# 11 Waste Management Implications

## 11.1 Introduction

This chapter presents the findings of the assessment of waste management implications arising from the SCL (TAW-HUH) during the construction and operational phases. Opportunities for waste avoidance, minimisation, reuse, recycling and disposal were examined. With the construction material import/ export balancing design approach and the appropriate mitigation measures implemented during the different phases of the Project, potential environmental impacts associated with waste management would be insignificant.

The waste management implication assessment has been conducted in accordance with the requirements of Annexes 7 and 15 of the TM-EIAO and Clause 3.4.2 of the EIA Study Brief for the Project.

## 11.2 Environmental Legislation, Standards and Guidelines

The relevant legislation and associated guidance notes relate to the study for the assessment of waste management implications include:

- Waste Disposal (Amendment) Ordinance (Cap 354) and subsidiary Regulations;
- Environmental Impact Assessment Ordinance (Cap 499) and subsidiary Regulations;
- Dumping at Sea Ordinance (Cap 466);
- Land (Miscellaneous Provisions) Ordinance (Cap 28); and
- Public Health and Municipal Service Ordinance (Cap 132) – Public Cleansing and Prevention of Nuisances By-laws.

Under the Waste Disposal (Amendment) Ordinance, some of the regulations are relevant to this EIA, including:

- Waste Disposal (Chemical Waste) (General) Regulation (Cap 354); and
- Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap 354).

### 11.2.1 Waste Disposal (Amendment) Ordinance

The Waste Disposal Ordinance (WDO) prohibits unauthorised disposal of wastes. Construction and Demolition (C&D) waste is not directly defined in the WDO but is considered as “trade waste” which is defined as waste from any trade, manufacturer or business, or any wasted building, or civil engineering materials, but does not include animal waste.

Under the WDO, wastes can only be disposed of at sites licensed by EPD. Breach of these regulations can lead to a fine and/ or imprisonment. The WDO also stipulates the requirements for issuing licenses for the collection and transportation of wastes. Licenses are however not required for the collection and transportation of C&D waste or trade waste.

### 11.2.2 Waste Disposal (Charges for Disposal of Construction Waste) Regulation

Under the WDO and the Charging Regulation, wastes can only be disposed of at designated waste disposal facilities licensed by EPD. Schedule 5 of Regulation defines that inert construction waste includes rock, rubble, boulder, earth, soil, sand, concrete, brick, tile, masonry or used bentonite. According to Schedule 6 of the Regulation, construction waste delivered to a landfill for disposal must not contain more than 50% by weight of inert material. Construction waste delivered to a sorting facility for disposal must contain more than 50% by weight of inert material, and construction waste delivered to a public fill reception facility for disposal must consist entirely of inert material.

For construction work with a value of more than HK$1M, the main contractor is required to establish a billing account at EPD before transporting the construction waste to the designated waste disposal facilities (eg landfill, public fill etc). The vessels for delivering construction waste to public fill reception facility would need prior approval from EPD. Breach of these regulations can lead to a fine and/or imprisonment.

Depending on the percentage of inert materials in the construction waste, construction waste can be disposed at public fill, sorting facilities, landfills and outlying islands transfer facilities where different disposal cost would be applied. The scheme encourages reducing, reusing and sorting of construction waste such that the waste producer can minimise their disposal fee.

### 11.2.3 Waste Disposal (Chemical Waste) (General) Regulation

Chemical waste includes any scrap materials, or unwanted substances specified under Schedule 1 of this Regulation, if such a substance or chemical occurs in such a form, quantity or concentration that causes pollution or constitutes a danger to health or risk of pollution to the environment.

A person shall not produce, or cause to be produced, chemical wastes unless he is registered with EPD. Any person who contravenes this requirement commits an offence and is liable to a fine and/or imprisonment. Chemical wastes must be treated, utilising on-site plant licensed by EPD or have a licensed collector to transport 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 trace wastes from production to disposal.

This regulation also prescribes the storage facilities to be provided on site including labelling and warning sign. To minimise the risks of pollution and danger to human health or life, the waste producer is required to prepare and make available written emergency procedures for spillage, leakage or accidents arising from storage of chemical wastes. The waste producer must also provide employees with training for such procedures.

### 11.2.4 Dumping at Sea Ordinance

According to the Dumping at Sea Ordinance, a permit from EPD is required if any waste producer intend to dump materials from vessels to designated marine dumping areas. The Authority will consider a number of factors including sources and nature of materials to be dumped, dumping rates, need for inspection / testing, water pollution avoidance measures etc before determining whether such a permit would be granted and, where deemed necessary, any conditions to be complied with. Breach of the requirements in the permit would result in a fine and / or to imprisonment.

