

8 WASTE MANAGEMENT IMPACT ASSESSMENT

8.1 Introduction

8.1.1 Infrastructure work for the housing development at Telegraph Bay will generate variable quantities and types of waste materials. This section of the EIA report involves an assessment of the potential environmental impacts from the waste generated for the proposed development. Reclamation work at Telegraph Bay was completed in 1989. The prime consideration relates to the excavation and removal of 330,000m³ of imported surcharge material and 156,400m³ of other excavated soils from the advance works and construction phase of the development. Post development considerations (following site occupation) have also been incorporated within this assessment.

8.1.2 The principal considerations include:

- (i) evaluation on the type and nature of wastes;
- (ii) estimation of total volumes; and
- (iii) assessment of handling, storage, transportation and disposal methods to be adopted and the potential environmental impacts.

8.2 Objectives

8.2.1 The overall objectives of the waste management assessment are summarised below:

- (i) to assess the activities involved for the proposed and determine the type, nature and estimated volumes of waste to be generated;
- (ii) to identify any potential environmental impacts from the generation of waste at the site;
- (iii) to recommend appropriate waste handling and disposal measures / routings in accordance with the current legislative and administrative requirements; and
- (iv) to categorise waste material where practicable (inert material / waste fractions) for disposal considerations i.e. public filling areas / landfill.

8.3 Waste Management and Environmental Regulations

8.3.1 Details on relevant legislative requirements and guidance regarding waste management in Hong Kong is presented within Chapter 3 of this report.

8.4 Nature and Type of Waste Materials

8.4.1 Advance Works and Construction Phase

8.4.1.1 Wastes which will be generated during the advance and construction phase of the development include the following:

- waste spoil from the removal of excess imported surcharge material (advance works);
- waste spoil from site preparatory works (e.g. top soil/vegetation) and excavation (e.g. pile foundations, excavation of service channels, cutting/landscaping features on site);
- marine muds from dredging operations;
- general construction waste (e.g. wood, scrap metal, concrete);
- chemical wastes generated by general site practices (e.g. vehicle and plant maintenance/servicing); and
- sewage and municipal wastes generated by site workers.

- 8.4.1.2 The sand and public fill for the surcharging works will be transported to site by barge. In total an estimated 630,000m³ of surcharge material will be imported to site, comprising approximately 360,000m³ of sand and 270,000m³ of public fill.
- 8.4.1.3 The proposed development site is primarily a reclaimed area and with the exception of the removal of excess surcharge material used for consolidation of the infill material and clearance of scrub/vegetation, no other demolition or site clearance requirements are relevant to the site under its current status. It is understood that bentonite slurries are *not* to be used during the construction.
- 8.4.1.4 In addition to the above, waste waters are also likely to be generated from:
- excavation and piling activities; and
 - vehicle and equipment washing.
- 8.4.1.5 Impacts on water quality from the generation of waste waters and proposed mitigation measures are discussed within Chapter 7. Total volumes generated on site cannot be accurately calculated although they are likely to be small.
- 8.4.1.6 Broad estimates for the volumes of generated waste have been calculated although total amounts will be determined by the contractor's working practices / site procedures and cannot be accurately quantified at this stage. Estimated volumes of materials to be generated are presented with Table 8.1. For volumes given a range of uncertainty of ± 20% has been estimated.
- 8.4.1.7 The construction programme is likely to extend over an approximate 4 year period, with the excavation and removal from site of excess surcharge material anticipated to take place over a 6 and 8 week period.

Table 8.1 Excavated and Waste Materials Arisings during the Advance Works and Construction Phase

Activity	Material Type	Total Quantities
<i>Site clearance</i>	Vegetation (trees/shrubs)	Coverage* - 11.2 ha (woodland) - 4.3 ha (shrubs)
<i>Excavation</i> (removal of excess surcharge material)	Imported surcharge material (sand and public fill)	330,000m ³
<i>Excavation</i> Piled foundations	Soil	10,000m ³
Service routes, service inspection chambers	Soil	1,400m ³
Cuttings / Landscape areas	Soil	135,000m ³
Box culvert (part of advance works)	Soil	6,000m ³
Marine Dredgings	Marine Muds	<4,000m ³
<i>Construction</i>	Construction Waste	1000m ³ **
	Chemical Waste (fuel, oils)	450 litre/month***
	General Refuse	1.07 kg per employee/day***

* Volume estimates will be based upon vegetation height and density of cover. Not expected to exceed 5000m³.

