6 WASTE MANAGEMENT IMPLICATIONS

6.1 INTRODUCTION

6.1.1 This Section identifies the waste arising from the construction and operation of the Theme Park and associated developments at Penny's Bay and assesses the potential environmental impacts associated with the handling and disposal of the waste. The options for reuse, minimisation, recycling, treatment, storage, collection, transport and disposal of wastes arising from the Project have been examined. Where appropriate, procedures for waste reduction and management are considered and environmental control measures for avoiding and minimising the potential impacts are recommended.

6.2 LEGISLATION AND GUIDELINES

INTRODUCTION

6.2.1 The criteria and guidelines for evaluating potential waste management implications are laid out in *Annexes 7* and *15* of the *EIAO TM* under the *EIAO* (Cap 499).

6.2.2 The following legislation covers, or has some bearing upon, the handling, treatment and disposal of wastes in the Hong Kong Special Administrative Region (HK SAR), and will also be considered in the assessment.

- 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 (Urban Council) and (Regional Council) By-laws; and
- Dumping at Sea Ordinance (1995).

WASTE DISPOSAL ORDINANCE

6.2.3 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.

6.2.4 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 issued for the collection and transport of C&D waste or trade waste.

WASTE DISPOSAL (CHEMICAL WASTE) (GENERAL) REGULATION

6.2.5 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 a 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.

6.2.6 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 to fine and imprisonment.

6.2.7 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. The system is designed to allow the transfer of wastes to be traced from cradle-to-grave.

6.2.8 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/she must also provide employees with training in such procedures.

LAND (MISCELLANEOUS PROVISIONS) ORDINANCE (CAP 28)

6.2.9 Construction and demolition materials(1) 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) and others. The *Land (Miscellaneous Provisions) Ordinance* requires that Dumping Licences are obtained by individuals or companies who deliver inert C&D material (or public fill) to the public filling areas. The licences are issued by the CED under delegated authority from the Director of Lands.

6.2.10 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 inert material is permissible. The material should, however, be free from marine mud, household refuse, plastic, metal, industrial and chemical wastes, animal and vegetable matters and any other materials considered unsuitable by the public filling supervisor.

PUBLIC CLEANSING AND PREVENTION OF NUISANCES BY-LAWS

6.2.11 These by-laws provide a further control on the illegal tipping of wastes on unauthorised (unlicensed) sites. The illegal dumping of wastes can lead to a fine and imprisonment.

(1) "C&D material" refers to surplus materials arising from any land excavation or formation, civil/building construction, road work, building renovation or demolition activities. It includes various types of reusable materials, building debris, rubble, earth, concrete, timber and mixed site clearance materials. When sorted properly, materials suitable for land reclamation and site formation (know as public fill) should be reused at public filling area whereas the remaining C&D waste are to be disposed of at landfills.

DUMPING AT SEA ORDINANCE

6.2.12 This *Ordinance* empowers the Director of Environmental Protection (DEP) to control the disposal and incineration of substances and articles at sea for the protection of the marine environment. Under the *Ordinance*, a permit from the DEP is required for the disposal of regulated substances within and outside the waters of the HK SAR. The permit contains terms and conditions that includes the following specifications:

- type and quantity of substances to be dumped;
- location of the disposal grounds;
- requirement of equipment for monitoring the disposal operations; and
- the need for environmental monitoring.

OTHER RELEVANT GUIDELINES

6.2.13 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. 6/92, Fill Management*; Works Branch, Hong Kong Government;
- *Works Branch Technical Circular 22/92, Marine Disposal of Dredged Mud;*
- *Works Branch Technical Circular, 32/92, The Use of Tropical Hard Wood on Construction Site*; Works Branch, Hong Kong Government;
- *Technical Circular No 1-1-92 Classification of Dredged Sediments for Marine Disposal*, Environmental Protection Department;
- *Works Branch Technical Circular No. 2/93, Public Dumps*, Works Branch, Hong Kong Government;
- *Works Branch Technical Circular No. 16/96, Wet Soil in Public Dumps*; Works Branch, Hong Kong Government;
- *Works Bureau Technical Circular No. 4/98, Use of Public Fill in Reclamation and Earth Filling Projects*; Works Bureau, HK SAR Government;
- *Works Bureau Technical Circular No 5/98, On-site Sorting of Construction Waste on Demolition Site*; Works Bureau, HK SAR Government;
- *Waste Reduction Framework Plan, 1998 to 2007*, Planning, Environment and Lands Bureau, Government Secretariat, 5 November 1998;
- *Works Bureau Technical Circular No 5/99, Trip-ticket System for Disposal of Construction and Demolition Material*; Works Bureau, HK SAR Government; and
- *Work Bureau Technical Circular No. 25/99, Incorporation of Information on Construction and Demolition Material Management in Public Works Sub-committee Papers*; Works Bureau, HK SAR Government.

CLASSIFICATION OF MARINE SEDIMENT FOR MARINE DISPOSAL

6.2.14 Dredged sediments destined for marine disposal are classified according to their level of contamination by seven heavy metals as stipulated in the *EPDTC No. 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:

Table 6.2a - Classification of Dredged Sediment

Class	Type
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 minimises 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 6.2b - Classification of Sediments by Metal Content (mg kg^{-1} dry weight)

Class	Cd	Cr	Cu	Hg	Ni	Pb	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

6.2.15 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 W*BTC 22/92*.

6.2.16 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), polycyclic aromatic hydrocarbons (PAHs), and tributyltin (TBT) should also be tested, if suspected to be present. However, EPD has not specified the criteria for any of these parameters.

6.2.17 In addition, in accordance with *WBTC Nos 6/92* and *22/92* and *Building Ordinance Office Practice Note for Authorised 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 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 Geotechnical Engineering Office at an early stage.

6.3 BASELINE CONDITION

6.3.1 The Theme Park and associated developments fall within the Tsuen Wan and Outlying Islands Waste Arising Districts. Municipal solid waste (MSW) arisings in North Lantau is

mainly from the Tung Chung New Town, Hong Kong International Airport and the MTRC Siu Ho Wan Depot. Currently, the MSW collected from North Lantau is delivered to the North Lantau Transfer Station (NLTS) at Siu Ho Wan.

6.3.2 The NLTS was commissioned in April 1998 and has a throughput of 650 tpd which will be expanded to 1,200 tpd to handle the anticipated growth of waste arising from North Lantau. The anticipated waste throughput of NLTS are 180, 370, 770, and 880 tpd for the years 2001, 2006, 2011 and 2016, respectively(2). At the NLTS, the waste is compacted into 20 ft ISO containers for bulk transfer by marine vessels to the Western New Territories (WENT) landfill for final disposal. The WENT landfill was commissioned in November 1993 and has a design capacity and void capacity of about 61M m^3 and 53 M m^3 respectively. Based on the current waste input forecasts, and making allowances for the implementation of the Waste Reduction Plan, the HK SAR's strategic landfills will be filled by 2019.

6.3.3 Currently there is no public filling area is available for the disposal of public fill arising from North Lantau. A public filling area is proposed at Yam Tsai Wan but no commitment is acknowledged.

6.3.4 There is only one Public Filling Barging Point in Lantau Island at Mui Wo (operates since 1998). The Siu Ho Wan Public Filling Barging Point (next to the NLTS) is scheduled to operate in 2004. Before the commissioning of the Siu Ho Wan Public Filling Barging Point, public fills generated in the construction of the Theme Park and the associated infrastructure will have to be either re-used on-site as far as practical or delivered to public filling areas in Kowloon and Tuen Mun or other reclamation sites on Lantau Island.

6.4 ASSESSMENT METHODOLOGY

6.4.1 The potential environmental impacts associated with the handling and disposal of waste arising from the construction and operation of the Theme Park and associated developments at Penny's Bay will be assessed in accordance with the criteria presented in *Annexes 7* and *15* of the *EIAO TM* and are summarised as follows:

- estimation of the types and quantities of the wastes to be generated, including, but not limit to: dredged/excavated sediment, excavated material, construction and demolition waste, chemical waste and general refuse during construction phase; as well as municipal solid waste, chemical waste and sewage sludge during operation phase;
- assessment of the secondary environmental impacts due to the management of waste with respect to potential hazards, air and odour emissions, noise, wastewater discharges, pest nuisance and traffic; and
- assessment of the potential impacts on the capacity of waste collection, transfer and disposal facilities.

6.5 IDENTIFICATION OF POTENTIAL ENVIRONMENTAL IMPACTS

CONSTRUCTION WASTE IMPACTS

(2) EPD Communication ref EP 20/03/205 M

6.5.1 As detailed in *Section 2*, the construction of the Theme Park and associated developments will involve a wide range of construction activities which will lead to the generation of solid wastes. Major construction activities are listed below:

- dredging and disposal of the marine sediment at the Penny's Bay Reclamation Stages I and II as well as Yam O Reclamation;
- construction of seawalls and reclamation;
- construction of road and drains; and
- construction of the Theme Park infrastructure.

6.5.2 As described in *Section 1.4*, an existing shipyard (Cheoy Lee Shipyard) will need to be demolished as part of the Project. However, the potential environmental impacts associated with the decommissioning and demolition of the shipyard will be evaluated under a separate EIA to be commissioned by the CED.

6.5.3 The Theme Park and associated developments construction activities will result in the generation of a variety of wastes which can be divided into distinct categories based on their composition, as follows:

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

6.5.4 The nature and quantity of each of these waste types arising from the construction of the Penny's Bay and Yam O reclamations and the Theme Park infrastructure are identified below.

Dredged/Excavated Sediment

6.5.5 The construction of the Theme Park will involve the reclamation of 280 ha of marine sea bed. The reclamation will be undertaken in two stages. Penny's Bay Reclamation Stage I reclamation has to be completed by Q3 2002 (including dredging, placement of seawall, filling and placement of surcharge) in order to be handed over to Hongkong International Theme Parks Limited (HKITP) for the construction and operation of the Theme Park. This means that the dredging, reclamation and consolidation works have to be finished within 32 months. The engineering feasibility of not dredging the marine sediment of the Penny's Bay Reclamation Stage I and increasing the consolidation rate by various ground improvement techniques has been evaluated. However, taking into account the depth (approximately 20 to 30 m) of the marine sediment to be left in place and the limited time available for undertaking the ground improvement prior to the construction for the Theme Park infrastructure, it is considered necessary to fully dredge the marine sediment of Penny's Bay Reclamation Stage I. The volume of marine sediment to be dredged for the Penny's Bay Reclamation Stage I is approximately 40 M m^3

6.5.6 The construction of the Phase II Theme Park on the Penny's Bay Reclamation Stage II will not be required immediately after the reclamation. It is therefore feasible to leave the marine sediment in place and carry out ground improvement prior to the Phase II Theme Park construction. Dredging of marine sediment for the Penny's Bay Reclamation Stage II will therefore be limited to the seawall area and the volume of marine sediment will be about 5 Mm^3 which is significantly less than the Penny's Bay Reclamation Stage I.

6.5.7 The construction of the Road P2 and the Temporary PTI at Yam O will require the reclamation of a 10 ha of marine seabed. Various reclamation methods aiming to minimise the requirement of dredging works have been considered. It is recommended that dredging of marine sediment should be limited to the seawall area. The amount of marine sediment to be dredged will be about 0.3 M m^3.

6.5.8 The construction of a 32 ha Water Recreation Centre with a 12 ha artificial lake and associated amenity facilities may require the dredging of about 1 M m^3 of marine sediment, which is approximately the top 1 m of the artificial lake. The construction of the CKWLR section between Yam O and the Penny's Bay Interchanges will also require excavation and disposal of a small quantity (approximately 1,300 m^3) of marine sediment for pile construction of elevation sections.

6.5.9 The total volume of marine sediment to be dredged and disposed off-site will be approximately 46.3 Mm^3. *Table 6.5a* summarises the dredging and filling requirements for the Penny's Bay Reclamation Stages I and II and Yam O Reclamation.

Table 6.5a - Dredging and Filling Requirements for Penny's Bay and Yam O Reclamation

Activities	Reclamation Area in ha	Volume in M m^3	Construction Period
Dredging for Penny's Bay Reclamation Stage I	200	40	Q2 2000 to Q4 2001
Dredging for Penny's Bay Reclamation Stage II	80	5	Q3 2001 to Q1 2005
Dredging for Yam O Reclamation	10	0.3	Q4 2001 to Q4 2002
Dredging of sediment for the construction of Water Recreation Centre	32	1.0	Q2 2001 to Q4 2002
Excavation for the construction of CKWLR section foundation (Yam O to Penny's Bay Interchanges)	N. A.	minimal	Q4 2001 to Q3 2003
Total Volume of Sediment to be Dredged		46.3	
Filling/Surcharge of Penny's Bay Reclamation Stage I: Sand Fill/Sand Surcharge Public Fill		 65 2	Q4 2000 to Q2 2002
Filling/Surcharge of Penny's Bay Reclamation Stage II: Sand Fill/Sand Surcharge Public Fill/Public Fill Surcharge		 7.4 8.5 and 2.5	Q2 2003 to Q4 2008
Filling/Surcharge of Yam O Reclamation Sand Fill Public Fill		 0.5 1.2	Q4 2002 to Q2 2003
Total Fill Requirement		84.6	

6.5.10 The chemical characteristics of the sediment to be dredged have been determined under the site investigation of this EIA. Since all sediment dredging/excavation works for Penny Bay Reclamation Stages I and II, Yam O Reclamation, Water Recreation Centre and CKWLR section will commence before 2002, the sediment will be characterised based on

the criteria stipulated in *EPDTC 1-1-92*. Vibrocores or grab samples were collected based on a 200 m grid system (see *Figures 6.5a and 6.5b*) and they were tested for Cd, Cr, Cu, Ni, Pb, Ag, Zn and Hg in accordance with the requirements of the *EPDTC 1-1-92*. The analysis results are presented in *Table 6.5b*.

Table 6.5b - Sediment Quality Analysis Results

	Sample Depth	Moisture (%)	Cd (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Hg (mg/kg)	Overall Classification
Penny's Bay Reclamation Stage 1										
TGS01	Seabed	-	< 0.6	80	71	22	66	150	0.2	*C*
TGS02	Seabed	32.4	< 0.6	23	15	< 10	23	56	< 0.1	A
TGS03	Seabed	-	< 0.6	38	36	20	45	110	0.1	A
TGS04	Seabed	53.8	< 0.6	47	47	20	55	120	0.2	A
TGS05	Seabed	-	< 0.6	32	32	10	41	90	0.1	A
TGS06	Seabed	24.9	< 0.6	< 10	7	< 10	20	33	< 0.1	A
TGS07	Seabed	-	< 0.6	10	16	< 10	39	64	< 0.1	A
TGS08	Seabed	26.1	< 0.6	23	24	10	33	75	< 0.1	A
TGS09	Seabed	-	< 0.6	< 10	11	< 10	27	36	< 0.1	A
TGS10	Seabed	-	< 0.6	20	20	10	29	64	< 0.1	A
TGS11	Seabed	-	< 0.6	35	44	20	49	120	0.2	A
TGS12	Seabed	53.3	< 0.6	35	45	20	49	120	0.2	A
TGS13	Seabed	-	< 0.6	34	46	20	51	120	0.2	A
TGS14	Seabed	43.1	< 0.6	28	31	20	48	100	0.2	A
TGS15	Seabed	-	< 0.6	36	44	20	53	120	0.2	A
TGS16	Seabed	52.6	< 0.6	37	49	20	55	130	0.2	A
TGS17	Seabed	-	< 0.6	31	42	20	61	110	0.2	A
TGS18	Seabed	51.5	< 0.6	44	47	20	56	120	0.2	A
TGS19	Seabed	-	< 0.6	48	50	22	52	120	< 0.1	A
TGS20	Seabed	-	< 0.6	44	47	21	50	130	0.2	A
TGS21	Seabed	-	< 0.6	46	49	20	48	130	0.3	A
TGS22	Seabed	-	< 0.6	29	29	10	59	97	0.2	A
TGS23	Seabed	-	< 0.6	42	42	20	47	120	0.3	A
TGS24	Seabed	54	< 0.6	47	49	21	53	130	0.2	A
TGS25	Seabed	-	< 0.6	47	49	21	49	140	0.2	A
TGS26	Seabed	48.2	< 0.6	37	40	20	45	110	0.2	A
TGS27	Seabed	-	< 0.6	45	47	20	47	120	0.2	A
TGS28	Seabed	53.1	< 0.6	46	49	20	48	120	0.2	A
TGS29	Seabed	-	< 0.6	45	41	20	49	120	0.3	A
TGS30	Seabed	49.6	< 0.6	42	43	20	45	120	0.4	A
TGS31	Seabed	-	< 0.6	44	48	20	51	120	0.2	A
TGS32	Seabed	53.5	< 0.6	46	49	20	49	130	0.2	A
TGS33	Seabed	-	< 0.6	46	50	20	48	120	0.2	A
TGS34	Seabed	-	< 0.6	61	51	28	46	130	0.2	B
TGS35	Seabed	-	< 0.6	59	54	26	44	130	0.3	B
TGS36	Seabed	-	< 0.6	55	48	25	42	120	0.2	B
TGS37	Seabed	-	< 0.6	65	48	28	44	120	0.2	B
TGS38	Seabed	-	< 0.6	49	42	25	47	110	0.2	A
TGS39	Seabed	50.5	< 0.6	65	50	29	44	110	0.2	B
TGS40	Seabed	-	< 0.6	59	53	28	46	130	0.2	B
TGS41	Seabed	50.9	< 0.6	59	52	28	46	140	0.2	B
TGS42	Seabed	-	< 0.6	63	53	29	45	130	0.2	B
TGS43	Seabed	36.6	< 0.6	26	18	10	44	63	< 0.1	A
TGS44	Seabed	-	< 0.6	56	42	26	49	110	0.2	B

