transportation.

6.3.36 All of the above can result in a deterioration in the receiving marine water quality and may have adverse effects on marine biota.

6.3.37 The use of dredged materials should be carried out as much as possible. However as the construction of the sea wall is necessary for reducing potential water quality impacts prior to placing fill material at the site, the use of dredged materials as fill may not be feasible as they would require storage until seawall construction which may result in additional environmental impacts due to its contaminated nature. Therefore, it is likely that off site disposal will be required. Class C sediment should be disposed of at the designated contaminated mud pits at East Sha Chau. The Contractor should consult the EPD for the final disposal site at the time of construction.

6.3.38 Provided that the mitigation measures recommended in *Section 5.5.52-61* are properly implemented and the sediments are disposed of at the approved disposal

sites, it is anticipated that the environmental impacts associated with the handling and disposal of sediment will not cause unacceptable environmental impacts.

Excavated Materials

6.3.39 Approximately 360,000 m^3 of excavated material will be generated during excavation of slopes, and a total volume of 550,000 m^3 of filling material will be required for the construction of road embankments (see *Table 6.3f*). Due to the nature of the excavated material, all the materials can be reused on-site if necessary engineering requirements are met. Therefore, no surplus excavated material will be generated.

Table 6.3f Estimated Cut and Fill Requirements

Types	Estimated Quantity (m^3)
Fill material Required	550,000
Rock Produced	90,000
Excavated Soil Generated	270,000
Shortage of Fill Material	190,000

Construction and Demolition Waste

6.3.40 If not properly managed, the storage, handling, transport and disposal of C&D material have the potential to create visual, water, dust and traffic impacts.

6.3.41 The disposal of inert C&D material (or public fill) at public filling areas or other reclamation sites is unlikely to raise any long term concerns because of the inert nature of the material. Disposal of C&D waste to licenced landfill will not cause unacceptable environmental impacts. Wherever, practical, the production of C&D wastes should be minimised by the careful control of ordering procedures and the segregation of materials. It will also assist in minimising costs should landfill charges be introduced.

6.3.42 C&D wastes currently account for approximately 35% of the annual consumption of limited landfill void available in Hong Kong (although this proportion has varied widely over recent years). Therefore, it is important to minimise, wherever possible, the wastes to be disposed of to landfill.

6.3.43 A number of structures will be removed or demolished for the construction of WCR. As resumption plans or building plans are not available, the exact quality of the demolition waste generated cannot be determined at this stage. However, a rough estimation on the volume of demolition waste was made, using the draft general layout plans (drawing no. *90291/PD101-106, 108-110* and *113*). The GFA estimated to be demolished will be 22,000 m^2. Based on a waste generation rate of 0.7 m^3 m^{-2} of GFA to be demolished, approximately 16,000 m^3 of demolition waste will be generated. It is expected that the buildings could be demolished within 5 months. The daily arising of demolition waste will therefore

be in the order of 110 m^3 d^{-1}. The daily generation rate of the demolition waste is small comparing with the daily quantity (in the order of 13,000 m^3 per day) of public fill arising in Hong Kong SAR and it will not have a significant impact on the demand for the public filling capacity.

6.3.44 It is recommended that the demolition Contractor should adopt the selective demolition method so that reusable material, like wood and metal, can be segregated and recycled, degradable materials can be disposed of at landfills, and inert demolition material can be reused on site or delivered to public filling area (e.g. Tseung Kwan O), public filling barging points or land formation sites.

Chemical Waste

6.3.45 Chemical wastes may pose serious environmental and health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the *Waste Disposal (Chemical Waste) (General) Regulation* and the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*. These hazards include:

- toxic effects to workers;
- adverse effects on air, water and land from spills;
- fire hazards; and
- disruption to sewage treatment works due to damage to the sewage biological treatment systems if waste is allowed to enter the sewage system.

6.3.46 Provided that the handling, storage and disposal of chemical wastes are in accordance with the Code of Practice, it will not cause unacceptable environmental impacts.