** Not expected to be exceeded (estimate based upon data from similar construction projects)

*** Provisional estimate

- 8.4.1.8 A summary of the waste types which will be generated during the advance works and construction phase is given within sections 8.4.1.1 to 8.4.1.4.

8.4.1.9 The majority of the proposed development site at Telegraph Bay is located within a reclamation area with the exception of Site 1 (undeveloped scrub land, residential) and Site 5 (Waterfall Golf Driving Range). The golf driving range located at Site 5 is the only known, non residential land use to have been identified within the development area.

8.4.1.10 Available historic aerial photographs and land survey maps, obtained from the Survey and Mapping Office (Lands Department), were reviewed in order to determine the previous land use at Site 5. A summary of the references reviewed is given below :

Source Reference	Dates
Aerial Photographs	1963, 1967, 1976, 1979, 1980, 1981, 1982, 1984, 1985, 1986, 1988, 1990, 1992, 1996, 1998
Survey Maps 1:5000 11-SW-C	1974, 1979, 1987, 1997

8.4.1.11 The earliest data source reviewed (aerial photograph dated 1963) indicated that Site 5 was occupied by two small buildings, the larger one with a rounded roof and located on a concrete platform. The area did not appear to be industrial in nature. The immediate surrounding area was terraced and cultivated. By 1979 the larger building had been demolished and replaced by a residential property. No changes in the site use were evident until 1986 when the area was excavated. The excavation works appear to commence on Site 5 at the same time as the Telegraph Bay reclamation works. By 1996 the excavation on site was complete and the area occupied by the golf driving range.

8.4.1.12 The golf driving range is not considered to present a potential for land contamination. Brief consultation with the ground maintenance contractor for the site identified that agrochemicals (fertilisers and herbicides) are applied sparingly and at fixed time intervals (e.g. application approximately every 4 monthly). Any agrochemicals used for ground maintenance are unlikely to present any significant risk since the use of such materials is controlled and in line with usage on, for example lawns or other public open spaces. Application is kept to minimum since the area is used by the public. It is also considered unlikely that significant concentrations would remain due to a number of processes e.g. biodegradation, surface runoff, binding to soils and immobilisation.

8.4.1.13 The potential for land contamination is therefore considered to be low. An investigation to assess the potential for ground contamination is not considered necessary.

8.4.1.1 *Excavated Material (Surcharge and Underlying soils)*

8.4.1.1.1 Any material to be excavated should be clean and acceptable for reuse either on site or for transportation to public filling areas / reclamation sites (i.e. the material complies with public dumping licensing requirements).

8.4.1.1.2 The imported surcharge material will be sand / public fill and the excavated soils principally reclamation fill which is understood to comprise gravelly coarse sand with many cobbles, boulders and building debris (detailed within earlier geotechnical site investigation reports¹). The reclamation fill is underlain by marine deposits and alluvium.

¹ Infrastructural Works for the Housing Development at Telegraph Bay. Draft EGWP5 Geotechnical Study of the Reclamation. August 1998. Mott Connell Ltd.

- 8.4.1.1.3 In addition, construction of the submarine outfall for the proposed sewage treatment works would require the removal and disposal of marine mud (an estimated volume of 4000m^3). The potential impacts and mitigation requirements relating to the excavation and removal of this material are discussed within Chapter 7.
- 8.4.1.1.4 Preliminary analysis of the marine mud has been carried out and results (as discussed in Chapter 7) indicate that the material is not contaminated (Class A – uncontaminated material, no special dredging or disposal requirements). Standard mitigation procedures will still be applicable to the dredging operations. Disposal options are outlined within this section of the report.
- 8.4.1.1.5 During the site preparatory works areas of woodland and some scrub/grassland will be cleared from site which will require disposal. An estimated area of approximately 11.2 ha (refer to Chapter 9) of woodland will be cleared, the majority of which (about 10.2 ha) is young woodland and less than 10 years old. Shrub cover occupies approximately 4.3 ha of the development site. Detailed information on the density and height of vegetation cover is not available at this stage and total volumes to be generated have been broadly estimated only (not expected to exceed 5000m^3).
- 8.4.1.2 *Construction Waste Material*
- 8.4.1.2.1 Construction waste likely to be generated during the site formation works include the following:
- waste wood from site hoarding and concrete form work;
 - waste steel bars from concrete reinforcement activities; and
 - material and equipment wrappings.
- 8.4.1.3 *Chemical Waste Material*
- 8.4.1.3.1 Chemical wastes to be generated during construction are likely to principally result from plant and vehicle maintenance and servicing. Typical wastes may include the following:
- solids wastes
 - empty fuel/lubricant drums;
 - used oil/air filters;
 - scrap batteries; and
 - vehicle parts.
 - Liquid wastes
 - used lubricants;
 - spent acid/alkali from batteries maintenance;
 - waste oils/grease;
 - gearbox fluids;
 - spent mineral oils/cleaning fluids; and
 - spent solvents/detergents produced from cleaning activities.
- 8.4.1.3.2 The majority of chemical waste produced is expected to consist of waste lubricants and oils.