	Sample Depth	Moisture (%)	Cd (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Hg (mg/kg)	Overall Classification
TGS45	Seabed	-	< 0.6	62	48	29	43	120	0.2	B
TGS46	Seabed	-	< 0.6	57	45	27	38	100	0.2	B
TGS47	Seabed	-	< 0.6	56	53	28	52	130	0.2	B
TGS48	Seabed	-	< 0.6	62	51	29	43	120	0.2	B
TGS49	Seabed	-	< 0.6	28	21	10	36	68	< 0.1	A
TGS50	Seabed	-	< 0.6	61	51	24	42	130	< 0.1	B
TGS51	Seabed	52.1	< 0.6	64	54	26	43	120	< 0.1	B
TGS52	Seabed	-	< 0.6	35	25	10	31	76	< 0.1	A
TGS53	Seabed	53.2	< 0.6	65	56	26	40	140	< 0.1	B
VC1	0.9-1.0 m	-	< 0.6	20	9	< 10	21	51	< 0.1	A
VC1	1.9-2.0m	-	< 0.6	10	< 5	< 10	10	24	< 0.1	A
VC1	2.9-3.0m	-	< 0.6	20	< 5	< 10	10	33	< 0.1	A
VC1	5.7-5.8m	-	< 0.6	30	8	20	20	59	< 0.1	A
VC1	8.9-9.0m	-	< 0.6	32	9	20	24	64	< 0.1	A
VC1	117.-11.8m	-	< 0.6	26	8	10	25	51	< 0.1	A
VC1	14.9-15.0m	-	< 0.6	< 10	< 5	< 10	10	25	< 0.1	A
VC2	0.9-1.0 m	-	< 0.6	29	8	20	20	64	< 0.1	A
VC2	1.9-2.0m	-	< 0.6	37	9	21	22	77	< 0.1	A
VC2	2.9-3.0m	-	< 0.6	42	10	22	24	130	< 0.1	A
VC2	5.7-5.8m	-	< 0.6	44	11	23	28	85	< 0.1	A
VC2	5.8-5.9m	-	< 0.6	44	11	23	28	85	< 0.1	A
VC2	8.9-9.0m	-	< 0.6	39	11	21	26	73	< 0.1	A
VC2	11.8-11.9m	-	< 0.6	35	10	20	28	63	< 0.1	A
VC2	14.7-15.0m	-	< 0.6	20	8	< 10	29	36	< 0.1	A
VC2	17.8-17.9m	-	< 0.6	34	13	10	35	59	< 0.1	A
VC2	20.9-21.0m	-	< 0.6	27	11	10	29	62	< 0.1	A
VC3	0.9-1.0 m	-	< 0.6	29	7	20	20	58	< 0.1	A
VC3	1.9-2.0m	-	< 0.6	42	10	22	25	86	< 0.1	A
VC3	2.9-3.0m	-	< 0.6	38	10	20	23	75	< 0.1	A
VC3	5.7-5.8m	-	< 0.6	44	11	24	27	84	< 0.1	A
VC3	8.9-9.0m	-	< 0.6	40	10	21	25	75	< 0.1	A
VC3	11.7-11.8m	-	< 0.6	40	13	20	32	77	< 0.1	A
VC4	0.9-1.0 m	-	< 0.6	34	14	20	35	78	0.2	A
VC4	1.9-2.0m	-	< 0.6	36	9	20	21	77	< 0.1	A
VC4	2.9-3.0m	-	< 0.6	37	10	20	24	81	< 0.1	A
VC4	5.7-5.8m	-	< 0.6	41	12	23	28	87	< 0.1	A
VC4	8.9-9.0m	-	< 0.6	44	11	22	25	76	< 0.1	A
VC4	11.7-11.8m	-	< 0.6	45	13	20	31	78	< 0.1	A
VC4	14.9-15.0m	-	< 0.6	41	14	20	39	77	< 0.1	A
VC5	0.9-1.0m	-	< 0.6	36	10	22	23	81	< 0.1	A
VC5	1.9-2.0m	-	< 0.6	40	11	22	26	85	< 0.1	A
VC5	2.9-3.0m	-	< 0.6	40	11	23	27	87	< 0.1	A
VC5	5.8-5.9m	-	< 0.6	41	12	25	29	82	< 0.1	A
VC5	8.9-9.0m	-	< 0.6	41	10	20	27	72	< 0.1	A
VC5	11.8-11.9m	-	< 0.6	43	14	20	33	81	< 0.1	A
VC5	14.9-15.0m	-	< 0.6	39	14	20	38	82	< 0.1	A
VC5	17.8-17.9m	-	< 0.6	21	8	< 10	20	39	< 0.1	A
VC5	20.9-21.0m	-	< 0.6	39	16	20	41	85	< 0.1	A
VC5	23.8-23.9m	-	< 0.6	10	5	< 10	24	26	< 0.1	A
VC5	26.8-27.0m	-	< 0.6	20	7	10	10	38	< 0.1	A
VC6	0.9-1.0 m	-	< 0.6	20	< 5	10	10	38	< 0.1	A
VC6	1.9-2.0m	-	< 0.6	20	< 5	< 10	10	33	< 0.1	A
VC6	2.9-3.0m	-	< 0.6	20	< 5	< 10	10	36	< 0.1	A

	Sample Depth	Moisture (%)	Cd (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Hg (mg/kg)	Overall Classification
VC6	5.8-5.9m	-	< 0.6	32	10	20	26	70	< 0.1	A
VC6	8.9-9.0m	-	< 0.6	29	9	20	21	62	< 0.1	A
VC6	11.8-11.9m	-	< 0.6	37	11	20	28	71	< 0.1	A
VC6	14.9-15.0m	-	< 0.6	22	8	< 10	30	57	< 0.1	A
VC7	0.9-1.0 m	-	< 0.6	29	7	20	20	63	< 0.1	A
VC7	1.9-2.0m	-	< 0.6	38	11	21	26	84	< 0.1	A
VC7	2.9-3.0m	-	< 0.6	40	11	22	27	85	< 0.1	A
VC7	5.8-5.9m	-	< 0.6	40	11	22	28	84	< 0.1	A
VC7	8.9-9.0m	-	< 0.6	41	10	22	24	76	< 0.1	A
VC7	11.8-11.9m	-	< 0.6	39	12	20	27	74	< 0.1	A
VC7	14.9-15.0m	-	< 0.6	43	14	21	37	86	< 0.1	A
VC7	17.8-17.9m	-	< 0.6	40	15	20	37	86	< 0.1	A
VC7	20.9-21.0m	-	< 0.6	< 10	6	< 10	< 10	22	< 0.1	A
VC8	0.9-1.0 m	-	< 0.6	< 10	< 5	< 10	10	20	< 0.1	A
VC8	1.9-2.0m	-	< 0.6	< 10	< 5	< 10	10	23	< 0.1	A
VC8	2.9-3.0m	-	< 0.6	< 10	< 5	< 10	20	58	< 0.1	A
VC8	5.7-5.8m	-	< 0.6	< 10	< 5	< 10	10	22	< 0.1	A
Penny's Bay Reclamation Stage II										
TGS54	Seabed	47.4	< 0.6	59	48	22	35	120	< 0.1	B
TGS55	Seabed	-	< 0.6	60	49	23	35	120	< 0.1	B
TGS56	Seabed	50.5	< 0.6	62	50	25	36	120	< 0.1	B
TGS57	Seabed	-	< 0.6	57	44	22	33	110	< 0.1	B
TGS58	Seabed	48.8	< 0.6	62	85	24	35	140	< 0.1	***C***
TGS59	Seabed	-	< 0.6	60	51	25	33	120	< 0.1	B
TGS60	Seabed	-	< 0.6	57	53	23	33	110	< 0.1	B
TGS61	Seabed	50.2	< 0.6	62	63	24	35	97	< 0.1	B
TGS62	Seabed	-	< 0.6	55	50	23	32	120	< 0.1	B
TGS63	Seabed	51.8	< 0.6	59	54	25	37	130	< 0.1	B
TGS64	Seabed	-	< 0.6	59	57	25	38	130	< 0.1	B
TGS65	Seabed	23	< 0.6	20	11	< 10	10	39	< 0.1	A
Yam O Reclamation										
SS6	0.3-0.9m	44.5	< 1	32	502	19	39	148	< 0.4	***C***
SS6	0.9-1.5m	39.7	< 1	33	16	23	32	152	< 0.4	B
SS6	1.9-2.5m	44.5	< 1	31	12	22	30	116	< 0.4	A
SS6	2.9-3.5m	43.1	< 1	32	11	19	27	99	< 0.4	A
SS6	5.2-5.8m	48.4	< 1	39	14	25	33	109	< 0.4	A
SS17	0.2-0.8m	43.7	< 1	25	31	15	39	97	< 0.4	A
SS17	0.9-1.5m	40.8	< 1	32	15	20	31	90	< 0.4	A
SS17	1.9-2.5m	47.8	< 1	31	12	20	31	92	< 0.4	A
SS17	2.9-3.5m	45.9	< 1	33	12	20	28	85	< 0.4	A
SS17	5.2-5.8m	49	< 1	42	15	26	32	82	< 0.4	A
SS18	0.0-0.6m	33	< 1	18	16	11	20	50	< 0.4	A
SS18	0.9-1.5m	48	< 1	45	31	28	60	140	< 0.4	A
SS18	1.9-2.5m	36.4	< 1	29	198	18	31	82	< 0.4	***C***
SS18	2.9-3.5m	43.9	< 1	32	11	21	29	102	< 0.4	A
SS18	5.2-5.8m	42.4	< 1	31	11	20	30	83	< 0.4	A
SS19	0.2-0.8m	50.1	< 1	33	49	19	41	112	< 0.4	A
SS19	0.9-4.5m	26.4	< 1	16	7	11	21	52	< 0.4	A
SS19	1.9-2.5m	37.6	1	8	6	9	21	49	< 0.4	A
SS19	2.9-3.4m	38	1	9	7	8	22	58	< 0.4	A
Water Recreation Center or CKWLR section										
SGS01	Seabed	45.4	< 0.2	47	49	15	57	105	0.1	A
SGS02	Seabed	49.9	< 0.2	45	12	15	48	87	0.2	A

	Sample Depth	Moisture (%)	Cd (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Hg (mg/kg)	Overall Classification
SGS03	Seabed	31.8	< 0.2	21	17	4	21	50	< 0.1	A
SGS04	Seabed	65.3	< 0.2	69	43	25	61	145	0.2	B
SGS05	Seabed	59.3	< 0.2	78	59	28	66	156	0.2	B
SGS06	Seabed	56.6	< 0.2	56	38	18	64	107	0.1	B
SGS07	Seabed	57.2	< 0.2	69	47	20	55	121	< 0.1	B
SGS08	Seabed	60.9	< 0.2	70	51	20	57	127	< 0.1	B
SGS09	Seabed	53	< 0.2	62	45	22	60	124	0.2	B

Notes:
(a) Value in underline indicate Class B sediment under EPD TC 1-1-92
(b) Value in double underline indicate Class C sediment under EPD TC 1-1-92

6.5.11 The sediment testing results indicate that except for four samples (TGS01 at Penny's Bay Reclamation Stage I area, TGS58 at Penny's Bay Reclamation Stage II seawall, SS6 and SS18 along the seawall of the Yam O Reclamation), the sediment of the other areas are either classified as Class A or Class B sediment which is suitable for open sea disposal.

6.5.12 TGS01 (both Cr and Cu exceed the Class C criteria) is located outside the seaward boundary of the Cheoy Lee Shipyard, although there is no sign of elevated levels of contamination in the sediment outside the seaward boundary of the shipyard, the contamination found at TGS01 may due to the operation of the shipyard. As TGS02 is classified as Class A, it is suggested that the extent of the contamination is limited to the near shore area, outside the seaward boundary of the shipyard. Information on the depth of sediment at the TGS01 is not available, however, it is expected to be quite shallow as it is close to the shore area. Assuming a sediment depth of about 2 m around TGS01 (a 200 m grid) the potential volume of contaminated sediment to be dredged and disposed of will be about 80,000 m^3.

6.5.13 The depth of sediment at TGS58 which may be classified as Class C cannot be determined from the site investigation. However, previous site investigation(3) undertaken during 1994 indicated that contaminated sediment will be limited to the top 0.5 m. Assuming only the top 0.5 m of sediment around TGS58 will be classified as Class C sediment, the potential volume of contaminated sediment to be dredged and disposed of will be approximately 20,000 m^3 (assuming a 200 m grid).

6.5.14 The copper contents of the surface sediment samples taken from SS6 (at depth of 0.3 to 0.9 m below seabed) and SS18 (at depth of 1.9 to 2.5 m below seabed) fall within the Class C criteria. The contamination may arise due to the previous operation of a log pond at Yam O. The sediment samples taken at SS6 at 1.5 m below the seabed show no contamination which suggests that the contaminated sediment is limited to the top 1.5 m. The analysis results of the SS18 samples suggest that a pocket of contaminated sediment occurs in this location. It is estimated that the potential volume of contaminated sediment to be dredged at SS6 and SS18 is about 10,000 m^3. It is recommended that further sediment testing should be taken at these areas to determine the exact boundary of the contaminated sediment so that the volume of contaminated sediment to be disposed of can be minimised.

(3) Lantau Port Development - Stage 1 Container Terminal No. 11 and 11 Ancillary Works (Design), EIA, for CED December 1994.

Table 6.5c - Estimated Classification and Volume of Dredged/Excavated Sediment

Area	Volume in M m^3			
	Class A	**Class B**	**Class C**	**Total**
Penny's Bay Reclamation Stage I	39.28	0.64	0.08	40
Penny's Bay Reclamation Stage II	4.58	0.4	0.02	5
Yam O Reclamation	0.285	0.005	0.01	0.3
Water Recreation Centre or CKWLR section	0.76	0.24	--	1.0
Total	*44.905*	*1.285*	*0.11*	*46.3*

6.5.15 The maximum quantity of uncontaminated sediment to be disposed will be about 634,000 m^3 $week^{-1}$ or 90,600 m^3 d^{-1}. The small amount of contaminated sediment will be dredged and disposed of at the beginning of the dredging works. It is anticipated that they could be dredged and disposed of within three to four weeks.

6.5.16 The FMC has allocated 30 M m^3 of uncontaminated and disposal capacity to the Penny's Bay Reclamation (East Nine Pin, East Tung Lung and north of Lantau). The Engineers should inform FMC the extra volume of sediment requiring disposal so further disposal ground can be allocated.

6.5.17 The dredging of sediment has the potential to cause adverse water quality impacts if not properly managed. The potential water quality impacts associated with the dredging of sediment are discussed in *Section 5*. The handling and disposal of the dredged sediment will also have the potential to cause adverse environmental impacts if not properly managed, in particular the handling and disposal of the seriously contaminated (Class C) sediment.

Use of Public Fill for the Reclamation

6.5.18 The Penny's Bay Reclamation Stage I requires a large amount of fill material (total of about 67 M m^3) (see *Table 6.5a*) and therefore offers a very good opportunity to utilise the public fill generated in the HK SAR. The use of public fill will not only alleviate the demand for virgin fill material but also reduce the pressure of disposing inert construction and demolition materials at the strategic landfills. The Penny's Bay Reclamation will maximise the use of good quality public fill generated in the HK SAR. Within the filling period, the Penny's Bay Reclamation Stage I will utilise about 2.0 Mm^3 of public fill which is the maximum volume of public fill that the reclamation could accommodate.

6.5.19 Stage II of the Penny's Bay Reclamation includes reclamation of about 80 ha from the sea from Q2 2003 to Q1 2006 (about 36 months), and it is proposed that maximum volume of public fill is used in the reclamation and seawall within the constraint imposed by the geometry and design requirements. In addition to public fill used in the reclamation, high-grade public fill, such as those arising from large-scale excavation projects, will also be used in seawall construction, within the constraints imposed by design requirements. The estimated void volume of Stage II, indicates that up to 8.5 M m^3 of public fill of varying grades can be used in the Stage II works (equivalent to most of the public fill to be generated in the territory during the reclamation period). In addition, approximately 2.5 M m^3 of public fill can also be used for surcharging purposes.

6.5.20 The Yam O reclamation requires 1.7 M m^3 of fill material between Q4 2002 and Q3 2003 (about 12 months). Public fill will be used as far as practical for the reclamation. It is

estimated that about 1.2 M m^3 of public fill (about 70% of the fill requirement) will be used for the reclamation and the balance will be sand fill (about 0.5 M m^3 which will mainly used for the construction of the seawall).

6.5.21 The use of public fill as filling material may give rise to floating debris during reclamation. Part of the Penny's Bay Reclamation Stages I and II as well as Yam O Reclamation will be designated as a public filling area. Public fill comprising earth, building debris and broken concrete may contain a small amount of floatable materials such as timber, plastic and paper. If not properly controlled, it may give rise to floating refuse.