General Refuse

6.3.47 The storage of general refuse has the potential to give rise to adverse environmental impacts. These include odour if the waste is not collected frequently (eg. daily), windblown litter, water quality impacts if waste enters water bodies, and visual impact. The sites may also attract pests, vermin, and other disease vectors if the waste storage areas are not well maintained and cleaned regularly. In addition, disposal of wastes, at sites other than approved landfills, can also lead to similar adverse impacts at those sites.

6.3.48 The amount of general refuse to be generated is small (Approximately 60 kg per day). Provided that the mitigation measures recommended in *Section 6.5* are adopted, the environmental impacts caused by storage, handling, transport and disposal of general refuse are expected to be minimal.

Biogas

6.3.49 The WCR project would require the TKO reclamation that is approximately 80 m wide and 940 m in length and the Yau Tong Coastal Section approximately 80 m wide and 800 m in length. The total reclamation area of the two proposed reclamations are relatively small and much of the underlying sediments will be

dredged to enable construction of a seawall. The quantity of the remaining sediment that will remain in place will be reduced significantly and is not expected to result in substantial biogas production. Further, the reclamation area is to be used for infrastructure purposes, for the development of the roadway, which is not considered to have the sensitivity to other land uses, such as residential developments, have during operation from biogas production. Other uses in the area, including the CED maintenance depot and the fish market area, which would be relocated to the seawall, would not require enclosed areas that allow biogas to accumulate. Due to the above, it is considered that the risk of biogas generated, if any, will be minimal.

6.3.50 As a good working practice, prior to entry into any confined space (ie drainage manhole) within the reclamation site (such as underground manholes, culverts and utility casings), the gas atmosphere within the confined space should be monitored for oxygen, methane, carbon dioxide and hydrogen sulphide. This is further detailed in *Section 6.4*.

Summary of Impact

6.3.51 The environmental impacts from the various waste types are summarised in *Table 6.3g*.

Table 6.3g Summary of Waste Management Impacts

Waste Type	General Evaluation
Dredged Material	Approximately 228,000 m^3 (198,669 m^3 Type C) of dredged material will be generated for the construction of submerged reef, seawall and reclamation in the Yau Tong Bay area. Approximately 299,000 m^3 (47,800 m^3 Type C) of dredged material will be generated for the construction of seawall and reclamation in the TKO section.
Excavated Materials	An estimated total of 360,000 m^3 of excavated materials will be reused onsite. Noise, air, water impacts arising from the excavation and handling of excavated materials are discussed in Sections 3, 4 and 5 respectively.
C&D Waste	A rough estimation on the volume of demolition waste was made, using the draft general layout plans (drawing no. *90291/PD101-106, 108-110* and *113*). The GFA estimated to be demolished will be 22,000 m^2. Based on a waste generation rate of 0.7 m^3 m^{-2} of GFA to be demolished, approximately 16,000 m^3 of demolition waste will be generated.
Chemical Waste	A small volume of chemical waste, such as used lubricating oils from plant maintenance materials, will be produced. Storage, handling, transport and disposal of chemical waste should be in accordance with the *Code of Practice on the Packaging, Handling and Storage of Chemical Wastes*. Provided that this occurs, and chemical wastes are disposed of at a licensed facility, the contractor should be in compliance with all relevant regulations and there will be little environmental impact.
General Refuse	Based on a waste generation rate of about 0.6 kg per person, it is estimated that the amount of general refuse to be generated will be in the order of 60 kg per day.

Recommended Mitigation Measures

Introduction

6.3.52 This section sets out recycling, storage, transportation and disposal measures which are recommended to avoid or minimise potential adverse impacts associated with waste arising from the construction of the WCR under the headings of each waste type. The Contractor should incorporate these recommendations into a comprehensive on-site waste management plan. Such a management plan should incorporate site specific factors, such as the designation of areas for the segregation and temporary storage of reusable and recyclable materials.

Waste Management Hierarchy

6.3.53 The various waste management options can be categorised in terms of preference from an environmental viewpoint. The options considered to be more preferable have the least impacts and are more sustainable in a long term context. Hence, the hierarchy is as follows:

- avoidance and minimisation, ie not generating waste through changing or improving practices and design;
- reuse of materials, thus avoiding disposal (generally with only limited reprocessing);
- recovery and recycling, thus avoiding disposal (although reprocessing may be required); and
- treatment and disposal, according to relevant laws, guidelines and good practice.