8.4.1.4 *Municipal and Sewage Waste*

8.4.1.4.1 Site construction workers will generate municipal (solid / liquid) and sewage wastes which have a potential to cause odour, health and water quality impacts. Municipal waste will be predominantly composed of food wastes, packaging and waste paper.

8.4.1.4.2 Approximately 1.07kg/employee/day of municipal waste is expected to be generated (Monitoring of Municipal Solid Waste 1996, EPD (1997) Hong Kong Government). The total quantity of waste generated will thus be dependent of the number on site workers the contractor proposes to use.

8.4.2 Post Development Phase (Site Occupation)

8.4.2.1 The proposed end use for the site comprises residential housing G/IC facilities and associated infrastructure. Wastes generated following site occupation should therefore be restricted to sewage and municipal wastes.

8.4.2.2 At this stage a detailed assessment of the quantities of waste materials generated has not been carried out and will be largely dependent (but not solely) upon the total population of the Telegraph Bay site.

8.4.2.3 Proposals for integrated domestic recycling strategies are being assessed as part of the Waste Reduction Study commissioned by the Hong Kong Government. Implementation of any recycling schemes / waste reduction strategies may result in a reduction of the total volumes generated.

8.4.2.4 Proposals for a sewage treatment plant located on site and associated Chemical Enhanced Preliminary Treatment (CEPT) Plant would generate sludge material (estimated at 4m³/day) requiring disposal to landfill and water effluent discharges.

8.4.2.5 All sludge material requiring landfill disposal must satisfy specific criteria with respect to percentage solid content. Dewatering or pretreatment may be requirement prior to landfill disposal and will need to be evaluated in order to identify an appropriate disposal route. It is understood that in general, sediments with a maximum 70% moisture content are acceptable at Hong Kong's strategic landfill sites.

8.5 Potential Impacts & Mitigation Measures

8.5.1 Waste materials have the potential to cause adverse environmental impacts during generation, storage, transport and disposal. Provided that there is strict management and control of all wastes generated on site during the works, and that material is collected, handled, stored, transported and disposed of in an appropriate manner, no significantly adverse environmental impacts are anticipated.

8.5.2 The development project should aim to implement waste management procedures in order to maintain minimal potential impacts to the environment. Overall this may be achieved by consideration and application of the protocols for each stage of the development i.e.

- (i) in the first instance and where practicable avoiding and/or minimising waste generation by improvements/changes in site design or procedures
- (ii) reusing/recycling/recovering materials where possible and thereby negating / minimising disposal requirements (e.g. by waste segregation according to type, separation of recyclable materials such as metal, reuse of wood from site