Excavated Material

6.5.22 *Construction of Theme Park:* The construction of the Penny's Bay Reclamation and Yam O Reclamation will require importation of a large quantity of fill materials. The construction of the building foundation for the Phase I of the Theme Park will generate some excavated materials. The quality of the excavated material will be the same as the fill materials used for the reclamation (ie either marine sand fill or clean public fill). The exact amount of surplus excavated material to be generated from the foundation works cannot be determined at this stage as detailed design information is not presently available. However, it is anticipated to be of a small percentage (less than 5%) of the fill requirement (15.9 M m^3) for the Penny Bay Reclamation Stage II (which will be undertaken concurrently with the construction of the Phase I Theme Park) and can all be reused for the filling works of Penny's Bay Reclamation Stage II. Therefore, no surplus excavated material will be generated from the Phase I development of the Theme Park.

6.5.23 The design of the Phase II development of the Theme Park will ensure a cut and fill balance as far as practical. The small amount of excavated material to be generated from the foundation works will be used for landscaping works in order to minimise the need to dispose of any surplus excavated material off-site.

6.5.24 *CKWLR section* : Approximately 10,200 m^3 of excavated material will be generated from slope excavation. The excavated materials will consist of clean rock and soil which could be reused on-site, for example, for filling at the Cheoy Lee Shipyard area. No surplus excavated material will be generated.

6.5.25 *Road P2 :* About 7,800 m^3 of excavated material will be generated from the excavation works. The excavated materials will be reused on-site for filling at Cheoy Lee Shipyard area and no surplus excavated material will be generated.

6.5.26 *Penny's Bay Rail Link:* As the majority of the PBRL will be constructed at grade, the excavation work will be limited to construction of cut and cover and drill and blast tunnels, and minor earthworks for the construction of tunnel portals. It is estimated that approximately 16,500 m^3 and 27,000 m^3 of excavated materials will be generated from the construction of the cut and cover tunnel, and the drill and blast tunnel, respectively. About 25,000 m^3 of excavated materials will be generated from other minor excavation work. These excavated materials (a total of 68,500 m^3) will be generated between Q3 2002 ad Q2 2004 (approximately 21 months) and will comprise mainly clean rock and soil. The Yam O station will be constructed on a pad foundation, and hence no piling will be required. The Theme Park station will be founded on steel H-piles or a pad foundation. No or

minimal excavation will be required for the construction of an H-piles or pad foundation. The quantity of excavated material arising from all the foundation works will be minimal.

6.5.27 As the Penny's Bay and Yam O reclamations require a large quantity of fill material and the Project will have an overall deficit of fill material. It is anticipated that all the excavated soil and rock generated from the Project will be re-used for the reclamation works. Since public filling areas only accept public fill with certain size (< 200 mm diameter). Some of the excavated material may require to be broken prior re-use on site. No surplus of excavated material will be generated.

Construction and Demolition Material

6.5.28 Construction and demolition material (C&DM)[4] will be generated from new buildings construction. C&DM 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. C&DM 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.

6.5.29 C&DM can be minimised with careful planning during the detail design stage as well as during construction. The contractor should use reusable non-timber formwork and temporary works. Moreover, the contractor should be required to carry out sorting of the C&DM into various categories and re-use/recycle the C&DM on site or other construction sites.

6.5.30 *Theme Park and Associated Developments:* The majority of the C&DM will be generated from the construction of the Theme Park and associated developments. The buildings of the Theme Park will be constructed using concrete, steel or other appropriate materials. The total quantities of C&DM arising from the construction process will depend on the exact types of the buildings and the construction methods adopted. Information relating to this is not available at this stage. This EIA therefore assumes that the maximum buildable area as regulated by the North East Lantau OZP would be constructed within the Theme Park development area. The OZP limits the floor coverage in the hotel area to 1.5 and 1.0 in the Theme Park and the RD&E area. This will lead to a conservative assessment, as likely development may be below those maximum levels set in the OZP. The buildable gross floor areas (GFA) for the Theme Park and RD&E area are given in *Table 6.5d*.

(4) Construction and Demolition material (C&D material) contains a mixture of inter and non-inert material. The inert portion is the "public fill". The non-inert portion is the "C&D waste".

Table 6.5d Buildable GFA for the Theme Park/RD&E Area and Hotel

Development	Estimate Construction Period	Theme Park & RD&E (m^2)	Hotel (m^2)	Total GFA (m^2)	Potential Arisings of C&DM (m^3)	Potential Arisings (m3) of		Estimated Generation Rate of C&D Waste (m^3 d^{-1})		Estimated Generation Rate of Public Fill (m^3 d^{-1})	
						C&D Waste	Public Fill	Average	Peak	Average	Peak
Phase I - Opening Day	April 2002 to April 2005	300,000	220,600	520,600	52,060	10,412	41,648	14	22	59	88
Phase I - Buildout	Q3 2008 to Q3 2011	100,000	105,100	205,100	20,510	4,102	16,408	2	3	8	11
Phase II - Buildout	Q4 2003 to Q2 2005, Q2 2007 to Q1 2009 and Q1 2014 to Q3 2015	400,000	409,800	809,800	80,980	16,196	64,784	12	19	49	74
Total		***800,000***	***735,500***	***1,535,500***	***153,550***	***30,710***	***122,840***				

Note:

(a) Based on a C&DM arisings rate of 0.1 m^3 per 1 m^2 of GFA constructed.

(b) Forecast ratio for C&D waste : public fill is 2 : 8 (Source Monitoring of Solid Waste in Hong Kong 1997)

(c) Peak factor of 1.5 is assumed

6.5.31 The Penny's Bay Reclamation Stage II site will be handed over to HKITP after March 2002. The construction of the Phase I Theme Park infrastructure is scheduled to be completed by April 2005. The average and maximum (assuming a peak factor of 1.5) daily arisings of C&D waste will be approximately 14 m^3 d^{-1} and 22 m^3 d^{-1}, respectively.

6.5.32 The average and peak arisings of C&D waste for the construction of the remaining infrastructures of the Phase I Theme Park to Phase I - Build Out between 2008 and 2011 will be about 2 m^3 d^{-1} and 3 m^3 d^{-1}, respectively**.**

6.5.33 The average and peak arisings of C&D waste for the construction of the Phase II Theme Park infrastructures between 2003 and 2015 will be about 12 m^3 d^{-1} and 19 m^3 d^{-1}, respectively or at nearby public filling areas.

6.5.34 For the public fill generated from the construction of the Theme Park and associated developments, since the daily operation rate is low, all the public fill is likely to be re-used on site.

6.5.35 *Penny's Bay Rail Link:* The quantity of C&DM generated from the construction of cut and cover tunnel will be minimal (in the order of 350 m^3). The amount of concrete which may be wasted from the shotcreting of the tunnel wall and construction of the tunnel lining will be negligible (in the order of 80 m^3) and will not be a concern. The Yam O Station will consist of two separate platforms which will be constructed along the existing track at Yam O. Concourses will be constructed above each of the platforms and be connected by link bridges. The Penny's Bay Rail Station will consist of two levels, the concourse and the platform levels. Both stations will be constructed using by *in situ* concrete. The side walls and roofs of the stations will largely be structural steel with cladding. The GFA for the Yam O and Penny's Bay Rail Stations are about 16,000 m^2 and 30,000 m^2, respectively. Based on a generation rate of 0.1 m^3 per 1 m^2 of GFA constructed(5), the quantity of C&DM to be produced from the construction of Yam O and Penny's Bay Rail stations will be approximately 4,600 m^3. Based on the construction timing (Q4 2002 to Q2 2004), the average and peak generation rate of C&D waste is 3 m^3 d^{-1} and 4 m^3 d^{-1}, respectively, whereas for public fill is 10 m^3 d^{-1} and 16 m^3 d^{-1}, respectively.

6.5.36 *Water Recreation Centre:* According to the development schedule of the Northshore Lantau, GFA of the Water Recreation Centre is about 2,000 m^2. Using the C&DM generation rate of 0.1 m^3 per m^2 of GFA constructed, the C&DM to be generated will be approximately 200 m^3. Based on the construction schedule(6), the average daily C&DM arisings is about 1.2 m^3 d^{-1}. Therefore the generation rate for C&D waste and public fill will be minimal.

6.5.37 *CKWLR section*: Based on the current information (7), demolition is required at Ngong Shuen Au, Wan Tuk Village and Cheoy Lee shipyard. These included an abandoned single storey concrete village school, one telephone exchange and one air quality monitoring station at Ngong Shuen Au as well as one concrete latrine, one refuse collection point, four partial concrete/wooden structures and six wooden structures at Wan Tuk Village. Although no details on the GFA is available, these structures are likely to be small

(5) Reduction of Construction Waste Final Report (March 1993). Hong Kong Polytechnics.
(6) From April 2004 to December 2004.
(7) Scott Wilson Communication 97240/2/20/52361 dated 25 November 1999.

and simple and the volume of demolition material to be generated is likely to be small. At the Cheoy Lee Shipyard, it is estimated that three stone built workshops of about 5-10 m in height, ten iron sheet built workshops about 5-10 m high, two iron sheet built workshop of about 2 m high, some wooden structures and damaged structures (composition unknown) will be demolished. The potential environmental impacts associated with the decommissioning and demolition of the shipyard will be evaluated under a separate EIA to be commissioned by the CED.

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

Chemical Waste

6.5.39 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 Penny's Bay reclamation and construction of the Theme Park and the associated infrastructure 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 paint, engine oils, hydraulic fluids and waste fuel;
- spent mineral oils/cleaning fluids from mechanical machinery; and
- spend solvents/solutions, some of which may be halogenated, from equipment cleaning activities.

6.5.40 Chemical wastes may pose serious environmental, 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 allow to enter the sewage system.

6.5.41 It is difficult to quantify the amount of chemical waste which will arise from the Theme Park and associated developments construction activities as it will be highly dependent on the Contractor's on-site maintenance intention and the quantities 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 to a few cubic metres per month.

General Refuse

6.5.42 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, aluminium cans and waste paper.

6.5.43 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 (for example, 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.

6.5.44 The peak construction period (around 2004) will occur during the construction of the Theme Park and the associated developments. It is anticipated that there will be about 4,300 workers to be employed on-site during this period. Based on a generation rate of 0.65kg per worker per day, the maximum daily arisings of general refuse during the construction period will be approximately 2.8 tonnes.

OPERATION WASTE IMPACTS

Municipal Solid Waste

6.5.45 The operation of the PBRL and road links to the Theme Park (including the CKWLR section, Road P2, Resort Road) will generate a negligible amount of waste which, consisting mainly of litter, trimmed vegetation and road maintenance waste. It has been estimated from experience that each of the PBRL stations may generate up to 5 m^3 d^{-1} of such waste although it is difficult to estimate at this stage the precise contribution from the commercial element all the stations until more details of their operations can be confirmed. The exact quantity of waste to be generated from the operation of the road links cannot be accurately estimated as it depends very much on the design and maintenance schedule of these roads. However, it is anticipated that it will be in the order of a few cubic metres per month.

6.5.46 The operation of the Eastern Stormwater Drainage Channel will generate sand and gravel from de-silting operations. The amount of sand and gravel collected will vary between dry and wet seasons.

6.5.47 The operation of the Theme Park, RD&E and hotels will generate a significant amount of MSW. The quantity of MSW to be generated from the Theme Park and associated facilities is estimated based on the experience of other world class international theme parks and resorts and is presented in *Table 6.5e*.

Table 6.5e - Predicted Waste Arisings from the Theme Park and Associated Facilities

Phase Development	Year	Annual Attendance/ Room	Rate of Arisings (kg/guest/yr)	Waste Arisings (tpd)
Phase I - Opening Day	2005			
Theme Park		7,500,000	0.39	8.0
RD&E		6,600,000	1.062	19.2
Hotel		1,400 rooms	2823.53/room/yr	10.8
Total				***38***
Phase I - Build Out	2014			
Theme Park		10,000,000	0.59	16.2
RD&E		10,100,000	1.1264	31.2
Hotel		3,100 rooms	3076.92/room/yr	26.1
Total				***73.5***
Phase II - Build Out	2024			
Theme Park		20,000,000	0.83	45.5
RD&E		17,100,000	1.4455	67.7
Hotel		7,000 rooms	3,214.29/room/yr	61.6
Total				***175***

Note:
(a) Waste generation rate of Theme Park, RD&E and Hotel has been obtained from HKITP.

6.5.48 The storage and handling of MSW has the potential to cause adverse environmental impacts. These include odour if the waste is not collected frequently (for example, daily), noise impact from collection and storage of waste, windblown litter, water quality impacts if waste enters water bodies, and visual impact. The waste storage areas may also attract pests, vermin, and other disease vectors if they are not well maintained and cleaned regularly. In addition, disposal of wastes at sites other than approved transfer stations or landfills, can also lead to similar adverse impacts at those sites.

6.5.49 During operation of the Theme Park and associated developments, refuse collection bins will be installed both indoors and outdoors. If not collected properly, windblown debris and litter in the open area may enter into the artificial lake of the Water Recreation Centre or the shore area of the reclamation. This may include litter, paper, package material, plastic bags, plastic bottles or food stuffs and give rise to floating refuse.

Chemical Waste

6.5.50 The operation of the Theme Park at Penny's Bay will use a variety of chemicals. Some of the used chemicals have to be disposed of. The operation of the Theme Park at Penny's Bay will be very similar to that of Disneyland. Based on the experience of Disneyland, the following chemicals may also be used in the Theme Park at Penny's Bay, as shown in *Table 6.5f*.

6.5.51 The remains of fireworks from the fireworks shows in the Theme Park may contain heavy metals in low concentrations (in a scale of ng kg^{-1}).

6.5.52 According to the literature search, the fireworks remains from the mid-level fireworks shows may contains dioxins furans (see *Section 3*). The fireworks shells will be dropped within the safety zone at the back of house and immediately collected for proper disposal. The fireworks remains will be treated as chemical waste and stabilised, if necessary, with cement to avoid the hazards and potential environmental impacts associated with the disposal of the waste. The stabilised fireworks remains should be safety for disposal at landfills.

6.5.53 As discussed in *Section 6.5.1*, if not properly managed the storage, handling, collection, transportation and disposal of chemical waste have the potential to cause significant adverse environmental impacts.

Sewage Sludge

6.5.54 According to the *Sludge Treatment and Disposal Strategy Study* (STDS) [(8)], Siu Ho Wan Sewage Treatment Works will employ a chemical treatment plus disinfection process. It is expected that the International Theme Park and associated developments will be a major source of sewage in the North Lantau area. The current projection indicates that in year 2011 the baseline flow plus the flow generated from the Theme Park and associated developments (12,140 m^3 d^{-1}) will be about 168,846 m^3 d^{-1}. The suspended solids (SS) and Biochemical Oxygen Demand (BOD) loading will be about 34,891 kg d^{-1} and 43,369 kg d^{-1}, respectively. Using the removal efficiency of 70% and 55%, for SS and BOD, respectively, the amount of sludge to be generated in 2011 will be approximately 14,356

(8) Environmental Resources Management (1999). Sludge Treatment and Disposal Strategy Study Final Report, 9 July 1999.

tonnes dry solids per annum (tds a^{-1}) or about 40 tds d^{-1}. The amount of sludge contributed from the Theme Park and the associated developments will be 2,489 tds a^{-1} or about 7 tds d^{-1} (about 17.5% of the total sludge generated). The *STDS* recommends that sludge generated at Siu Ho Wan STW be treated at a dedicated Centralised Sludge and Difficult Waste Incineration Facility (SDIF), which is planned to be in operation in 2007. Prior to the operation of the SDIF, the sludge will be delivered to landfill for disposal.

Table 6.5f - Chemicals Which May be Used at the Theme Park at Penny's Bay

Chemical Name	Common Name	Unit	Maximum Daily Amount	Average Daily Amount
1-Bromo-3-Chloro-5, 5-Dimethylhydantoin	Bromine Tablets	kg	23	11
Acetylene		m^3	255	255
Acrylic Paint		m^3	3	2
Aliphatic Polymeric Isocyanate	Polyurethane Paint	m^3	2	2
Argon		m^3	198	
Argon		m^3	10	10
Barquat OJ-50		m^3	0	0
BP-300 Insecticide		kg	102	102
Carbon Dioxide CO_2	Refrigerated Liquid	kg	12,387	12,387
Dichloroisocyanuric Acid - dry	Sodium Diclor - ChlorBrite	kg	23	23
Dichloroisocyanuric Acid - dry	Sodium Dichlorgranules	kg	23	23
Grease		m^3	1	1
Helium		m^3	680	680
Hydrochloric Acid HC1	Muriatic Acid	m^3	24	17
Hydrochloric Acid HC2	Muriatic Acid - 31%	m^3	6	6
Mathane	Compressed Natural Gas (CNG)	m^3	38	19
Mathane	Compressed Natural Gas (CNG)	kg	6,328	4,672
Motor Oil		m^3	7	7
Nitrogen		kg	3,479	3,452
Nitrogen - liquid	Rerrigerated Liquid Nitrogen	m^3	28	28
Oxygen		m^3	234	234
Petroleum Distillate	Diesel Fuel	m^3	0	0
Petroleum Distillate	Diesel Fuel #2	m^3	76	76
Petroleum Distillate	Hydraulic Oil	m^3	15	9
Petroleum Distillate	Kerosene	m^3	1	0
Petroleum Hydrocarbons	Unleaded Gas	m^3	76	76
Potassium Permanaganate		kg	91	91
Propane - Dimethyl Methane	Propane	m^3	53	26
Sodium Hypochlorite	Bleach, Pool Chlorine	m^3	7	7
Styrene	Unsaturated Polyester Resin	m^3	1	1
Waste Aerosol Cans	Aerosol Cans (used)	kg	91	23
Waste Flammable Liquid NOS	Waste Mixed Solvents	m^3	2	1
Waste Flammable Liquid NOS	Waste Solvent Contaminated Rags	kg	726	408
Waste Lithium Batteries	Lithium Batteries (used)	kg	363	91
Waste Nickel Cadmium Batteries	Ni-Cad Batteries (used)	kg	363	91
Waste Oil		m^3	4	1
Waste Oil and Water		m^3	2	1
Waste Oily Rags and Absorbent		kg	454	227
Waste Paint Related Material	Waste Paint	m^3	2	1

Note:
(a) The nature of chemicals used and volumes are provided for EIA reference and may change, subsequently.