### 11.2.5 Land (Miscellaneous Provisions) Ordinance

The inert portion of C&D materials may be taken to public filling facilities including public filling area, public filling barging points and stockpiling areas. These facilities usually form part of land reclamation schemes and are operated by CEDD. This ordinance requires Dumping Licenses (to be issued by CEDD) to be obtained by individuals or companies, who deliver inert C&D materials to the public filling facilities.

Individual licenses and windscreen stickers are issued for each vehicle involved. 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, individual and chemical wastes, animal and vegetable matters and any other materials considered unsuitable by the Filling Supervisor.

### 11.2.6 Public Cleansing and Prevention of Nuisances Regulation

This regulation provides further control on illegal dumping of litter or waste in street and public places (including water course, stream, channel etc). Offence of this regulation would result in a fine and / or to imprisonment.

### 11.2.7 Other Relevant Guidelines

The following documents and guidelines also relate to waste management and disposal:

**Table 11.1:** Other relevant documents and information

| Bureau / Department | Documents / Guidelines / Technical Circulars |
|---|---|
| ex-Planning, Environmental and Lands Branch | • Waste Disposal Plan for Hong Kong (December 1989)<br>• Waste Reduction Framework Plan, 1998 to 2007 |
| ex- Environment, Transport and Works Bureau | • Works Branch Technical Circular (WBTC) No. 32/92, The Use of Tropical Hard Wood on Construction Site<br>• WBTC No. 2/93, Public Dumps<br>• Works Bureau TC No 2/93B, Public Filling Facilities<br>• WBTC No. 16/96, Wet Soil in Public Dumps<br>• Works Bureau TC Nos. 4/98 and 4/98A, Use of Public Fill in Reclamation and Earth Filling Project<br>• Works Bureau TC Nos. 25/99, 25/99A and 25/99C, Incorporation of Information on Construction and Demolition Material Management in Public Works Sub-committee Papers<br>• Works Bureau TC No. 12/2000, Fill Management<br>• Works Bureau TC No. 19/2001, Metallic Site Hoardings and Signboards<br>• Works Bureau TC No. 06/2002, Enhanced Specification for Site Cleanliness and Tidiness<br>• Works Bureau TC No. 12/2002, Specification Facilitating the Use of Recycled Aggregates<br>• Chapter 4 of the General Guidelines for Management of the Project Administration Handbook (PAH)<br>• ETWBTC (Works) No. 34/2002, Management of Dredged / Excavated Sediment<br>• ETWBTC (Works) No. 19/2005, Environmental Management on Construction Site |
| DEVB | • DEVB TC (Works) No 6/2010, Trip-ticket System for Disposal of Construction and Demolition Materials |
| EPD / CEDD | • New Disposal Arrangements for Construction Waste (1992) |
| EPD | • A Policy Framework for Management of Municipal Solid Waste (2005 -2014), (December 2005)<br>• Code of Practice on the Packaging, Labeling and Storage of Chemical Wastes (1992) |
| PlanD | • Hong Kong Planning Standards and Guidelines, Chapter 9 (Section 6 – Waste Management) |

According to Chapter 4 of the General Guidelines for Management of the Project Administration Handbook (PAH), for Designated Projects, a Construction & Demolition Material Management Plan (C&DMMP) has to be submitted to the Public Fill Committee in case of C&D materials exceed 50,000$m^3$.

ETWBTC (Works) No. 19/2005, Environmental Management on Construction Site, sets out the policy, procedures and requirements for contractor to prepare and implement and enhanced Waste Management Plan, which becomes a part of the Environmental management Plan in accordance with the aforesaid ETWBTC (Works) No. 19/2005.

### 11.2.8 Disposal Criteria for Dredged / Excavated Sediment

ETWBTC (Works) No. 34/2002 stipulates the procedures for seeking approval to dredged/ excavated sediment and the management framework for marine disposal of such sediment. Applications for approval of dredging proposal and allocation of marine disposal shall be made to the Secretary of Marine Fill Committee (MFC). Marine Dumping Permits as stipulated under the Dumping at Sea Ordinance are required from EPD for the disposal of dredged sediment. No dredging works is allowed to proceed until all issues on management of dredged sediments have been resolved and all relevant arrangements have been endorsed by the relevant authorities including MFC and EPD. The Project Proponent has regularly provided update information to MFC via Railway Development Office (RDO) on estimated quantities of sediment disposal from SCL (TAW – HUH), for reserving the relevant dumping sites allocated by MFC. Exact location of marine disposal will be assigned by MFC. The project proponent had obtained confirmation from MFC on the proposed disposal arrangement before the commencement of the construction works (see MFC's letter included in **Appendix 11.1**).