6.3.54 The Waste Disposal Authority should be consulted by the Contractor on the final disposal of wastes.

6.3.55 This hierarchy should be used to evaluate waste management options, thus allowing maximum waste reduction and often reducing costs. For example, by reducing or eliminating over-ordering of construction materials, waste is avoided and costs are reduced both in terms of purchasing of raw materials and in disposing of wastes.

Dredged Material

6.3.56 The volume of material dredged should be minimised by limiting dredging during reclamation to seawall formation. Other no dredge options could also be investigated, subject to engineering feasibility.

6.3.57 Potential impacts associated with the exposure to and disposal of contaminated sediments could be mitigated by adopting the following measures:

- minimising exposure to any contaminated material by the wearing of protective gear such as gloves, providing adequate hygiene and washing facilities and preventing eating during dredging;

- any contaminated sediment dredged should not be allowed to stockpile on site and should be immediately removed from site once dredged;

- all vessels for marine transportation of dredged sediment should be fitted with tight fitting seals to their bottom openings to prevent leakage of materials; and

- loading of barges and hoppers should be controlled to prevent splashing of dredged material to the surrounding water, and barges or hoppers should under no circumstances to be filled to a level which will cause the overflowing of materials or polluted water during loading or transportation.

6.3.58 Other suitable mitigation measures for handling of dredged material are dealt with, in *Section 5* of this EIA.

Excavated Materials

6.3.59 Excavated materials are not considered likely to cause adverse impacts with respect to their disposal, since they will be reused onsite as far as possible. If any surplus uncontaminated inert materials do arise then they may be delivered to public filling areas.

6.3.60 Excavated materials should be segregated from other wastes to avoid possible contamination, thereby allowing disposal at public filling areas. Inert excavated materials are not considered likely to cause adverse impacts with respect to their disposal as there is sufficient space available in TKO Public Filling Area during the construction of the WCR.

Construction and Demolition Waste

6.3.61 In order to minimise waste arisings and keep environmental impacts within acceptable levels, the mitigation measures described below should be adopted.

6.3.62 Careful design, planning and good site management can minimise over ordering and generation of waste materials such as concrete, mortars and cement grouts. If feasible, the noise enclosures used at each site should be designed so that they are reusable, after they have been dismantled and removed, thereby not generating construction waste. The design of formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. Alternatives such as steel formwork or plastic facing should be considered to increase the potential for reuse.

6.3.63 The Contractor should recycle as much as possible the C&D material on-site. Proper segregation of wastes on site will increase the feasibility that certain components of the waste stream can be recycled by specialised contractors. Concrete and masonry, for example can be crushed and used as fill and steel

reinforcing bar can be used by scrap steel mills. Different areas of the work sites can be designated for such segregation and storage depending on site specific conditions.

6.3.64 The requirements for surface run-off and the handling and disposal of bentonite slurries should follow the *Practice Note For Professional Persons, Construction Site Drainage, Professional Persons Consultative Committee*, 1994 (*ProPECC PN 1/94*) which require a WPCO discharge license for any discharge into any drainage on sewerage system and include measures such as those described in *Section 5.5* to reduce impacts to surrounding waters..

6.3.65 The public filling area at the vicinity of WCR is the TKO Public Filling Area. If landfill disposal has to be used, the wastes will most likely be delivered to the SENT Landfill.

6.3.66 At present, Government is developing a charging policy for the disposal of waste to landfill. When it is implemented, this will provide additional incentive to reduce the volume of waste generated and to ensure proper segregation to allow free disposal of inert material to public filling areas.

6.3.67 C&D materials should be segregated on site into different waste and material types. Wherever possible, materials should be reused or recycled with the remaining inert materials before being disposed of at public filling areas. Waste containing putrescible materials should be disposed of at landfill.

6.3.68 In order to minimise the impacts of the demolition works these wastes must be cleared as quickly as possible after demolition. The demolition and clearance works should therefore be undertaken simultaneously.