6.6 PREDICTION AND EVALUATION OF ENVIRONMENTAL IMPACTS

CONSTRUCTION WASTE IMPACTS

Dredged Material

6.6.1 Although over 95% of the marine sediments to be dredged are either Class A or Class B, dredging of a large quantity of sediment within a short period of time will have the potential to cause adverse water quality impacts if not properly managed. *Section 5* has discussed the mitigation measures necessary to avoid adverse water quality impacts during the dredging works. As FMC has already allocated sufficient capacity at the gazetted marine dumping grounds for the disposal of the Class A and Class B sediments arising from the Penny's Bay Reclamation and Yam O Reclamation (East Nine Pin, East Tung Lung and north of Lantau), the disposal of these sediment is secured.

6.6.2 Seriously contaminated sediment (Class C) must be dredged with great care in order to avoid adverse water quality impacts. The amount of Class C sediment to be dredged is small and contamination is limited to a few locations. Provided the mitigation measures recommended in *Section 6.7* are properly implemented and the contractor follows the procedures stated under *WBTC 22/99* and applies for a dumping licence, no adverse environmental impact is envisaged. The Class C sediment should be disposed of at the East Sha Chau Contaminated Mud Pits. With respect to the relatively small quantity (a total of 0.11 M m^3) potentially seriously contaminated (Class C) sediment to be disposed of at East Sha Chau Contaminated Mud Pits, it is not anticipated to have significant impact on the operation of the mud pits. No adverse environmental impact is anticipated if the Class C sediment is properly transported to and disposed at the East Sha Chau Contaminated Mud Pits. A SQR should be prepared to obtain dumping permit close to construction date as possible, preferably at the detailed design stage.

Use of Public Fill for the Reclamation

6.6.3 The public fill, while relatively chemically inert, may contain a small amount of floating debris. If not properly managed, the floating debris may result in impacts and, if allowed to float into the marine channel, may cause damage to marine craft. Provided that mitigation measures such as the use of surface booms to contain the floating debris, are properly implemented, no insurmountable environmental impacts with regards to floating debris will be anticipated.

Construction and Demolition Materials

6.6.4 With respect to the nature of the construction activities, the C&D waste will consist of a mixture of inert (ie concrete, tiles, bricks, etc. which are classified as public fill) and non-inert (paper, plastic, wood, etc. which are classified as C&D waste) material. The public fill should be re-used on site, as far as practicable. If on-site use is not practicable, the public fill should be delivered to other reclamation sites or to public filling areas available at that time. The disposal of public fill at public filling areas or other reclamation sites is unlikely to raise any long term concerns because of its inert nature.

6.6.5 Disposal of C&D waste to strategic landfills will not cause unacceptable environmental impacts. However, given the very limited landfill space which is available, it is important

to minimise, wherever possible, the wastes being delivered to landfill. Government policy is not to accept C&D waste with more than 20% (by weight) inert material at landfill sites. Wherever, practical, the production of C&D waste should be minimised.

6.6.6 It is estimated that a peak rate of about 22 m^3 d^{-1} of C&D waste will be generated during the construction of the Phase I of the Theme Park. To minimise the amount of C&D waste to be disposed of at strategic landfills and to maximise the recovery of inert material for subsequent reclamation, it is recommended that segregation of inert and non-inert C&DM should be carried out on-site. Taking account of the composition of the C&DM, it is possible to divert 20% of the C&DM for landfill disposal. The segregated public fill can be reused as fill for the Penny's Bay Reclamation Stage I. The number of truck trips for delivery of C&D waste to landfill will be about 3 trips per day (9) and it is not anticipated that this will cause any adverse traffic impacts.

6.6.7 Phase II of the Theme Park will be constructed over a much longer period (about 10 years instead of three years), and the anticipated arisings of C&D waste is about 19 m^3 d^{-1}. The daily traffic generated due to disposal of public fill and C&D waste will only be about 3 trips per day and it is not anticipated as causing any adverse traffic impacts.

6.6.8 On site sorting is recommended to separate C&DM into C&D waste and public fill to minimise the volume of waste to be disposal of at landfill. The highest daily cumulative C&D waste and public fill generation will be from the period of Q4 2003 to Q2 2004, during the construction of Theme Park Phase I - Opening Day, Theme Park Phase II - Buildout and PBRL, where the average and peak generation rates for C&D waste are 29 m^3 d^{-1} and 45 m^3 d^{-1} respectively, whereas for public fills materials, generation is anticipated as 118 m^3 d^{-1} and 178 m^3 d^{-1}, respectively. With respect to the relatively small volume of C&D waste generation, no adverse environmental impact associated with the handling and disposal of C&D waste are anticipated. In addition, due to the large fill requirement of Penny's Bay Reclamation the public fill is expected to be re-used on site.

6.6.9 With the implementation of good construction site practices such as those stated in *the Air Pollution Control (Construction Dust) Regulation*, the handling and disposal of C&DM will not cause adverse dust impacts.

6.6.10 It is not anticipated that there will be any potential hazard associated with the handling and disposal of C&D waste if general construction safety procedures are properly implemented.

Chemical Waste

6.6.11 It has been estimated that a few cubic metres of lubrication oil and solvent will be generated per month from the maintenance of construction plant. The chemical waste to be generated from the construction activities will be readily accepted at the Chemical Waste Treatment Centre (CWTC) at Tsing Yi.

6.6.12 Storage, handling, transport and disposal of chemical waste should be arranged in accordance with the *Code of Practice on the Packaging, Labelling and Storage of Chemical Waste* published by the EPD. Provided that this occurs, the potential

(9) Assuming the payload of each truck is about 6.7m3

environmental impacts arising from the handling, storage and disposal of a small amount of chemical waste generated from the construction activities will be negligible.

General Refuse

6.6.13 It is expected that a maximum number of 4,300 workers will be employed on-site at any one time. Based on the waste generation rate of about 0.65 kg per worker per day, it is estimated that the amount of general refuse to be generated will be in the order of 2.8 tpd. Waste recycling facilities such as separate facilities for paper, aluminium cans, plastic bottles, etc., should be made available during the construction period. Provided that the mitigation measures recommended in *Section 6.7* are adopted, the environmental impacts caused by the storage, handling, transport and disposal of general refuse are expected to be minimal. It is recommended that the general refuse should be collected on a daily basis and be delivered to the North Lantau Transfer Station for bulk transfer to landfill for final disposal. With respect to the small quantity of general refuse to be disposed of, this is not anticipated that it will cause any adverse impact to the operation of the North Lantau Transfer Station.

OPERATION WASTE IMPACTS

Municipal Solid Waste

6.6.14 As discussed in *Section 6.5.2*, the amount of MSW to be generated from the operation of the Theme Park will increase from about 38 tpd in 2005 to 75 tpd in 2014, then to 175 tpd in 2024 without any waste recycling/reduction. Although the majority (around 70%) of the MSW will be generated from the RD&E and hotels, a significant amount of waste will be generated from the Theme Park. An efficient and effective waste collection system is essential in order to avoid any nuisance to visitors due to waste storage, collection and transport within the site. The waste handling and collection system should also facilitate materials recovery and recycling.

6.6.15 Floating refuse from windblown refuse and litter may vary from small debris to large floating objects such as plastic bags. The floating refuse is likely to be chemically inert, however, if not collected properly, this floating refuse may drift along the coastal area of the Theme Park and associated developments and the artificial lake of the Water Recreation Centre, which may create aesthetic or odour impact, or cause damage to marine craft. Provided that mitigation measures such as the use of a surface boom to contain the floating refuse, are properly implemented, no insurmountable environmental impacts with regards to floating debris will be anticipated.

6.6.16 The feasibility of waste collection using an automatic refuse collection system (ARCS) at the Theme Park has been considered by the HKITP. The ARCS, which is a vacuum-driven system for refuse collection, was installed at the Magic Kingdom Park in Orlando, Florida when that park was built in the early 1970s. The ARCS is still used at the Magic Kingdom for managing some of their solid waste, but not all. The ARCS system has not been installed at any other Disney theme park built since the Magic Kingdom in Orlando, Florida (ie Epcot Center, MGM Studios, Animal Kingdom, Disney's California Adventure, Disneyland Paris, Tokyo Disneyland or Tokyo Disney Seas).

6.6.17 The reasons for not using the ARCS at other Disney theme park are:

- The Magic Kingdom was constructed with a series of subterranean tunnels built beneath the park. These tunnels enabled the installation of the ARCS, whose vacuum piping runs through the tunnels. The ARCS cannot be built without building a system of subterranean tunnels, since it would be extremely difficult to perform maintenance or otherwise service the ARCS system if the vacuum pipes were buried underground. Due to the potential settlement of the newly formed Penny's Bay reclamation, the construction of the subterranean tunnel will be expensive and the long term maintenance of the tunnels could be high. It is therefore considered that ARCS will not be suitable for the International Theme Park at Penny's Bay.

- Operational staff at the Magic Kingdom, Orlando, Florida notes that the ARCS system requires a significant amount of maintenance. The vacuum piping frequently gets clogged with refuse, which requires staff to locate the obstruction, and requires frequent maintenance to ensure sufficient vacuum is being pulled to facilitate the collection of refuse. Three parks have been built in Florida after the Magic Kingdom, and in each case park designers elected not to install the ARCS system, in part because of the operating experience with the ARCS system at the Magic Kingdom and also because Disney has not built a park with a system of subterranean tunnels since the Magic Kingdom, Orlando, Florida.

6.6.18 The HKITP proposes to collect refuse from the litter bins manually and immediately transport the waste to the Refuse Collection Points (RCPs) at the back of house (described *in Section 2.7.5*) using electrical karts. To avoid any potential odour nuisance to the guests due to transportation of waste within the Theme Park, the waste collection vehicles will travel along the roads at the back of house. At the RCPs the waste will either be sorted to recovery recyclables (such as paper and cardboard, plastics, glass, wood, ferrous & non-ferrous metals, etc.) or compacted into containers for off-site disposal. Provided that all the refuse bags are properly closed during transportation to prevent littering and leakage of leachate, and collection routes are properly planned to avoid conflict with the pedestrians, it is not anticipated that the proposed waste collection arrangements within the Theme Park will cause any nuisance to guests.

6.6.19 RCPs will be located at strategic locations within the Theme Park and away from public areas in back of house facilities. Therefore odour and noise impact to visitor or hotel residents will be minimal. Although specific locations will be determined during the design stage, it is anticipated that one will be provided for each major waste generator. Therefore, each hotel will have a refuse collection point as will each theme park (ie Phase I and Phase II Theme Park) and the RD&E. The RCPs will contain compactors, dumpsters, and related equipment to provide an adequate waste hauling service for the resort. For the purpose of the EIA, it is assumed that there will be five hotel RCPs (one for each hotel), two RCPs for each theme park (four total) and two for the RD&E area. There will be a total of approximately 11 RCPs in the entire theme park resort area. A solid waste storage and recycling area of about 0.3 ha will be allocated within each back of house in order to provide sufficient space for undertaking materials recovery and recycling.

6.6.20 To facilitate recycling, waste recycling bins for paper, aluminium cans and plastic bottles etc. will be located throughout the Theme Park to promote waste separation at source. Collection of recyclables from the waste recycling bins will also be arranged properly to minimise the nuisance caused to the visitors.

6.6.21 To avoid double handling of the waste at the transfer station, it is recommended that the waste containers used at the Theme Park should be compatible with those used at the NLTS (standard 20 ft ISO container). This will enable direct transfer of the Theme Park containers to NLTS by trucks and then to strategic landfill via marine vessels.

Recycling

6.6.22 This section estimates the quantity of wastes which are potentially recyclable and the market for these materials during the operational phase of Theme Park and associated developments. Based on these assessments, the target for recycling of the solid waste arisings at the Theme Park is estimated. The waste arisings and amount of recovered materials will be monitored closely after the commissioning of the Theme Park to more accurately estimate the target waste recovery rate. Key issues are identified when source separation programmes are planned and implemented.

6.6.23 The *Waste Reduction Framework Plan* (WRFP) set a target to reduce 58% of the total wastes generated in 2007. While the reduction target in the *WRFP* is not mandatory, it is still a useful reference. It should be noted that the target comprises three components: the existing recycling rate under a predominantly market driven system, the reduction by waste bulk reduction facilities (mainly through waste-to-energy incineration) and the reduction by waste prevention programmes to be initiated under the Plan. The targets for each of these three components are 30%, 14% and 14%, respectively in 2007. If it is assumed that every sector in society contributes the same target, the target is therefore to reduce 44% of total waste generated by recycling and avoidance, and to incinerate 14% of the wastes, with the remaining wastes sent to landfills for disposal in 2007.

6.6.24 ***Estimation of the Quantity of Potentially Recyclable Materials:*** Due to the unavailability of information on waste generation and disposal and waste composition from similar world-class theme parks, the quantity of potentially recyclable materials has been estimated in three indirect ways, each with some limitations. The first method is based on the experience of Disneyland in California, USA. The second approach is based on the commercial and industrial waste surveys carried out under the *Waste Reduction Study*(10) (WRS) in 1994. The third approach is based on the MSW monitoring results by the EPD in 1998. These methods and their limitations are discussed below.

6.6.25 The first method is based on results of recycling in Disneyland, California. The following assumptions are implicit in this method:

- the quantities of recyclable materials in the waste stream generated from the Theme Park at Penny's Bay is assumed to be similar to those in Disneyland. It is noted that for example, fewer aluminium cans are used in Disneyland, with preference given to the use of purpose made plastic and paper containers. This could be different from the Theme Park at Penny's Bay where more aluminium cans may be found in the waste stream given the availability of cheaper beverage in aluminium cans in line with similar theme parks in Hong Kong.

- the markets for various recyclable materials in Hong Kong are similar to those in the Disneyland. A number of issues should be noted for Hong Kong, including the small and virtually absence of market for food wastes and the potentially higher acceptable level of contamination of the recyclables.

6.6.26 *Table 6.6a* shows the estimated quantity of potentially recyclable material from the Theme Park at Penny's Bay using this method in 2005, 2014 and 2024.

(10) Waste Reduction Study, Environmental Resources Management on behalf of the Environmental Protection Department, 1994.

Table 6.6a - Predicted Quantity of Recyclable Materials in the Theme Park at Penny's Bay Based on US Experience

Disneyland		**Theme Park at Penny's Bay (tpa)**		
		2005	**2014**	**2024**
Total waste	*18,030*	*13,870*	*26,828*	*63,785*
Potentially Recyclable Material				
Food waste	12.48%	1,731	3,348	7,972
Cardboard	8.48%	1,176	2,275	5,417
Aluminum	0.03%	4	8	19
Paper	1.37%	190	368	875
Green waste	1.00%	139	268	639
Glass	0.54%	75	145	345
Lumber	0.73%	101	196	466
Metal	0.98%	136	263	626
Plastics	0.04%	6	11	26
Recycling	***25.65%***	***3,558***	***6,881***	***16384***
Landfilled	***74.35%***	***10,312***	***19,946***	***47491***

6.6.27 Using this method, the quantity of potentially recyclable materials is 26% of the total waste generated. It is noted that the 26% recycling rate is achieved through the composting of food wastes (12%) and the recycling of cardboard (8%).

6.6.28 A major limitation of this method is that, without an estimate of waste arising composition, it is not possible to assess whether the proportion of potentially recyclable materials estimated is reasonable in the context of local recyclable market. It is also noted that this approach assumes that there will be composting facilities for food wastes. This will be further discussed in the following section on the market for compostable and recyclable materials.

6.6.29 The second method to estimate the quantity of potentially recyclable materials is based on the survey of the commercial (distribution) waste generators carried out under the WRS in 1994. The survey covers a total of 24 establishments, including wholesalers, retailers, restaurants, hotels and boarding houses. *Table 6.6b* shows the waste composition estimation of the Theme Park at Penny's Bay based on the survey results. This method assumes that the waste composition reflects the practice in Hong Kong, eg the preparation of meals and the use of particular throwaway items in Hong Kong in 1994. The quantity of recyclable materials to be recovered by the recycling industry under a market driven condition is calculated using the existing recycling rate which is reported in the *Waste Reduction Framework Plan* (11) published by the HK SAR Government in 1998. The estimated quantity of wastes recovered and recycled by the informal sector reflects the market for recyclables from commercial and industrial sources in Hong Kong at that time.