- hoarding/concrete formwork, utilisation of excavated materials such as rock fill and top soil on site for backfilling or landscaping)
- (iii) ensuring that all treatment and disposal options comply with best practice and any relevant guidelines and legislation.
- 8.5.3 In view of the anticipated volumes of wastes to be generated on the site during the construction phase from the removal of excess surcharge material and other excavated soils, accurate records should be maintained detailing the quantities of materials a) generated on site b) reused on site and c) disposed off site, together with disposal routes/locations. This accords with good site practice.
- 8.5.4 Waste materials should be disposed off site as soon as possible and volumes generated during the site formation works should be minimised, through recycling and reuse. Solid materials which cannot be recycled or reused will need to be disposed of to landfill, public dumps, or the chemical waste treatment plant.
- 8.5.5 Further to this assessment the above recommendations for waste management should be included in the contractors Environmental Pollution and Control Requirements as well as the Environmental Monitoring and Audit Manual.
- 8.5.1 Excavated Materials
- 8.5.1.1 Environmental impacts that may be generated during handling, storage and disposal of the excavated materials will need to be controlled. The principal adverse effects relate to dust, visual impacts, water quality and general health and safety.
- 8.5.1.2 The majority of the material to be excavated should be clean and acceptable for reuse either on site as filling materials or for transportation to public filling areas / reclamation sites.
- 8.5.1.3 Excavated materials should be reused or transported off site as soon as it is generated in order to minimise the potential for adverse environmental impacts. It is recognised that stockpiling of material will be required in some instances. Any stockpiles should be clearly segregated in terms of material type as far as practical. This will aid in the potential for re-use of material (e.g. top soil for landscaping, suitable fill material for engineering works) and in final disposal, if necessary. Within the stockpile area, measures should be in place to control the generation of dust and contaminated surface water run-off (i.e. high suspended solids).
- 8.5.1.4 All excavated material will need to be handled in a manner that minimises the release of fugitive dust to nearby residences, especially during hot and dry weather. This will require the use of dust suppression measures such as dampening with the fine water spray and covering with tarpaulin. Where possible the movement of material should also be kept to a minimum. Air quality impacts are discussed within Chapter 4 of this report.
- 8.5.1.5 The use of water sprays should be controlled to prevent the generation of site runoff contaminated with elevated levels of suspended solids. The surface water system for the stockpile area should be segregated and fitted with silt traps where necessary. During heavy rainfall material should also be covered. Stockpiles can also be visually intrusive. Such impacts can be mitigated through locating the stockpile appropriately to minimise visual impacts.

- 8.5.1.6 The following measures should be incorporated into the Environmental Pollution and Control Requirements for the contractors' specification for stockpile management:
- locate stockpiles to minimise visual impacts and nuisance related to noise and air quality (dust);
 - minimise land-take by minimising the size of the stockpiles and associated working areas;
 - provide fencing to separate sensitive habits and landscape areas to prevent stockpiling at inappropriate locations;
 - designate appropriate haulage routes;
 - use dust suppression techniques; and
 - prevent surface water pollution by the use of berms and channels and direct runoff into retention ponds, settlement ponds and/or silt traps.
- 8.5.1.7 A reduction in the volume of material to be disposed to public filling areas may be achieved by optimising the re-use of suitable material on site as far as practical. Proposed areas on the development site include:
- Route 7 surcharge works (300,000m³);
 - Road D1/D2 embankment construction (29,500m³); and
 - General landscaping areas (28,920m³).
- 8.5.1.8 Volumes of material which may be incorporated into these areas have been estimated at this stage and are preliminary indicators only. Further assessment of the potential for material re-use off site may also be carried out with completion of the Fill Management Committee (FMC) Questionnaire on Surplus and Fill Requirements. Potential restrictions however may apply due to timing and possible delays between when excavated materials are available for re-use and when the material may be utilised on site as part of the site formation works. Consent from the District Lands Office will be required to allow any temporary stockpiling, with agreement from other relevant parties.
- 8.5.1.9 Table 8.2 summarises the estimated values of materials to be re-used and transported off site for disposal.

Table 8.2 Summary of materials to be re-used / transported off site for disposal

Material type	Time of Arising*	Estimated total volumes generated	Estimated volumes for re-use on site / Route 7 works	Estimated volumes for off site disposal**	Proposed off site disposal method/area
Vegetation	Months 2-3 Advance works	<5,000m ³	-	<5,000m ³	Recycle / landfill
Excess surcharge material	Months 18 & 21 Advance works	330,000m ³	Route 7 surcharge works – 300,000m ³ D1/D2 – 29,500m ³ Landscaping – 28,920m ³	123,980m ³	Public fill area
Excavated materials (other)	Months 4-48 Main works Months 3-12 Advance works (Box culvert)	152,400m ³			
Marine Muds	Month 5-24 Main works	<4,000m ³	-	<4,000m ³	Marine disposal [#]
Construction wastes	Project duration	10,000m ³	-	10,000m ^{3##}	Public fill area