Chemical Waste

6.3.69 For those processes which 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.

6.3.70 Chemical waste that is produced, as defined by *Schedule 1* of the *Waste Disposal (Chemical Waste) (General) Regulation*, should be handled in accordance with the *Code of Practice on the Packaging, Handling and Storage of Chemical Wastes*. Any person who produce chemical waste are required to register as a chemical waste producer with EPD. Containers used for the storage of chemical wastes should:

- be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed;
- have a capacity of less than 450 l unless the specifications have been approved by the EPD; and
- display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the Regulations.

6.3.71 The storage area for chemical wastes should:

- be clearly labelled and used solely for the storage of chemical waste;
- be enclosed on at least 3 sides;
- have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area, whichever is the greatest;
- have adequate ventilation;
- be covered to prevent rainfall entering (water collected within the bund must be tested and disposed as chemical waste if necessary); and
- be arranged so that incompatible materials are adequately separated.

6.3.72 Disposal of chemical waste should:

- be via a licensed waste collector; and
- be to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Facility which also offers a chemical waste collection service and can supply the necessary storage containers; or
- be to a reuser of the waste, under approval from the EPD.

6.3.73 The Centre for Environmental Technology operates a Waste Exchange Scheme which can assist in finding receivers or buyers.

General Refuse

6.3.74 General refuse generated on-site should be stored in enclosed bins or compaction units separate from construction and chemical wastes. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from construction and chemical wastes, on a daily or every second day basis to minimise odour, pest and litter impacts. The burning of refuse on construction sites is prohibited by law.

6.3.75 General refuse is generated largely by food service activities on site, so reusable rather than disposable dishware should be used if feasible. Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated or easily accessible, so separate, labelled bins for their deposit should be provided if feasible.

6.3.76 Office wastes can be reduced through recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered if one is available.

Biogas

6.3.77 As a good working practice, prior to entry into any confined space (ie drainage manhole) within the reclamation site (such as underground manholes, culvers and utility casings), the gas atmosphere within the confined space should be monitored for oxygen, methane, carbon dioxide and hydrogen sulphide. The working practices should follow the EPD Landfill Gas Hazard Assessment Guidance Note,

Waste Facilities Development Group, EPD, 1997 guidelines as follows:

- Any chamber, manhole or culvert which is large enough to permit access to personnel should be subject to entry safety procedures. Such work in confined spaces is controlled by the *Factories and Industrial Undertakings (Confined Spaces) Regulations of the Factories and Industrial Undertakings Ordinance*. Following the Safety Guide to Working in Confined Spaces ensures compliance with the above regulations.

6.3.78 The key issues with regards to confined spaces which are at risk of landfill gas build-up are set out below:

- The entry or access point should be clearly marked with a warning notice (in English and Chinese) which states that there is the possibility of flammable and asphyxiating gases accumulated within.

- The warning notice should also give the telephone number of an appropriate competent person who can advise on the safety precautions to be followed before entry and during occupation of the manhole.

- Personnel should be made aware of the dangers of entering confined spaces potentially containing hazardous gases and, where appropriate, should be trained in the use of gas detection equipment.

- Prior to entry, the atmosphere within the chamber should be checked for oxygen, methane and carbon dioxide concentrations. The chamber may then only be entered if oxygen is greater than 18% by volume, methane is less than 10% of the Lower Explosive Limit (LEL), which is equivalent to 0.5% by volume (approximately), and carbon dioxide is less than 0.5% by volume.

- If either carbon dioxide or methane are higher, or oxygen is lower, than the values given above, then entry to the chamber should be prohibited and expert advice should be sought.

- Even if conditions are safe for entry, no worker should be permitted to enter the chamber without having another worker present at the surface. The worker who enters the chamber should wear an appropriate safety/recovery harness and, preferably, should carry a portable methane, carbon dioxide and oxygen meter.

6.3.79 In general, when work is being undertaken in confined spaces, sufficient approved resuscitation equipment, breathing apparatus and safety torches should be available. Persons involved in or supervising such work should be trained and practised in the use of such equipment. A permit-to-work system for entry into confined spaces should be developed by an appropriately qualified person and consistently employed.