(11) Waste Reduction Framework Plan, Planning, Environment and Land Bureau, Hong Kong SAR Government, 1998.

Table 6.6b - Estimate of Waste Composition and Quantity of Recyclable Materials at the Theme Park at Penny's Bay based on Waste Reduction Study Survey on Commercial (Distribution) Waste Generators in 1994

	WRS			Theme Park at Penny's Bay (tpa)								
	1994			2005			2014			2024		
	Waste arising	Market driven recycling rate	Potential for further recovery	Waste arising	Estimated quantity of recyclable recovered by informal sector	Further recovery by Disney	Waste arising	Estimated quantity of recyclable recovered by informal sector	Further recovery by Disney	Waste arising	Estimated quantity of recyclable recovered by informal sector	Further recovery by Disney
Food	39.17%	0%	30%	5,433	-	1,630	10,509	-	3,153	25,020	-	7,506
Plastic bags	1.56%	}	)	216	58	45	419	113	88	996	269	209
Plastic Bottles	0.20%	}	}	28	7	6	54	14	11	128	34	27
Plastic Packaging	4.92%	)27%	}21%	682	184	143	1,320	356	277	3,143	849	660
Other Plastic	1.48%	}	}	205	55	43	397	107	83	945	255	199
Rubber	1.53%	}	}	212	57	45	410	111	86	977	264	205
Paper	15.03%	14%	23%	2,085	354	479	4,032	685	927	9,600	1.632	2,208
Cardboard	24.32%	79%	4%	3,373	2,665	135	6,525	5,154	261	15,534	12,272	621
Textiles	0.22%	7%	21%	31	2	6	59	4	12	141	10	30
Wood/pallet	0.11%	33%	9%	15	5	1	30	10	3	70	23	6
Glass	0.14%	40%	15%	19	8	3	38	15	6	89	36	13
Tin can	1.76%	98%	neg.	244	239	neg.	472	463	neg.	1,124	1,102	neg.
Ferrous metal	0.01%	97%	neg.	1	1	neg.	3	3	neg.	6	6	neg.
Non-ferrous metal	0.00%	98%	neg.	-	-	neg.	-	-	neg.	-	-	neg.
Misc.	9.55%	0%	0%	1,325	-	0	2,562	-	0	6,100	-	0
Total	***100%***			***13,870***	***3,638***	***2,537***	***26,828***	***7,036***	***4,908***	***63,875***	***16,752***	***11,684***

6.6.30 The quantity of potentially recyclable materials that may be further recovered by proactive source separation programmes is based on the potential for further recycling published in the *Waste Reduction Framework Plan* . The recycling rate for further recovery is adjusted downward to reflect the waste reduction target set in the WRFP. It should be noted that the recovery and recycling by Disney is assumed to be not in competition with the informal recovery sector which operates under market conditions in Hong Kong. It is also assumed that composting facilities for the source separated food wastes.

6.6.31 According to the commercial (distribution) waste generation survey carried out under the WRS, the proportion of food wastes is high, amounting to close to 40%, followed by cardboard (24%) and paper (15%). The quantity of recyclable materials recovered by the market driven recycling industry in the Theme Park at Penny's Bay is estimated to be about 26% of the total wastes generated.

6.6.32 Further recovery of the remaining materials through proactive source separation at Disneyland is estimated to be 18% of the total wastes generated, around 60% of which is to be achieved by the composting of food wastes, assuming that a composting facility will become available in Hong Kong.

6.6.33 The third method is based on the annual monitoring results of MSW by the EPD in 1998. This reflects the market for recyclable materials from MSW in Hong Kong in 1998. It should be noted that the waste composition from commercial and industrial sources may be different from those generated at the Theme Park at Penny's Bay. Adjustment has been made to reflect the possibly small quantity of metals in the waste stream in the Theme Park at Penny's Bay. *Table 6.6c* shows the estimated composition of wastes and estimated quantity of potentially recyclable materials to be recovered by the recycling industry under a market driven condition. Potential for further recovery by Disney is also estimated, based on the potential for further recovery as indicated in the *Waste Reduction Framework Plan* and adjusted to reflect the waste reduction target.

6.6.34 Based on the MSW composition in 1998, the main component of wastes is paper (including cardboard), followed by food waste and plastics. These three materials account for over 83% of the total waste arisings. The quantity of potentially recyclable materials to be recovered by the recycling industry under a market driven condition is estimated to be about 23% of the total waste generated. Paper contributes to 73% of the total quantity recycled, followed by plastics (23%). This method assumes that the Theme Park at Penny's Bay generates waste with similar composition to the MSW from the domestic, commercial and, to a certain extent, the industrial sectors.

Table 6.6c - Estimate of Waste Composition and Quantity of Recyclable Materials in the Theme Park at Penny's Bay based on MSW Composition and Recycling in 1998

	MSW in HK			Theme Park at Penny's Bay (tpa)								
	1998			2005			2014			2024		
	Adjusted arising[(a)]	Market driven recycling rate	Potential for further recovery by Disney	Waste arising	Estimated quantity of recyclable recovered by informal sector	Potential for further recovery by Disney	Waste arising	Estimated quantity of recyclable recovered by informal sector	Potential for further recovery by Disney	Waste arising	Estimated quantity of recyclable recovered by informal sector	Potential for further recovery by Disney
Food waste	25%	0%	35%	3,542	-	1,240	6,852	-	2,398	16,314	-	5,710
Paper	39%	44%	15%	5,350	2,354	802	10,348	4,553	1,552	24,637	10,840	3,695
Glass	3%	4%	18%	366	15	66	708	28	127	1,686	67	304
Wood	3%	15%	11%	476	71	52	920	138	101	2,191	329	241
Bulky waste	2%	0%	0%	329	-	-	636	-	-	1,514	-	-
Plastics	19%	28%	25%	2,667	747	667	5,159	1,445	1,290	12,283	3,439	3,071
Textile	3%	12%	25%	386	46	96	746	89	186	1,776	213	444
Others	6%	0%	0%	896	-	-	1,733	-	-	4,126	-	-
Total	***100%***			***13,870***	***3,233***	***2,924***	***26,828***	***6,253***	***5,655***	***63,875***	***14,889***	***13,465***

Note*:*
(a) The adjusted waste composition is derived by removing metal arising in the waste stream.

6.6.35 The quantity of potentially recyclable materials that may be further recovered by proactive source separation programmes is based on the potential for further recycling published in the *Waste Reduction Framework Plan* . The recycling rate for further recovery is adjusted to reflect the waste reduction target set in the WRFP. It should be noted that the recovery and recycling by Disney is assumed to be not in competition with the informal recovery sector which operates under market conditions in Hong Kong. It is also assumed that composting facilities will become available for the recovery of source separated food wastes.

6.6.36 Further recovery of the remaining wastes through proactive source separation programmes at Disneyland is estimated to be 21%, around 40% of which is to be achieved by the composting of food wastes, assuming that a composting facility will become available in Hong Kong.

6.6.37 *Table 6.6d* summarises the quantity of potentially recyclable materials using the indirect methods. The first method shows that 26% of the wastes in the Theme Park are potentially recyclable. The other two methods to estimate that the recycling industry will recover 23% to 26% of the waste generated under normal market driven conditions. Another 18% to 21% of the recyclable materials will need to be diverted from the wastestream if the reduction target in the *Waste Reduction Framework Plan* is to be achieved. The common recyclable materials in all of the three methods include cardboard, to some extent plastic and mixed paper. These estimates assume that composting facilities will become available to receive the food waste which amount to 40-60% of the quantity of recyclable materials to be further recovered. The following sections discuss the markets for each of these materials in Hong Kong.

Table 6.6d - Summary of Estimated Recycling Rates

	Estimates based on Disneyland in US	**Estimates based on WRS surveys in 1994**	**Estimates based on MSW in 1998**
Potentially recyclable materials recovered by recycling industry under market driven condition			
Recyclable materials	N.E.	25.8%	23.3%
Compostable materials	N.E.	0%	0%
Total	N.E.	25.8%	23.3%
Potentially recyclable materials further recovered through source separation programme by the Theme Park			
Recyclable materials	13.2%	6.6%	12.1%
Compostable materials	12.5%*	11.7%*	8.6%*
Total	25.7%*	18.3%*	20.7%*

Note:
(a) N.E. - Not Estimated
(b) * assuming a compost facility is available to handle the source separated food wastes

6.6.38 ***Market for Recyclable Materials:*** EPD estimates that 1.6 M tonnes of materials were recovered in 1998. About 24% were recycled locally and 76% were exported, mainly to Mainland China for recycling. It should be noted that the majority of these materials are recycled by an informal sector operating under market conditions with little support from Government. Government, companies and non-governmental organisations have started to launch recycling programmes in the last few years but the quantity recovered through the this formal recovery system is small. *Table 6.6e* shows the estimated recovery of major recyclable materials in 1998.

Table 6.6e - Recovery of Major Recyclable Materials in Hong Kong in 1998 (thousand tonnes)

Waste Type	Exported for Recycling	Recycled Locally	Total
Ferrous metals	505	3.8	509
Glass	< 0.1	3.9	3.9
Non-ferrous metals	88	21	109
Paper and cardboard	392	292	684
Plastics	182	32	214
Rubber tyre	0	8.7	8.7
Textiles	11	2	13
Wood	1	20	21
Total	***1,180***	***380***	***1,560***

Note:
(a) Source: Environmental Protection Department (1999) *Monitoring of Solid Waste in Hong Kong 1998*

6.6.39 ***Market for Food Wastes:*** Currently, there is no market for food wastes in Hong Kong. The public composting facility in Sha Ling currently handles livestock wastes and its design capacity is 20,000 tonnes a year. However, the *WRFP* outlines a programme to compost source separated organic materials from commercial sources (eg hotels, restaurants and food processing industry). When a new compost facility is in place, the Theme Park's source separated food waste and green waste may be transported to the facility for composting. Even using a high recovery rate (*Table 6.6a*), the quantity of source separated food wastes is only 1,731 tpa or 22 tpd in 2005 which may be fairly readily absorbed in a 20,000 tpa composting facility.

6.6.40 ***Market for Waste Cardboard:*** Waste cardboard is one of the most commonly collected waste materials in Hong Kong. In 1998, 684,000 tonnes of paper wastes in Hong Kong were recovered for recycling, most of it was cardboard. The recycling rate for these materials is fairly high (79% for commercial and industrial wastes in 1994) according to the WRS. Mainland China is the major end market for waste cardboard exported with the Philippines, Thailand and South Korea being other more minor outlets.

6.6.41 ***Market for Mixed Paper Waste:*** The market for mixed paper waste in Hong Kong is much poorer due to the high levels of contamination and low value of the mixed paper. According to the surveys carried out in the WRS, the recycling rate for mixed paper waste is only 14%. Most of the mixed paper wastes are exported to Mainland China.

6.6.42 ***Market for Waste Glass:*** Only a few companies in Hong Kong recover waste glass bottles for recycling. The glass bottles are cleaned and reused as bottles for other products. The market for waste glass bottles is mainly within Hong Kong and hence is limited as there are no major local glass bottle manufacturers.

6.6.43 ***Market for Waste Wood:*** The market for waste wood is mainly within Hong Kong. Waste wood is typically refabricated into wooden cases or containers which are made to order. The refabricated containers are used as packaging for the export of goods. The waste wood recycling industry is found to be declining in a recent survey carried out under the

Materials Recovery and Recycling Facilities (MRRF) Study [12] currently being undertaken by ERM.

6.6.44 ***Market for Scrap Metals :*** The recycling rate for commercial/industrial scrap metal is high in Hong Kong. With the recent decline of manufacturing industry, however, recycling companies collecting commercial/industrial scrap metal have difficulty in securing good quality materials. Most of the scrap metal collected in Hong Kong is exported to Mainland China.

6.6.45 ***Market for Scrap Plastics:*** Most of the plastic scrap collected and recycled in Hong Kong is from industrial source. A limited quantity of plastic scrap from commercial sources are recycled. For plastic waste of known type, reprocessing may take place in Hong Kong where plastic wastes are typically and fed to extruders to produce plastic pellets are made as raw materials for manufacturing. Source separated plastic containers and packaging plastics of known material type are likely to have high potential for recycling. The market for plastic scrap from Hong Kong is mainly in Mainland China.

6.6.46 ***Market for Textile Waste:*** Textile recovery and recycling exists in two forms in Hong Kong. The first form which is more common, is to collect and then export the rags for re-spinning. The second form is to collect and sort the rags into different grades before selling them to local metal workshops for use in cleaning. The decline of metal industries in Hong Kong is partly responsible for the significant reduction in the recycling of textile waste locally. A limited quantity of good quality clothing are collected and sold to buyers (mainly for overseas market).

6.6.47 ***Future Markets:*** The decline of manufacturing industry in Hong Kong is the main factor which has led to the shrinking supply of industrial scrap and local markets and therefore a reduction in the quantity of materials recovered in the last few years. However, as Mainland China is the main market for many of the recyclable materials which have a high market price, the market for good source separated materials still exists and China is expected to be the main outlets for recyclables recovered in Hong Kong for the foreseeable future.

6.6.48 The *MRRFs Study* currently being undertaking by the EPD will look at the development of MRRFs in Hong Kong. These MRRFs will enhance the market value of some of the materials collected and increase the recycling of marginally recyclable materials. The study is not yet completed and the MRRFs are likely to focus on materials which are currently least recycled, for example, recyclables from domestic sources.

6.6.49 ***Possible Recycling Target for The Theme Park:*** The targets to divert 58% of the MSW generated in the *WRFP* prepared by the HK SAR Government is not mandatory. According to the Plan, individual waste producing sectors will be asked to set their own targets. Individual companies will be invited to join some of the programmes such as the Wastewi$e Scheme in which companies are required to set reduction targets and achieve the target before they are awarded the Wastewi$e Logo. There is not a legal requirement to set a recycling target. The quantity of recyclable materials estimated in this section

(12) Materials Recovery and Recycling Facilities Study, Environmental Resources Management on behalf of the Environmental Protection Department.

should be viewed as a reference to assess the waste management system, rather than a mandatory mitigation measure.

6.6.50 As discussed in the previous sections, the quantity of recyclable materials to be recovered by the recycling industry under a market driven condition is estimated to be about 23 to 26% of the total waste generated. This assumes the recycling industry can recover the high value materials from the waste stream. If the Theme Park is to develop its own source separation programmes, it may create competition with the recycling industry for the supply of recyclable materials.

6.6.51 An analysis of the markets shows that markets for the major recyclables exists, especially when source separation programmes are in place to enhance the market value of the materials.

6.6.52 The following issues on recycling at the Theme Park at Penny's Park are observed:

- An important requirement is to monitor and maintain good records relating to waste arisings and composition, the types and quantities of waste recovered for recycling and waste disposal on at least an annual basis. This allows a more accurate estimate of the quantity and types of recyclable materials. The proxy approaches used in this assessment have their limitations and should be used with caution. The operator should maintain good record of the types and quantities of waste disposed of and recovered, so that both EPD and the operator can monitor the results of the waste reduction measures implemented.

- Source separation is the key to successful recycling and the market for most recyclable materials exist in Mainland China. Some materials are likely to suffer from high transport cost if they are recycled in Mainland China due to their low market value and heavy weight, including glass and food waste. In particular, food waste, which is estimated to contribute to up to 40% of total the waste likely to be generated, will need to be separated before it can be composted.

- The operation of the Theme Park should avoid using disposable products. The selection and labelling of recyclable materials in hotels, restaurants and retail shops also increase the quantity of recyclable materials. For example, avoiding expanded polystyrene (EPS) and the labelling of plastic containers, would facilitate recycling.

- In addition to monitoring waste arisings, the monitoring of recycling programmes annually and an evaluation of these programmes on a regular basis will be important in order to improve the recycling programmes and update the recycling targets.

- To increase the recyclable quantity from 23 to 26% of total waste generated anticipated market driven conditions to 44% with additional proactive source separation programmes requires significant commitment from the Theme Park to divert additional waste materials from disposal, as well as the availability of a composting facility as outlined in the *Waste Reduction Framework Plan*. This is equivalent to 7 to 8 tpd of additional recyclable materials on top of the 9 to 10 tpd waste estimated in 2005.

- The material recovery facility required to handle the additional recyclable materials should be provided within the Theme Park. This assumes that the source separation programme in the Theme Park will not compete with the recovery by the informal sector. This also assumes that the waste management system will allow the recycling industry to recover the material at an appropriate time before the wastes are containerised and sent for disposal. Coordination of the efforts of the recycling industry and the management of the Theme Park's source separation programmes will be required. One approach is to set up a small materials recovery facility (MRF) with a capacity of around 17 tpd in 2005, 32 tpd in 2014 and scope for expansion to 81 tpd in 2024 within the Theme Park back of house, as part of the network of neighbourhood MRFs (NMRFs) to be established in Hong Kong under recommendations from the MRRF Study. The materials in NMRFs can then be further re-processed in the specialised MRFs which will turn the recovered materials into a form acceptable by the markets.