* refer to estimated works schedule presented in Appendix 2.1

** does not include requirement to dispose of material following completion of Route 7 surcharge works

material is uncontaminated

dependent upon site practices – cannot be estimated at this stage

- 8.5.1.10 Organic matter (vegetation and wood) from the site clearance works will also require disposal. Where practical, material which can be utilised should be segregated and transferred off site to a suitable handling facility. Material that may not be segregated practically or is unacceptable for re-use should be sent to a suitable disposal landfill such as the SENT Landfill (SENT restrictions specify a maximum of 30% by weight of inert construction and demolition waste).
- 8.5.1.11 Confirmation of the classification of marine sediments should be carried out prior to the selection of the final disposal option. Guideline values issued within the EPD Technical Circular No 1-1-92 can be used to determine suitability of dredged materials for marine disposal (classification is based upon metals only). The Works Branch Technical Circular No. 22/92 outlines the procedures to be followed for the disposal of marine muds. For uncontaminated mud disposal requirements of $500,000\text{m}^3\text{ PEPO/SWC}^2$ will handle applications for disposal.
- 8.5.1.12 Preliminary analysis of the marine mud has been carried and results (as discussed in Chapter 7) indicated that the material is not contaminated (Class A – uncontaminated material, no special dredging or disposal requirements).
- 8.5.1.13 Excavated material which cannot be re-used on site may be transferred to another development project and re-used within possible engineering/landscaping works. Material which cannot be re-used will require disposal to public filling areas. The following disposal sites for public filling are *currently* available, however it is recognised that these areas lie remote from the development site.
- Tuen Mun Area 38 Reclamation
 - Pak Shek Kok Reclamation
 - Tsueng Kwan O Area 137 Stage II
 - Shatin/Ma On Shan Reclamation
- 8.5.1.14 The capacity for the above public filling areas to accept wastes during the construction period will however be dependent upon current and future demands on these disposal sites. Accurate predictions on the likely disposal site for the excavated material during the construction phase of the Telegraph Bay development cannot be made at this stage.
- 8.5.1.15 The majority of material removal will take place during the advance works (removal of excess surcharge material) and the initial 24 months of the construction works programme (excavated soils from cutting/landscaping works). This material will be transported from site by marine based access (estimated at $112,580\text{m}^3$ of excavated soils, 4000m^3 of marine muds). These estimates are based upon the assumption that some materials will be re-used on site or as part of the Route 7 works, as detailed within Table 8.2. The total volumes of waste material to leave the site by road are anticipated to be small and principally associated with construction wastes (not expected to exceed $10,000\text{m}^3$) and some volumes of excavated soils (estimated at $11,400\text{m}^3$). Road access to the site is not scheduled for completion until 2003, by which time the majority of excavation works will be completed.
- 8.5.1.16 A traffic impact assessment has been carried out for the Telegraph Bay development by MVA Hong Kong Ltd.

² Principal Environmental Officer of the Solids Waste Control Group of EPD

8.5.2 Construction Waste Materials

8.5.2.1 In view of the inert nature of such material, its disposal is unlikely to cause long-term environmental concern. Stockpiling of all material prior to disposal should comply with the control measures outlined earlier in order to minimise any potential impacts related to dust, visual impact, water quality and general health and safety.

8.5.2.2 The excessive generation of construction wastes increases disposal costs and may take up valuable landfill space. Implementation of good site management, planning and design considerations should be in place to reduce over-ordering and waste generation. Where possible, construction wastes such as wood and metal should be separated out from other wastes for recycling. All recyclable material should be clearly segregated and stored in appropriate skips/containers or stockpiled. Segregation of material will aid in the potential for re-use of material and in final disposal, if necessary. Material recycling or re-use reduces the requirement for new construction materials together with overall collection, transport and disposal costs. Only when material cannot be reused should it be disposed of to a public filling area (<20% non inert materials) or, as a last resort, landfilled.

8.5.2.3 It will be the contractor's responsibility to ensure that waste is collected by approved licensed waste collectors and that appropriate measures are taken to minimise adverse impacts such as dust generation. The contractor must also ensure that all necessary waste disposal permits are obtained.