Other Waste Management Requirements

6.3.80 This Section describes waste management requirements and provides practical actions which can be taken to minimise the impacts arising as a result of the generation, storage, handling, transport and disposal of wastes.

6.3.81 Waste reduction is best achieved at the planning and design stage, as well as by ensuring that processes are run in the most efficient way. Good management and control can prevent the generation of significant amounts of waste. For unavoidable wastes, reuse, recycling and optimal disposal are most practical when segregation occurs on the construction site, as follows:

- dredged material for disposal at marine disposal sites;
- excavated material (inert) suitable for reclamation or fill;
- inert C&D material (public fill) for reuse at public filling areas;
- C&D waste for landfill;
- chemical waste; and
- general refuse.

6.3.82 The criteria for sorting solid waste is described in *New Disposal Arrangements for Construction Waste*. Waste containing in excess of 20% by volume of inert material should be segregated from waste with a larger proportion of putrescible material.

6.3.83 Proper storage and site practices will minimise the damage or contamination of construction materials. On site measures may be implemented which promote the proper disposal of wastes once off-site. For example having separate skips for inert (rubble, sand, stone, etc) and non-inert (wood, organics, etc) wastes would help to ensure that the former are taken to public filling areas, while the latter are properly disposed of at controlled landfills. Since waste brought to public filling areas will not attract a charge, while that taken to landfill may attract some future charge, separating waste may also help to reduce waste disposal costs, should landfill charging be introduced.

6.3.84 Specifically, it is recommended that:

- A sediment testing programme should be carried out during the detailed design stage to determine the quantity and quality of sediments to be removed for allocation to a disposal site;

- wastes should be handled and stored in a manner which ensures that they are held securely without loss or leakage thereby minimising the potential for pollution;

- only reputable waste collectors authorised to collect the specific category of waste concerned should be employed;

- removal of demolition wastes should be arranged to coincide with the demolition work;

- appropriate measures should be employed to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers;

- the necessary waste disposal permits should be obtained from the appropriate authorities, if they are required, in accordance with the *Waste Disposal Ordinance (Cap 354), Waste Disposal (Chemical Waste) (General) Regulation (Cap 354) and the Crown Land Ordinance (Cap 28)*;

- collection of general refuse should be carried out frequently, preferably daily;

- waste should only be disposed of at licensed sites and site staff and the civil engineering Contractor should develop procedures to ensure that illegal disposal of wastes does not occur;

- waste storage areas should be well maintained and cleaned regularly;

- records should be maintained of the quantities of wastes generated, recycled and disposed (determined by weighing each load or by another method); and

- during demolition, the Contractor should adopt selective demolition measures so that reusable material, like wood and metal, can be disposed of at landfills, and inert demolition materials can be reused on site or delivered to public filling areas, public filling points or land formation sites.

6.3.85 Training and instruction of construction staff should be given at the site to increase awareness and draw attention to waste management issues and the need to minimise waste generation. The training requirements should be included in the site waste management plan.

Residual Impacts

6.3.86 With implementation of the recommended construction waste mitigation measures, residual impacts are not expected to occur.

6.4 Conclusion

6.4.1 The following quantities of waste are expected to arise during the construction of the WCR from Yau Tong Bay Coastal as summarised in *Table 6.3g*: dredged materials (228,000 m^3); excavated materials (360,000 m^3 which can be reused on site); construction and demolition waste (16,000 m^3); chemical waste (small quantity); and general refuse (60 kg per day).

6.4.2 Mitigation measures relating to good practice have been recommended to ensure that adverse environmental impacts are prevented and that opportunities for waste minimisation and recycling are followed.

6.4.3 Provided that the recommendations put forward in this report are conscientiously

acted upon, no waste related regulatory noncompliance should occur as a result of the storage, handling, collection, transport, and disposal of wastes arising from the construction and operation of the WCR.

6.5 Construction Waste EM&A Requirements

6.5.1 It is recommended that auditing of each waste stream should be carried out periodically by an Independent Consultant to determine if wastes are being managed in accordance with approved procedures and the site waste management plan and to see if waste reduction targets are being achieved or could be improved. Site specific EM&A requirements have been formulated and are presented in the EM&A Manual. These are summarised in *Section 10.6*.