6.6.53 According to the assessment, the market driven recycling industry can recycle 23-26 % of waste to be generated in the Theme Park. It is recommended that a additional further target of 10% for the recovery of recyclables and potentially, an extra 10% for the recover of source separated wood waste (assuming that a composting facility for food waste planned in the *Waste Reduction Framework Plan* is available) is adopted in the Waste

Management Plan of the Theme Park. The composition of the waste and the actual recycling rate for various materials should be monitored. The preliminary recycling target should be reviewed on an annual basis to determine the practical recycling rate that can be achieved based on the recycling market as well as the potential change of the recycling target beyond the WRFP's 10-year planning period.

Territory-wide Environment Implications of the Additional Tourists

Solid Waste Arisings

6.6.54 Based on the operating experience of other international theme parks, the amount of Municipal Solid Waste (MSW) to be generated from the operation of the Theme Park (Phase I and II) at Penny's Bay has been assessed to be 38 tpd in 2005, increasing to 73.5 tpd in 2014 and 175 tpd in 2024. These estimates assumed that no waste reduction measures were in place. Without waste reduction measures, such arisings would increase the demand for valuable landfill void space.

6.6.55 The North Lantau Transfer Station (NLTS) was commissioned in April 1998 and has a throughout of 650 tpd which will be expanded to 1,200 tpd to handle the anticipated growth of waste arisings from the North Lantau area. The anticipated waste throughputs of NLTS are 180, 370, 770, and 880 tpd for the years 2001, 2006, 2011 and 2016, respectively(13). At the NLTS, the waste is compacted into 20 ft ISO containers for bulk transfer by marine vessels to the Western New Territories (WENT) landfill for final disposal. The Transfer Station will be able to handle the waste arisings from the Theme Park (Phases I and II) and associated developments at least until 2016. The WENT landfill was commissioned in November 1993 and has a design capacity and void capacity of about 61 M m^3, and 53 Mm^3 respectively. Based on the current waste input forecast, the SAR's strategic landfills even with the full implementation of the Waste Reduction Framework Plan will be exhausted by 2019. The waste arisings assessment has further estimated that with no waste reduction initiatives, the wastes generated from the Theme Park (Phase I and II) between 2005 and 2019 are expected to reduce the life of the strategic landfills by only 20 days.

Waste Reduction Opportunities

6.6.56 A detailed review of waste reduction opportunities has been undertaken in *Section 6.* The review indicates that the quantity of recyclable materials that may be recovered by local recyclers under market driven conditions is estimated to be about 23 to 26% of the total quantity of waste generated at the Theme Park. These estimates are based on the prevailing market conditions in Hong Kong.

6.6.57 In addition, the potential for further recovery of major recyclables exists when source separation programmes are in place to enhance the value and quality of the materials. It is, thus, recommended that the Theme Park should institute a source separation programme to recover additional recyclables from the remaining waste stream. A preliminary recycling target of 10% is recommended for the additional recovery of recyclable materials. A further 10% is recommended for the recovery of compostable materials, if a composting

(13) EPD Communication ref EP 20/03/205 M

facility is available in the HK SAR. The targets should be adopted in the Waste Management Plan for the Theme Park.

6.6.58 Additionally, an annual waste composition and recycling monitoring programme will be implemented to determine the practical recycling rate that can be achieved given the prevailing market for recyclables.

6.6.59 With a standard waste recycling rate of only 23%, the life of strategic landfills will be prolonged by 5 days. With a source separation programme to recover recyclables from the remaining waste stream, the life of strategic landfills will be prolonged by another 2 days. With a further 10% removal rate for compostable materials, assuming that a composting facility is available, the life of strategic landfills will be prolonged by another 2 days.

Disposal

6.6.60 Based on the waste arisings from the Theme Park and associated facilities less that recycled by informal sector or 23-26 %, the daily waste arisings in 2005, 2014 and 2024 will be 28 to 29 tpd, 54 to 57 tpd and 130 to 135 tpd, respectively. The Theme Park recyclable recovery programme can further reduce waste by 10 %, which in 2005, 2014 and 2024 will be 4 tpd, 7 tpd and 18 tpd respectively. In addition, when a composting facility becomes available in HK SAR, an extra 10 % of the waste could be recovered, ie 4 tpd, 7 tpd and 18 tpd in 2005, 2014 and 2024, respectively.

6.6.61 The anticipated waste throughout of NLTS is 370, 770, and 880 tpd for the years 2006, 2011 and 2016, respectively. With the through capacity of 1,200 tpd, this indicates that there will be sufficient spare capacity at the NLTS to handle the waste arising from the Theme Park and associated developments at least to the year 2016. HKITP should closely liaise with the EPD regarding waste transfer and disposal arrangements as the handling capacity of the NLTS and strategic capacity approaches its maximum capacity.

Chemical Waste

6.6.62 The HKITP will register as a chemical waste producer under the *Chemical Waste Control Scheme*. It will make arrangements with the Chemical Waste Treatment Centre at Tsing Yi or other vendors for the collection, recycling and disposal of the chemical waste generated from the Theme Park. Similar schemes have been adopted by other Disney Theme Parks and they have managed to recycle about 90% (by weight, 83% is recycled and 8% is combusted as fuel) of the chemical wastes generated.

6.6.63 The HKITP will target to recycle as much chemical waste as possible in order to minimise the need for treatment and disposal. With respect to the types and quantities of chemical wastes that may be generated from the Theme Park, it is considered that the Chemical Waste Treatment Centre will have the capacity to treat the chemical waste arising from the Theme Park.

6.6.64 Chemical waste will be stored, handled, transported and disposed of in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation* and the *Code of Practice on Packaging, Labelling and Storage of Chemical Wastes*. They should be collected and transported to the CWTC or other licensed facility by a licensed waste haulier. Provided that appropriate handling, storage and disposal procedures are followed, no unacceptable

impacts associated with the management of chemical wastes during the operational phase of the PBRL are anticipated.

Sewage Sludge

6.6.65 Based on a sludge generation rate of 14,365 tds a^{-1} in 2011, approximately 40 tds per day of sludge will be generated, which is equivalent to approximately 130 m^3 of sludge. 10 m^3 skips (as currently employed in Sha Tin STW) could be used for the transportation of the sludge to the disposal facility. A maximum of 13 truck loads will be required. It is therefore considered that the traffic impacts associated with off-site sludge disposal will be minimal.

6.6.66 Should the proposed centralised Sludge and Difficult Wastes Incineration Facility (SDIF) be located near the WENT landfill, it will be more cost effective and environmentally preferred to transport the sludge in modified 20ft ISO containers (similar to the one currently used at the Stonecutters' Island STW) via the NLTS to the WENT Landfill Reception Area and then to the SDIF.

6.6.67 During the containment, storage and delivery of sewage sludge, odour impact may arise. Provided that fully enclosed containers and storage area are used and odour removal systems are installed, no adverse environmental impact is expected.

Summary of Construction and Operation Impacts

Table 6.5g - Summary of Waste Management Impacts

Waste Type	General Evaluation
Construction Phase	
Dredged/Excavated Sediment	Approximately 46.3 M m^3 of sediment will be dredged/excavated, of which 0.11 M m^3 is expected to be seriously contaminated (Class C). Full-dredge option is adopted at Penny's Bay Reclamation Stage I due to limited time available for ground improvement works. However, for Penny's Bay Reclamation Stage II and Yam O Reclamation, only sediment at seawall location will be dredged. The estimated dredged/excavated sediment and Class C sediment at Penny's Bay Reclamation Stage I, Penny's Bay Reclamation Stage II, Yam O Reclamation and Water Recreation Centre are 40 M m^3 from Q2 2000 to Q4 2001 (0.08 M m^3 Class C sediment), 5 M m^3 from Q3 2001 to Q1 2005 (0.02 M m^3 Class C sediment), 0.3 M m^3 from Q4 2001 to Q4 2002 (0.01 M m^3 Class C sediment) and 1 M m^3 from Q2 2001 to Q4 2002 (no Class C sediment), respectively. Minimal (1,300 m3) volume will be generated at CKWLR section from Q2 2001 to Q3 2003. All Class C sediment will be generated during the first few weeks of dredging at each reclamation and will be disposal of at East Sha Chau Contaminated Mud Pits. The FMC has allocated 30 M m^3 of uncontaminated and disposal capacity to the Penny's Bay Reclamation (East Nine Pin, East Tung Lung and north of Lantau). The Engineers should inform FMC the extra volume of sediment requiring disposal so further disposal ground can be allocated.
Use of Public fill for the reclamation	The volume of sand fill to be used at Penny's Bay Reclamation Stage I, Penny's Bay Reclamation Stage II and Yam O Reclamation are 65M m^3 (from Q4 2000 to Q2 2002), 7.4 M m^3 (from Q2 2003 to Q1 2006) and 0.5 M m^3 (from Q4 2002 to Q2 2003), respectively. For Penny's Bay Reclamation Stage I can accommodate approximately 2 M m^3 of public fill. Whereas 8.5 M m^3 of public fill (equivalent to most of the public fill to be generated in the territory during the reclamation period) will be used at Penny's Bay Reclamation Stage II which is the maximum volume from its geometry and design requirements. The Yam O Reclamation will accept 0.7 M m^3 of public fill. Floating debris may be generated due to public filling. However, provided that frequent collection and use of surface booms, no adverse environmental impact is expected.
Excavated Material	During the construction of Theme Park infrastructure foundation, excavated material will be generated, which is approximately 5% of the fill material. The estimated excavated material to be generated at CKWLR section, Road P2 and PBRL are 10,200 m3, 7,800 m3 and 68,500 m3, respectively. Since the excavated material will comprise sand fill, public fill, soil or rock, as well as the large filling requirement for the reclamation, the excavated material can be re-used on site and no surplus is expected. Air quality, noise and water quality impacts arising from the excavation and handling of excavated material are addressed *Sections 3, 4* and *5*.
C&D Waste	The construction of infrastructures for the Theme Park will generate approximately 154,000 m^3 of C&DM, of which about 31,000 m^3 is C&D waste and 123,000 m^3 is public fill. The estimated average C&D waste generation rate for Theme Park Phase I - Opening Day, Theme Park Phase I - Buildout and Theme Park Phase II - Buildout are 14 $m^3 d^{-1}$ (22 $m^3 d^{-1}$ peak rate) from April 2002 to April 2005, 2 $m^3 d^{-1}$ (3 $m^3 d^{-1}$ peak rate) from Q3 2008 to Q3 2011 and 12 $m^3 d^{-1}$ (19 $m^3 d^{-1}$ peak rate) from Q4 2003 to Q3 2015. The PBRL will generate 920 m^3 of C&D waste and 3,680 m^3 of public fill from the period of Q4 2002 to Q2 2004 and the average and peak daily C&D waste generation rate are 44 $m^3 d^{-1}$ and 65 $m^3 d^{-1}$, respectively. The Water Recreation Centre will generate 200 m^3 of C&D material from Q2 2004 to Q4 2004 and the C&D waste and public fill generation is minimal (both less then 1 $m^3 d^{-1}$). The highest daily cumulative C&D waste and public fill generation will be from the period of Q4 2003 to Q2 2004, during the construction of Theme Park Phase I - Opening Day, Theme Park Phase II - Buildout and PBRL, where average and peak generation rate for C&D waste are 29 $m^3 d^{-1}$ and 45 $m^3 d^{-1}$ respectively, whereas for public fills generation are 118 $m^3 d^{-1}$ and 178 $m^3 d^{-1}$, respectively. With respect to the relatively small volume of C&D waste generation, no adverse environmental impact associated with the handling and disposal of C&D waste. In addition, due to the large fill requirement of Penny's Bay Reclamation the public fill is expected to be re-used on site. The potential environmental impacts associated with the decommissioning and demolition of the Cheoy Lee Shipyard will be evaluated under a separate EIA to be commissioned by the CED.

Waste Type	General Evaluation
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	The maximum daily number of workers on site (4,300) will be from 2003 to 2004. Based on a waste generation rate of about 0.65 kg per person, it is estimated that the amount of general refuse to be generated will be in the order of 2.8 tpd.
Operation Phase	
Municipal Solid Waste	The operation of the PBRL and road links to the Theme Park (including the CKWLR section, Road P2, Resort Road) will generate negligible amount of waste (in the order of a few cubic metres per month). The operation of the Eastern Stormwater Drainage Channel will generate sand and gravel from de-silting operations. The amount of sand and gravel collected will vary between dry and wet seasons. The amount of municipal solid waste to be generated from the operation of the Theme Park will increase from about 38 tpd in 2005 to 73.5 tpd in 2014, then to 175 tpd in 2024. Although majority (around 70%) of the MSW will be generated from the RD&E and hotels, a significant amount of waste will be generated from the Theme Park. An efficient and effective waste collection system is essential in order to avoid any nuisance to visitors due to waste storage, collection and transport within the site. The waste handling and collection system should also facilitate the material recovery and recycling. The floating refuse may arise at the coastal area of the Theme Park and associated developments and the artificial lake of the Water Recreation Centre. Although chemically inert, if floating refuse is not collected properly, these floating refuse may drift, which may create aesthetic or odour impact, or cause damage to marine craft. Provided that mitigation measures such as the use of surface boom to contain the floating refuse, are properly implemented, no insurmountable environmental impacts with regards to floating debris will be anticipated.
Recycling	According to the assessment, the market driven recycling industry can recycle 23-26 % of waste to be generated in the Theme Park. It is recommended that a additional further target of 10% for the recovery of recyclables and potentially, an extra 10% for the recover of source separated wood waste (assuming that a composting facility for food waste planned in the *Waste Reduction Framework Plan* is available) is adopted in the Waste Management Plan of the Theme Park.
Disposal	Based on the waste arisings from the Theme Park and associated facilities less that recycled by informal sector or 23-26 %, the daily waste arisings in 2005, 2014 and 2024 will be 28 to 29 tpd, 54 to 57 tpd and 130 to 135 tpd, respectively. The Theme Park recyclable recovery programme can further reduce waste by 10 %, which in 2005, 2014 and 2024 will be 4 tpd, 7 tpd and 18 tpd respectively. In addition, when a composting facility becomes available in HK SAR, an extra 10 % of the waste could be recovered, ie 4 tpd, 7 tpd and 18 tpd in 2005, 2014 and 2024, respectively. The anticipated waste throughout of NLTS is 370, 770, and 880 tpd for the years 2006, 2011 and 2016, respectively. With the through capacity of 1,200 tpd, this indicates that there will be sufficient spare capacity at the NLTS to handle the waste arising from the Theme Park and associated developments at least to the year 2016. HKITP should closely liaise with the EPD regarding waste transfer and disposal arrangements as the handling capacity of the NLTS and strategic capacity approaches its maximum capacity.

Waste Type	General Evaluation
Chemical Waste	The operation of the Theme Park at Penny's Bay will use a variety of chemicals. Some of the used chemicals have to be disposed of. The operation of the Theme Park at Penny's Bay will be very similar to that of Disneyland. In addition, the remains of fireworks from the fireworks shows in the Theme Park may contain heavy metal in low concentrations (in a scale of ng kg^{-1}), and mid-level fireworks remains may contain dioxins furans, which is also classified as chemical waste under *Schedule 1* of the *Waste Disposal (Chemical Waste) (General) Regulation*. The HKITP will register as a chemical waste producer under the *Chemical Waste Control Scheme.* It will make arrangements with the Chemical Waste Treatment Centre at Tsing Yi or other vendors for the collection, recycling and disposal of the chemical waste generated from the Theme Park. Similar schemes have been adopted by other Disney Theme Parks and it managed to recycle about 90% (by weight, 83% is recycled and 8% is combusted as fuel) of the chemical waste generated. The HKITP will target to recycle as much chemical waste as possible in order to minimise the need for treatment and disposal. With respect to the types and quantities of chemical wastes that may be generated from the Theme Park, it is considered that the Chemical Waste Treatment Centre will be able to treat the chemical waste arising from the Theme Park. Chemical waste will be stored, handled, transported and disposed of in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation* and the *Code of Practice on Packaging, Labelling and Storage of Chemical Wastes*. They should be collected and transported to the CWTC or other licensed facility by a licensed waste haulier. Provided that appropriate handling, storage and disposal procedures are followed, no unacceptable impacts associated with the management of chemical waste during the operational phase of the PBRL are anticipated.
Sewage Sludge	Based on sludge generation rate of 14,365 tds a^{-1} in 2011, approximately 40 tds per day of sludge will be generated, which is equivalent to approximately 130 m^3 of sludge. 10 m^3 skips (as currently employed in Sha Tin STW) could be used for transportation of sludge to the disposal facility. A maximum of 13 truck loads will be required. It is therefore considered that the traffic impacts associated with off-site sludge disposal will be minimal. Should the proposed centralised Sludge and Difficult Wastes Incineration Facility (SDIF) be located near the WENT landfill, it will be more cost effective and environmentally preferred to transport the sludge in modified 20ft ISO containers (similar to the one currently used at the Stonecutters' Island STW) via the NLTS to the WENT Landfill Reception Area and then to the SDIF. During the containment, storage and delivery of sewage sludge, odour impact may arise. Provided that fully enclosed containers and storage area are used and odour removal systems are installed no adverse environmental impact is expected.

6.7 MITIGATION MEASURES

INTRODUCTION

6.7.1 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 Penny's Bay reclamation and the associated Theme Park developments. The construction Contractors should incorporate these recommendations into a waste management plan for the construction works. The Contractors should submit a waste management plan to the Engineer for approval. 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.