8.5.3 Chemical Waste

8.5.3.1 Chemical wastes as defined in the Waste Disposal (Chemical Waste) (General) Regulation will require disposal by appropriate and approved means and could require pre-notification to EPD prior to disposal.

8.5.3.2 Potential hazards associated with the inappropriate handling of these materials include:

- effects on human health (i.e. dermal and toxic effects with respect to site workers);
- phytotoxic effects to vegetation;
- contamination of the soil, groundwaters and surface water following spillage;
- risk of fire or explosions; and
- discharge of chemical wastes to sewer and potential disruption of the sewage treatment works.

8.5.3.3 Chemical wastes should be stored in a locked, fully bunded area which is impermeable to both water and the waste being stored. The waste storage area should also be covered to prevent rainfall from accumulating within the bunded areas. The bunded area must have a volume of either 110% of the largest container or 20% by volume of the chemical waste stored in that area. Appropriate spill absorption material should be stored near the storage area in order to clean up any minor spill events. The risks associated with spillage can be further minimised by the following:

- designation of an appropriate, well ventilated storage area;
- minimisation of waste production and careful handling of waste fuel and oil residues;
- use of appropriate and labelled (Chinese and English) storage containers;
- storage of wastes remote from sensitive receivers (e.g. drains, residential properties and water bodies); and
- education of workers on the concepts of site cleanliness and appropriate waste management procedures.

8.5.3.4 An appropriate disposal facility could be the Chemical Waste Treatment Centre (CWTC) at Tsing Yi. If chemical wastes are to be generated, the contractor will need to register with EPD as a chemical waste producer and observe the requirements for chemical waste storage, labelling, transportation and disposal. The contractor will have to furnish EPD with the following information:

- particulars of the waste producer, a nominated contact person and type of business;
- particulars of the waste generation processes, locations of waste arisings; and
- waste types, quantities and generation rates.

8.5.3.5 The contractor will also need to consider the guidance in "A Guide to Chemical Waste Control Scheme: A Guide to the Registration of Chemical Waste Producers" and the "Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes".

8.5.3.6 Where appropriate, recycling/reprocessing opportunities for certain waste liquids (i.e., oils and solvents) should be identified to reduce overall volumes.

8.5.3.7 Material that is not acceptable to the CWTC such as spent batteries should be sent to a co-disposal landfill such as the SENT Landfill.

8.5.4 Municipal / Sewage Wastes

8.5.4.1 The storage of municipal wastes if not appropriately managed can give rise to several adverse environmental impacts for site workers and site neighbours. These include:

- odour nuisance if putrescible material is not collected on a frequent basis;
- wind-blown material causing litter problems;
- vermin and pests in the waste storage area if it is not well maintained and cleaned regularly; and
- adverse visual impact.

8.5.4.2 A temporary refuse collection facility should be set-up by the contractor. Wastes should be stored in appropriate containers prior to collection and disposal. A private waste collection firm may be commissioned by the site contractor to remove the waste regularly (daily basis), to the satisfaction of the Engineer.

8.5.4.3 Sewage generated on the site should be controlled through the use of chemical toilets or sewage holding tanks. Either would require regular cleaning with the resulting sewage disposed of appropriately (i.e. sewage treatment works).

8.5.4.4 Following site occupation considerations to the above municipal and sewage waste control measures apply.

8.6 Conclusions and Recommendations

8.6.1 Site formation works for Telegraph Bay are expected to generate a number of waste materials. These include:

- vegetation from site clearance works;
- waste spoil from excavation and site preparatory works;
- sediments from marine dredgings;
- construction waste materials;
- chemical wastes (limited quantities); and
- municipal / sewage wastes

8.6.2 The potential impacts of waste arisings from the construction and post construction phases of the development have been assessed. In order to suitably manage the potential environmental effects full consideration should be given to the re-use of surplus clean material on site or within other development projects once material balances are known.

8.6.3 In view of the large volumes of material to be removed during the advance and construction works this would assist in reducing impacts to known pressures on the filling capacity of public filling areas.

8.6.4 All mitigation measures outlined within this section should be in place to control or eliminate the potential impacts to the environment from waste generation for the development site.

8.7 References

Practice Note For Professional Persons ProPECC PN 1/94

EPD Technical Circular No. 1-1-92, "*Classification of Dredged Sediments for Marine Disposal*"