6.7.2 During the operational phase of the Theme Park, the HKITP should develop a Waste Management Plan which details the arrangements for minimisation, material recovery/recycling, collection, transportation and disposal of various types of waste generated from the operation of the Theme Park.

6.7.3 It is the Contractor's (for the construction phase) and the HKITP's (for the operational phase) responsibility to ensure that only approved licensed waste collectors are used and that appropriate measures to minimise adverse impacts, including windblown litter and dust from the transportation of these wastes are employed. In addition, the Contractor must ensure that all the necessary waste disposal permits are obtained.

CONSTRUCTION PHASE

Dredged/Excavated Sediment

6.7.4 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/excavation;
- any contaminated sediment dredged should not be allowed to stockpile on the 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 either overflowing of materials or polluted water during loading or transportation.

6.7.5 Other suitable mitigation measures for handling or dredged material are dealt with, in *Section 5*.

Use of Public Fill for Reclamation

6.7.6 The Contractor should enforce strict application of the public fill license and monitor the material placed in the reclamation and barges to control disposal of unauthorised material. The Contractor shall also provide floating booms and collect any floating materials on a daily basis at the public filling area.

Measures Taken in the Planning and Design Stages to Reduce the Generation of C&DM

6.7.7 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 waste management hierarchy is as follows:

- avoidance and minimisation, that is, 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 law, guidelines and good practice.

6.7.8 This hierarchy should be used to evaluate the 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 the purchasing of raw materials and in disposing of wastes. Records of quantities of wastes generated, recycled and disposed (locations) should be properly kept.

6.7.9 Standard formwork should be used as far as practicable in order to minimise the arisings of C&DM. The use of more durable formwork or plastic facing for the construction works should be considered during the detailed design.

6.7.10 Any uncontaminated soil should be reused on site as far as possible for landscape works in order to minimise the amount of public fill to be disposed off-site. Should there be any surplus public fill generated from the project, the HKITP should liaise with the Public Filling Sub-Committee to identify as far as possible suitable reclamation or site formation projects near the project site to reuse the material.

6.7.11 The design of the foundation works will minimise the amount of excavated material to be generated. Should piling be required, H-piling will be used as far as practical.

6.7.12 The purchasing of construction materials will be carefully planned in order to avoid over ordering and wastage of construction materials, such as ready mixed concrete.

Measures To be Taken in the Construction Stage To Reduce the Generation of C&DM

6.7.13 The Contractor should recycle as much as possible of the C&D material on-site. Public fill and C&D waste should be segregated and stored in different containers or skips to enhance reuse or recycling of materials and their proper disposal. 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 sites should be designated for such segregation and storage.

6.7.14 The use of wooden hoardings shall not be allowed. An alternative material, which can be reused or recycled, for example, metal (aluminium, alloy etc) shall be used.

6.7.15 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 disposal of inert material to public filling areas.

6.7.16 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

6.7.17 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.

6.7.18 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 as follows. Containers used for 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.

6.7.19 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.

6.7.20 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 re-user of the waste, under approval from the EPD.

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

Management of General Refuse

6.7.22 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 basis to minimise odour, pest and litter impacts. The burning of refuse on construction sites is prohibited by law.

6.7.23 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 and made easily accessible, so separate, labelled bins for their deposit should be provided if feasible.

6.7.24 Office wastes can be reduced through the recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered if one is available. In addition, waste separation facilities for paper, aluminium cans, plastic bottles etc., should be provided.

Management of Waste Disposal

6.7.25 A trip-ticket system should be established in accordance with *Works Bureau Technical Circular No 5/99* to monitor the disposal of C&DM and solid wastes at public filling facilities and landfills, and to control fly-tipping. A trip-ticket system will be included as one of the contractual requirements and implemented by the Engineer. The Engineer should audit the result of the system.

6.7.26 A recording system for the amount of waste generated, recycled and disposed of (including the disposal sites) should be established during the construction stage.

Staff Training

6.7.27 Training should be provided to workers on the concepts of site cleanliness and on appropriate waste management procedures, including waste reduction, reuse and recycling at the beginning of the contract.

Summary

6.7.28 The EIA has considered in the planning and design stages measures to minimise the generation of C&DM. The measures to minimise C&DM have been described in the above sections. The Contractor should reuse the public fill generated from the project either on-site or in other construction sites as far as possible. The EIA has required the Contractor under the contract to submit a waste management plan for the construction works to the Engineer for approval on the advice of the EPD.

6.7.29 The waste management plan should include appropriate measures including the allocation of an area for waste segregation. The Engineer should ensure that the day-to-day operations on site comply with the waste management plan. The contractor should separate public fill from C&D waste for disposal at appropriate locations and to sort the C&DM by category on-site to facilitate reuse/recycling in order to reduce the generation of waste.

6.7.30 The reuse/recycled materials will include paper/cardboard, timber and metal. The Contractor, where feasible, should use reusable or recyclable steel instead of timber in formworks and temporary works to further minimise the generation of waste. The disposal of public fill and C&D waste will be controlled through a trip-ticket system. Record of types and quantities of waste disposed, reused and recycled will be kept for monitoring purpose.

OPERATION PHASE

6.7.31 The HKITP has made and will continue to make every effort to protect the environment and has made a strong commitment to waste avoidance, source reduction and recycling. The HKITP has experience in the development of many innovative waste avoidance programmes in the past and will continue to search for environmentally friendly and cost-effective solutions in the future. Because of the prominent image of the Theme Park's characters, they may wish to participate in different local waste recovery and recycling programmes to promote waste reduction in the HK SAR. To minimise the amount of waste to be disposed of at landfill and to maximise the recovery of material from the waste stream, the Theme Park at Penny's Bay will implement a waste prevention and recycling programme which is outlined below. The measures will form part of the Waste Management Plan for the operation and management of the Theme Park.

6.7.32 To minimise the potential adverse impacts to aesthetics and odour impacts, the HKITP should maintain floating refuse collection initiatives at both the coast of the Theme Park and within the artificial lake of the Water Recreation Centre.

Waste Avoidance Measures

6.7.33 The HKITP will implement a waste avoidance programme to minimise the production of waste. The waste avoidance programme to the extent feasible, may consist of the following components:

- electronic communications (ie voice mail and email); message boards, routing slips and double-sided copying will be used, as far as practical, to reduce the quantities of paper that otherwise would require disposal at landfill;
- worn linens to the maximum extent feasible based upon available markets and third-party recycling facilities be used to make scarves and aprons for cast members;
- soft drinks to the maximum extent feasible based upon available markets and third-party recycling facilities be served in souvenir cups that are taken home by guests for reuse as opposed to being discarded at the Theme Park as waste, appropriate recycling bins should be set up to recover these cups for reuse or recycling if the visitors choose not to take them home;
- hamburgers and similar food types will be wrapped in paper or an equally environmentally acceptable material instead of in polystyrene clamshells;
- unused prepared food will be sent to a food bank, and distributed to the needy, to the maximum extent feasible based upon available markets and third-party recycling facilities;
- excess water-based paints will be reused as far as practical;
- plastic drink cup lids will be supplied to guests upon their request when purchasing beverages;
- fast-food service trays in selected locations will be washed and reused (instead of using disposable cardboard carry-out trays);

- souvenir, booklets, dining-ware, etc. which are recyclable should have appropriate instructions and signs printed on the surface;
- waste recycling bins for paper, aluminium cans, plastic bottles, etc. should be provided throughout the Theme Park to promote waste separation at source;
- all products sold in the Theme Park should be packed in minimal amount of packaging materials;
- pallets made of more durable and reusable materials plastics than wood should be used in transportation of food, drinks, etc.;
- the distribution centre of the Theme Park will utilise reusable shipping containers as far as practical instead of cardboard boxes for internal routing'
- fabric fenders instead of tropical hardwood fenders should be used at the proposed piers; and
- the hoarding of the proposed piers should be metal (aluminium, alloy etc) instead of wood.

Materials Recovery and Recycling Programme

6.7.34 *Papers:* Recycling bins will be provided at shops and food service locations to collect cardboard containers. Personnel in every office will be provided with bins to recycle office paper. Large containers for recycling paper will be placed near photocopy machines. The collected paper will be transported to RCPs at the back of house for sorting and baling.

6.7.35 *Glass Bottles and Glass Jars*: Due to the number of activities that will be taken place at the hotels, such as conventions, banquets, bar service, and room service, substantial quantities of beverage bottles may be generated. Recycling bins will be placed in the service areas near the restaurants for recovery of glass bottles and jars. The operator should ensure that the collected glass containers could be reused/recycled. "Deposit-refund" scheme can be adopted to promote glass bottles recovery. The operator should also consider to shift to use other more promising recyclable beverage containers such as aluminium cans and plastic bottles. The collected glass bottles and jars will be transported to the RCP for processing and recycling.

6.7.36 *Aluminium Cans*: Aluminium can recycling bins will be placed at break areas and pantries. The collected aluminium cans will be transferred to the RCP for processing.

6.7.37 *Plastics:* Recycling bins for plastic bottles recovery should be set up at prominent places to facilitate visitors to participate in material recovery activities. Mixed plastic recycling programmes are difficult to implement because of the low bulk density of the material and its low value. Therefore, such programmes will be implemented to the extent practicable. The Theme Park will implement a source separating programme for polyethylene terapthalate (PET), high-density and low-density polyethylene (HDPE & LDPE). Most of the PET and HDPE consists of soft drink and water bottles and the major sources of this material may be at the hotels and restaurants. The PET and HDPE bottles collected will be transferred to the RCPs for collection by the recyclers. LDPE which is used in the warehouse distribution and delivery process may also be recycled. Shrink wrap, which is used to secure items being delivered on pallets on open tow carts, will be recovered to the extent practicable and delivered to the RCPs. Once sufficient material is accumulated to fill a truck, the recycler will be called in to collect the material. The recycling programme

may extend to cover other types of plastics or to recycle mixed plastic if the technology is available to make the plastic recycling programme more efficient and cost-effective.

6.7.38 *Kitchen Grease*: Should there be a market for kitchen grease in Hong Kong, the Theme Park Operator will consider establishing a kitchen grease recycling programme in Hong Kong.

6.7.39 *Scrap Metal:* Due to the high value of scrap metal, there is a high incentive to recover and recycle the scrap metals generated from the Theme Park. Scrap metal will be generated and separated at the machine, welding, automotive and sheet metal shops. Scrap metal will also be collected, when feasible, on construction and demolition and rehabilitation projects. Scrap metal will be placed in roll on/off containers. Once the containers is full, the recycler will be called in to remove the loaded container and return an empty one.

6.7.40 *Laser Printer Toner Cartridges*: The Theme Park will make arrangements with the toner cartridge suppliers to collect and recycle used toner cartridges for laser printers to avoid disposal of the cartridges at the WENT landfill as far as practical.

6.7.41 *Green Waste*: The landscaping works will generate a considerable amount of grass clippings, leaves, brush and tree trimmings. However, the handling capacity of the existing Sha Ling composting facility is limited (about 15 to 20 tpd) and is currently composting livestock wastes. The facility is unlikely to be able to handle the green waste generated from the Theme Park. Should there be a market or facility which could process the green waste arising from the Theme Park, the HKITP is willing to consider establishing a recycling programme for green waste.

6.7.42 *Scrap Lumber*: Wooden pallets should be reused as far as practicable. Broken pallets, wooden scrap and lumber from demolition projects will be collected and recycled as far as practical. Currently, there is a market for scrap lumber and it is anticipated that the scrap lumber generated from the Theme Park could be adsorbed by the local market. More durable pallets made from plastic lumber should be used wherever practicable.

6.7.43 *Asphalt:* The Theme Park will require the contractor to reuse and recycle as much as practical the used asphalt generated from the construction and rehabilitation of asphalt roadways and parking lots. Any surplus used asphalt will be delivered to public filling facilities rather than landfill.

Chemical Waste

6.7.44 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.

6.7.45 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 as follows. Containers used for 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.

6.7.46 The storage area for chemical wastes should:

- by 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.

6.7.47 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 re-user of the waste, under approval from the EPD.

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

Sewage Sludge

6.7.49 The containment, storage and delivery of the sewage sludge should be enclosed. Odour removal facilities should also be installed to minimise the potential air quality impacts to any sensitive receivers.

6.8 EVALUATION OF RESIDUAL ENVIRONMENTAL IMPACTS

6.8.1 With the implementation of recommended mitigation measures, in particular the establishment and implementation of a Waste Management Plan by HKITP, minimal residual impacts are anticipated with either the construction or operational wastes from Theme Park and associated developments.

6.9 ENVIRONMENTAL MONITORING AND AUDIT

6.9.1 It is recommended that regular auditing of each of the waste streams is conducted during the construction phase of the Project. The specific monitoring requirements are detailed in *Annex N* of this EIA Report which comprises the stand-alone Project EM&A Manual.

6.10 CONCLUSION AND RECOMMENDATIONS

6.10.1 The following quantities of waste are expected to arise during the construction of the Theme Park and associated developments: Dredged materials (approximately 46.3M m^3 or a maximum rate of 90,600 m^3 d^{-1}), construction and demolition waste (a peak generation rate of approximately 45 m^3 d^{-1}); chemical waste (a few cubic metres per month); and general refuse (2.8 tpd during peak construction period). No surplus of excavated materials is envisaged.

6.10.2 The Theme Park and associated developments will reclamation's will require a large amount of fill material and therefore offers a very good opportunity to utilise the public fill generated in the HK SAR. The use of public fill will not only alleviate the demand for virgin fill material but also reduce the pressure of disposing of inert Construction and Demolition Material (C&DM) at the strategic landfills. This *Section* has detailed the intention to maximise the use of good quality public filling material within the Penny's Bay Reclamation Stage I and II and Yam O reclamation's whilst ensuring that the Project programme is not adversely affected. In this regard, within the six months filling period, the Penny's Bay Reclamation Stage I reclamation will utilise about 2 M m^3 of public fill which is the maximum volume of public fill that the reclamation can accommodate. Stage II of the Penny's Bay Reclamation requires 15.9 M m^3 of fill material between April 2003 and March 2005 (about 24 months). Again, public fill will be used as far as practical for the reclamation. It is estimated that about 8.5 M m^3 (equivalent to most of the public fill to be generated in the territory during the reclamation period) will be used for the reclamation which is the maximum public fill volume given the geometry of the reclamation, and the balance will be sand fill (about 7.4 M m^3). Thus Stage II reclamation allows the majority (53%) of the Stage II reclamation to be filled with public fill material. The Yam O reclamation requires 1.7 M m^3 of fill material between October 2002 and June 2003 (about 9 months). Public fill will be used as far as practical for the reclamation. It is estimated that about 1.2 M m^3 (about 70% of the fill requirement) will be used for the reclamation and the balance will be sand fill (about 0.5 M m^3 which will mainly used for the construction of the seawall). These initiatives will have an indirect environmental benefit by utilisation of public filling material to the greatest degree bearing in mind the programming constraints.

6.10.3 Prior to construction, the Contractor should submit a Waste Management Plan to the Engineer for approval. 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.

6.10.4 Based on the operation experience of the other international theme park, the amount of MSW to be generated from the operation of the Theme Park at Penny's Bay will increase, within the HK SAR territory, without any waste recycling/reduction, from about 38 tpd in 2005 to 73.5 tpd in 2014, then to 175 tpd in 2024, which fall within the throughput capacity of NLTS.

6.10.5 The quantity of recyclable materials potentially recovered by local recyclers under market driven condition is estimated to be about 23 to 26% of the total waste generated. These estimates are based on the market condition in Hong Kong. The analysis of the markets show that a market for the major recyclables exists, especially when source separation programmes are in place to enhance the market value of the materials.

6.10.6 According to the assessment, the market driven recycling industry can recycle 23-26 % of waste to be generated in the Theme Park. It is recommended that a additional further target of 10% for recyclable recovery programme and potentially, an extra 10% for food waste source separation programme (assuming that a composting facility for food waste planned in the *Waste Reduction Framework Plan* is available) be adopted in the Waste Management Plan of the Theme Park. The composition of the waste and actual recycling rate of various materials should be monitored. The preliminary recycling target should be

reviewed on an annual basis to determine the practical recycling rate that can be achieved based on the recycling market.

6.10.7 Based on the waste arisings from the Theme Park and associated facilities and market driven recycling rate of 23-26 %, the daily waste arisings after market driven recycling in 2005, 2014 and 2024 are 28 to 29 tpd, 54 to 57 tpd and 130 to 135 tpd, respectively. The Theme Park recyclable recovery programme can further reduce waste by 10 %, which in 2005, 2014 and 2024 are 4 tpd, 7 tpd and 18 tpd respectively. In addition, when food waste composting facility is available in HK SAR, an extra 10 % of waste to be generated from the Theme Park can be reduced, ie 4 tpd, 7 tpd and 18 tpd in 2005, 2014 and 2024, respectively.

6.10.8 A waste avoidance and recycling programme, which forms a major part of the HKITP's Waste Management Plan for the operation of the Theme Park, should be implemented and closely monitored.

6.10.9 The assessment indicates that the North Lantau Transfer Station will be able to handle the waste arising from the Theme Park and associated developments.

6.10.10 Good waste management practices have been recommended to ensure that adverse environmental impacts from Theme Park and associated developments construction and operational wastes are prevented. This EIA concludes that no unacceptable environmental impacts will result from the storage, handling, collection, transport, and disposal of wastes arising from the construction and operation of the Theme Park and the associated developments.

6.11 IMPACTS SUMMARY

Table 6.11a - Impacts Summary Table

Issue	Construction Impact	Operation Impact
Assessment Points	Theme Park EIA Study Area	Theme Park EIA Study Area
Relevant Criteria	*Waste Disposal Ordinance, Waste Disposal (Chemical Waste) (General) Regulation, Land (Miscellaneous Provisions) Ordinance, Public Health and Municipal Services Ordinance, Dumping at Sea Ordinance, Waste Disposal Plan for Hong Kong, New Disposal Arrangements for Construction Waste, Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes, EPDTC 1-1-92, WBTC Nos. 6/92, 22/92, 32/92, 2/93, 16/96, 4/98, 5/98, 5/99 and 25/99,* and *Waste Reduction Framework Plan*.	*Waste Disposal Ordinance, Waste Disposal (Chemical Waste) (General) Regulation, Public Health and Municipal Services Ordinance, Waste Disposal Plan for Hong Kong, Environmental Guidelines for Planning in Hong Kong* and *Waste Reduction Framework Plan*.
Potential Impacts	*Dredged/Excavated Sediment* Approximately 46.3 M m^3 of sediment will be dredged/excavated, of which 0.11 M m^3 is expected to be seriously contaminated (Class C). The estimated dredged/excavated sediment and Class C sediment at Penny's Bay Reclamation Stage I, Penny's Bay Reclamation Stage II, Yam O Reclamation and Water Recreation Centre are 40 M m^3 (0.08 M m^3 Class C sediment), 5 M m^3 (0.02 M m^3 Class C sediment), 0.3 M m^3 (0.01 M m^3 Class C sediment) and 1 M m^3 (no Class C sediment), respectively. Minimal (1,300 m3) volume will be generated at CKWLR section. All Class C sediment will be generated during the first few weeks of dredging at each reclamation and will be disposal of at East Sha Chau Contaminated Mud Pits. The FMC has allocated 30 M m^3 of uncontaminated and disposal capacity to the Penny's Bay Reclamation (East Nine Pin, East Tung Lung and north of Lantau). The Engineers should inform FMC the extra volume of sediment requiring disposal so further disposal ground can be allocated. *Use of Public Fill for the Reclamation* The volume of sand fill to be used at Penny's Bay Reclamation Stage I, Penny's Bay Reclamation Stage II and Yam O Reclamation are 65M m^3, 7.4 M m^3 and 0.5 M m^3, respectively, whereas the public fill to be used are 2 M m^3, 8.5 M m^3 and 0.7M m^3, respectively. Floating debris may be generated during public filling.	*Municipal Solid Waste* The operation of the PBRL and road links to the Theme Park (including the CKWLR section, Road P2, Resort Road) as well as the Eastern Stormwater Drainage Channel will generate negligible amount of waste. The amount of municipal solid waste to be generated from the operation of the Theme Park will increase from about 38 tpd in 2005 to 73.5 tpd in 2014, then to 175 tpd in 2024. Although majority (around 70%) of the MSW will be generated from the RD&E and hotels, a significant amount of waste will be generated from the Theme Park. An efficient and effective waste collection system is essential in order to avoid any nuisance to visitors due to waste storage, collection and transport within the site. The waste handling and collection system should also facilitate the material recovery and recycling. The floating refuse may arise at the coastal area of the Theme Park and associated developments and the artificial lake of the Water Recreation Centre.

Issue	Construction Impact	Operation Impact
	Excavated Material During the construction of Theme Park infrastructure foundation, excavated material will be generated, which is approximately 5% of the fill material. The estimated excavated material to be generated at CKWLR section, Road P2 and PBRL are 10,200 m^3, 7,800 m^3 and 68,500 m^3, respectively. Since the excavated material will comprise of sand fill, public fill, soil or rock, as well as the large filling requirement for the reclamation, the excavated material can be re-used on site and no surplus is expected. *C&D Waste* The construction of infrastructures for the Theme Park will generate approximately 154,000 m^3 of C&D Material, of which about 31,000 m^3 is C&D waste and 123,000 m^3 is public fill. The highest daily cumulative C&D waste and public fill generation will be from the period of Q4 2003 to Q2 2004, during the construction of Theme Park Phase I - Opening Day, Theme Park Phase II - Buildout and PBRL, where average and peak generation rate for C&D waste are 29 $m^3 d^{-1}$ and 45 $m^3 d^{-1}$ respectively, whereas for public fills generation are 118 $m^3 d^{-1}$ and 178 $m^3 d^{-1}$, respectively. *Chemical Waste* A small volume of chemical waste, such as used lubricating oils from plant maintenance materials, will be produced. Provided 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* The maximum daily number of workers on site (4,300) will be from 2003 to 2004. Based on a waste generation rate of about 0.65 kg per person, it is estimated that the amount of general refuse to be generated will be in the order of 2.8 tpd.	*Recycling* According to the assessment, the market driven recycling industry can recycle 23-26 % of waste to be generated in the Theme Park. It is recommended that a additional further target of 10% for the recovery of recyclables and potentially, an extra 10% for the recover of source separated wood waste (assuming that a composting facility for food waste planned in the *Waste Reduction Framework Plan* is available) is adopted in the Waste Management Plan of the Theme Park. The composition of the waste and the actual recycling rate for various materials should be monitored. The preliminary recycling target should be reviewed on an annual basis to determine the practical recycling rate that can be achieved based on the recycling market as well as the potential change of the recycling target beyond the WRFP's 10-year planning period. *Disposal* Based on the waste arisings from the Theme Park and associated facilities less that recycled by informal sector or 23-26 %, the daily waste arisings in 2005, 2014 and 2024 will be 28 to 29 tpd, 54 to 57 tpd and 130 to 135 tpd, respectively. The Theme Park recyclable recovery programme can further reduce waste by 10 %, which in 2005, 2014 and 2024 will be 4 tpd, 7 tpd and 18 tpd respectively. In addition, when a composting facility becomes available in HK SAR, an extra 10 % of the waste could be recovered, ie 4 tpd, 7 tpd and 18 tpd in 2005, 2014 and 2024, respectively. The anticipated waste throughout of NLTS are 370, 770, and 880 tpd for the years 2006, 2011 and 2016, respectively. It indicates that there will be sufficient spare capacity at the NLTS to handle the waste arising from the Theme Park and associated developments at least to year 2016. HKITP should closely liaise with the EPD regarding waste transfer and disposal arrangements when the handling capacity of the NLTS is close to its maximum capacity.

Issue	Construction Impact	Operation Impact
		Chemical Waste The operation of the Theme Park at Penny's Bay will use a variety of chemicals. Some of the used chemicals have to be disposed of. The operation of the Theme Park at Penny's Bay will be very similar to that of Disneyland. In addition, the remains of fireworks from the fireworks shows in the Theme Park may contain heavy metal in low concentrations (in a scale of ng kg^{-1}), and mid-level fireworks remains may contain dioxins furans, under which is classified as chemical waste under *Schedule 1* of the *Waste Disposal (Chemical Waste) (General) Regulation*. Chemical waste will be stored, handled, transported and disposed of in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation* and the *Code of Practice on Packaging, Labelling and Storage of Chemical Wastes*. They should be collected and transported to the CWTC or other licensed facility by a licensed waste haulier.
		Sewage Sludge Based on sludge generation rate of 14,365 tds a^{-1} in 2011, approximately 40 tds per day of sludge will be generated, which is equivalent to approximately 130 m^3 of sludge. 10 m^3 skips (as currently employed in Sha Tin STW) could be used for transportation of sludge to the disposal facility. A maximum of 13 truck loads will be required. It is therefore considered that the traffic impacts associated with off-site sludge disposal will be minimal. Should the proposed centralised Sludge and Difficult Wastes Incineration Facility (SDIF) be located near the WENT landfill, it will be more cost effective and environmentally preferred to transport the sludge in modified 20ft ISO containers (similar to the one currently used at the Stonecutters' Island STW) via the NLTS to the WENT Landfill Reception Area and then to the SDIF. During the containment, storage and delivery of sewage sludge, odour impact may arise. Provided that fully enclosed containers and storage area are used and odour removal systems are installed, no adverse environmental impact is expected.

Issue	Construction Impact	Operation Impact
Mitigation Measures	The Contractor should development a Waste Management Plan to Engineer approval prior to construction. 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. *Dredged/Excavated Sediment* • 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/excavation; • any contaminated sediment dredged should not be allowed to stockpile on the 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 other overflowing of materials or polluted water during loading or transportation. *Use of Public Fill for the reclamation* The Contractor should enforce strict application of the public fill license and monitor the material placed in the reclamation and barges to control disposal of unauthorised material. The Contractor shall also provide floating booms and collect any floating materials on a daily basis at the public filling areas. *Measures Taken in the Planning and Design Stages to Reduce the Generation of C&DM* • avoidance and minimisation, that is, 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 law, guidelines and good practice.	To minimise the potential adverse impacts to aesthetics and odour impacts, the HKITP should maintain floating refuse collection initiatives at both the coast of the Theme Park and within the artificial lake of the Water Recreation Centre. *Waste Avoidance Measures* • electronic communications; message boards, routing slips and double-sided copying will be used, as far as practical, to reduce the quantities of paper that otherwise would require disposal at landfill; • worn linens to the maximum extent feasible based upon available markets and third-party recycling facilities be used to make scarves and aprons for cast members; • soft drinks to the maximum extent feasible based upon available markets and third-party recycling facilities be served in souvenir cups that are taken home by guests for reuse as opposed to being discarded at the Theme Park as waste, appropriate recycling bins should be set up to recover these cups for reuse or recycling if the visitors choose not to take them home; • hamburgers and similar food types will be wrapped in paper or an equally environmentally acceptable material instead of in polystyrene clamshells; • unused prepared food will be sent to a food bank, and distributed to the needy, to the maximum extent feasible based upon available markets and third-party recycling facilities; • excess water-based paints will be reused as far as practical; • plastic drink cup lids will be supplied to guests upon their request when purchasing beverages; • fast-food service trays in selected locations will be washed and reused (instead of using disposable cardboard carry-out trays); • souvenir, booklets, dining-ware, etc. which are recyclable should have appropriate instructions and signs printed on the surface; • waste recycling bins for paper, aluminium cans, plastic bottles, etc. should be provided throughout the Theme Park to promote waste separation at source; • all products sold in the Theme Park should be packed in minimal amount of packaging materials; • plastic pallets instead of wood should be used in transportation of food, drinks, etc.; • the distribution centre of the Theme Park will utilise reusable shipping containers as far as practical instead of cardboard boxes for internal routing' • fabric fenders instead of tropical hardwood fenders should be used at the proposed piers; and • the hoarding of the proposed piers should be metal (aluminium, alloy etc) instead of wood.

Issue	Construction Impact	Operation Impact
	This hierarchy should be used to evaluate the 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. Records of quantities of wastes generated, recycled and disposed (locations) should be properly kept. Standard formwork should be used as far as practicable in order to minimise the arisings of C&DM. The use of more durable formwork or plastic facing for the construction works should be considered during the detailed design. Any uncontaminated soil should be reused on site as far as possible for landscape works in order to minimise the amount public fill to be disposed off-site. Should there be any surplus public fill generated from the project, the HKITP should liaise with the Public Filling Sub-Committee to identify as far as possible suitable reclamation or site formation projects near the project site to reuse the material. The design of the foundation works will minimise the amount of excavated material to be generated. Should piling be required, H-piling will be used as far as practical. The purchasing of construction materials will be carefully planned in order to avoid over ordering and wastage of construction materials, such as ready mixed concrete. *Measures To be Taken in the Construction Stage To Reduce the Generation of C&DM* The Contractor should recycle as much as possible of the C&D material on-site. Public fill and C&D waste should be segregated and stored in different containers or skips to enhance reuse or recycling of materials and their proper disposal. 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 should be designated for such segregation and storage.	*Materials Recovery and Recycling Programme* *Papers:* Recycling bins will be provided at shops and food service locations to collect cardboard containers. Personnel in every office will be provided with bins to recycle office paper. Large containers for recycling paper will be placed near photocopy machines. The collected paper will be transported to RCPs at the back of house for sorting and baling. *Glass Bottles and Glass Jars*: Due to the number of activities that will be taken place at the hotels, such as conventions, banquets, bar service, and room service, substantial quantities of beverage bottles may be generated. Recycling bins will be placed in the service areas near the restaurants for recovery of glass bottles and jars. The operator should ensure that the collected glass containers could be reused/recycled. "Deposit-refund" scheme can be adopted to promote glass bottles recovery. The operator should also consider to shift to use other more promising recyclable beverage containers such as aluminium cans and plastic bottles. The collected glass bottles and jars will be transported to the RCP for processing and recycling. *Aluminium Cans*: Aluminium can recycling bins will be placed at break areas and pantries. The collected aluminium cans will be transferred to the RCP for processing. *Plastics:* Recycling bins for plastic bottles recovery should be set up at prominent places to facilitate visitors to participate in material recovery activities. Mixed plastic recycling programmes are difficult to implement because of the low bulk density of the material and its low value. Therefore, such programmes will be implemented to the extent practicable. The Theme Park will implement a source separating programme for polyethylene terapthalate (PET), high-density and low-density polyethylene (HDPE & LDPE). Most of the PET and HDPE consists of soft drink and water bottles and the major sources of this material may be at the hotels and restaurants. The PET and HDPE bottles collected will be transferred to the RCPs for collection by the recyclers. LDPE which is used in the warehouse distribution and delivery process may also be recycled. Shrink wrap, which is used to secure items being delivered on pallets on open tow carts, will be recovered to the extent practicable and delivered to the RCPs. Once sufficient material is accumulated to fill a truck, the recycler will be called in to collect the material. The recycling programme may extend to cover other types of plastics or to recycle mixed plastic if the technology is available to make the plastic recycling programme more efficient and cost-effective.

Issue	Construction Impact	Operation Impact
	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 disposal of inert material to public filling areas. 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* 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. 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* as follows. Containers used for 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. The storage area for chemical wastes should: • by 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.	*Kitchen Grease*: Should there be a market for kitchen grease in Hong Kong, the Theme Park Operator will consider establishing a kitchen grease recycling programme in Hong Kong. *Scrap Metal:* Due to the high value of scrap metal, there is a high incentive to recover and recycle the scrap metals generated from the Theme Park. Scrap metal will be generated and separated at the machine, welding, automotive and sheet metal shops. Scrap metal will also be collected, when feasible, on construction and demolition and rehabilitation projects. Scrap metal will be placed in roll on/off containers. Once the containers is full, the recycler will be called in to remove the loaded container and return an empty one. *Laser Printer Toner Cartridges*: The Theme Park will make arrangements with the toner cartridge suppliers to collect and recycle used toner cartridges for laser printers to avoid disposal of the cartridges at the WENT landfill as far as practical. *Green Waste*: The landscaping works will generate a considerable amount of grass clippings, leaves, brush and tree trimmings. However, the handling capacity of the existing Sha Ling composting facility is limited (about 15 to 20 tpd) and is currently composting livestock wastes. The facility is unlikely to be able to handle the green waste generated from the Theme Park. Should there be a market or facility which could process the green waste arising from the Theme Park, the HKITP is willing to consider establishing a recycling programme for green waste. *Scrap Lumber*: Wooden pallets should be reused as far as practicable. Broken pallets, wooden scrap and lumber from demolition projects will be collected and recycled as far as practical. Currently, there is a market for scrap lumber and it is anticipated that the scrap lumber generated from the Theme Park could be adsorbed by the local market. More durable pallets made from plastic lumber should be used wherever practicable. *Asphalt:* The Theme Park will require the contractor to reuse and recycle as much as practical the used asphalt generated from the construction and rehabilitation of asphalt roadways and parking lots. Any surplus used asphalt will be delivered to public filling facilities rather than landfill.

Issue	Construction Impact	Operation Impact
	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 re-user of the waste, under approval from the EPD. The Centre for Environmental Technology operates a Waste Exchange Scheme which can assist in finding receivers or buyers. *Management of General Refuse* 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 basis to minimise odour pest and litter impacts. The burning of refuse on construction sites is prohibited by law. 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 of easily accessible, so separate, labelled bins for their deposit should be provided if feasible. 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. In addition, waste separation facilities for paper, aluminium cans, plastic bottles etc., should be provided. *Management of Waste Disposal* A trip-ticket system should be established in accordance with *Works Bureau Technical Circular No 5/99* to monitor the disposal of C&DM and solid wastes at public filling facilities and landfills, and to control fly-tipping. A trip-ticket system will be included as one of the contractual requirements and implemented by the Engineer. The Engineer should audit the result of the system. A recording system for the amount of waste generated, recycled and disposed of (including the disposal sites) should be established during the construction stage.	*Sewage Sludge* The containment, storage and delivery of the sewage sludge should be enclosed. Odour removal facilities should also be installed to minimise the potential air quality impacts to any sensitive receivers.

Issue	Construction Impact	Operation Impact
	Staff Training Training should be provided to workers on the concepts of site cleanliness and on appropriate waste management procedures, including waste reduction, reuse and recycling at the beginning of the contract.	
Residual Impact	No residual impact.	No residual impact.
Environmental Acceptability	Acceptable	Acceptable