### 11.2.9 Landfill Disposal Criteria for Contaminated Soil

Excavated contaminated soil has to meet certain criteria before disposal to landfill is allowed. The criteria are set out in the Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards and Car Repair/ Dismantling Workshops. These criteria relate primarily to Toxicity Characteristic Leaching Procedure (TCLP) limits. In case these limits are exceeded, in-situ treatments would be required before final disposal to landfill.

## 11.3 Assessment Methodology

The potential environmental impacts associated with the handling and disposal of waste during the construction and operational phase will be assessed in accordance with the following:

- Estimation of the types, timing and quantities of the wastes to be generated; and
- Assessment of the potential impact on the capacity of waste collection, transfer and disposal facilities.

Secondary environmental impacts due to the management of waste, including potential air emission and noise arising from the temporary spoil stockpiling and barging facility has been assessed and evaluated in **Sections 7 and 8** of this Report respectively.

## 11.4 Identification and Evaluation of Waste Management Implications

### 11.4.1 Construction Phase

During the construction phase, the main activities (land based) that will potentially generate waste include excavation, tunnelling (cut-&-cover, drill-&-blast, TBM, mining), demolition and construction of stations and associated structures. Typical waste types associated with these activities include:

- C&D materials;
- C&D waste;
- Excavated contaminated materials and marine sediments;
- Chemical waste; and
- General refuse.

Bituminous materials generated will be separated from other inert material during the onsite sorting process as far as practicable.

#### 11.4.1.1 C&D Materials

The proposed alignment will run through various layers of materials including rock at the bottom and marine sediments (as residual material from previous reclamation works in Kai Tak and Ho Man Tin) at some of the locations, and fill material on the top. These materials will need to be excavated for cut-&-cover and open-cut activities (eg tunnels, stations etc). For bored and mined tunnelling, only the spoil within the tunnel will be excavated. The construction of SCL (TAW-HUH) is to be conducted in stages and the major construction sites are shown in **Table 11.2**.

**Table 11.2 :** Key Working Sites during Construction of SCL (TAW-HUH)

| Working Sites | Activity Period | |
|---|---|---|
| | From | To |
| HIK and TAW to Hin Keng Viaducts & At Grade Structures | 2013 | 2016 |
| Hin Keng to Ma Chai Hang Tunnels and MCV | 2013 | 2016 |
| Ma Chai Hang to DIH Tunnels and DIH to Prince Edward Road East Tunnels | 2012 | 2016 |
| Lung Cheung Road Road Diversion & Piling Works for DHS | 2012 | 2014 |
| DIH & DHS | 2012 | 2016 |
| DHS to KAT Tunnels and DIH (below Prince Edward Road East) to KAT Tunnels and KAT to TKW Tunnels | 2012 | 2015 |
| KAT and Sections of Approach Tunnels | 2012 | 2015 |
| TKW and Sections of Tunnels between KAT & TKW and TKW to MTW Tunnels | 2012 | 2016 |
| MTW and MTW to HOM Tunnels | 2012 | 2016 |
| Kai Tak Runway Barging Facility | 2012 | 2012 |
| HOM [1] | 2011 | 2015 |
| HUH [1] | 2012 | 2015 |

Note:
[1] Construction of HOM and HUH will be implemented under other Designated Project

**Tables 11.3a-b** give the estimated quantity of C&D materials and sediments to be excavated.

**Table 11.3a:** Summary of quantities of C&D materials generated [1] [2]

| C&D Material | | Total ($m^3$) |
|---|---|---|
| Soft Material | | 3,489,600 |
| Rock | All grades | 452,200 |
| Artificial Hard Material | Bituminous / Concrete pavement | 80,000 |
| Sub-total | | **4,021,800** |
| Material Re-used | | 455,000 |
| Disposal | | **3,566,800** |

Note:
[1] Quantities of C&D materials from HUH are: soil material 138,000$m^3$, and 52,600$m^3$ sediment.
[2] Quantities of C&D materials from HOM are: rock 678,500$m^3$, AHM 8,200$m^3$, soil material 403,400$m^3$ and non-inert 5,900$m^3$.
[3] The quantities shown above are estimates only and will be subject to further review during the detailed design and construction stage.

**Table 11.3b:** Summary of quantities of sediments generated

| Material | | Total ($m^3$) |
|---|---|---|
| Sediments | Land-based & Marine-based sediment | 278,400 |
| Sub-total | | **278,400** |

Note:
The quantities shown above are estimates only and will be subject to further review during the detailed design and construction stage.

The total volume of C&D materials and sediments generated is estimated to be 4,300,200$m^3$. A total of 455,000$m^3$ of the materials will be reused in the project, whilst the remaining 3,845,200$m^3$ is required to be disposed. For HUH, 138,000$m^3$ of soil and 52,600$m^3$ of sediment will be disposed of by SCL (MKK-HUH). For HOM, 678,500$m^3$ of rock, 8,200$m^3$ of AHM, 403,400$m^3$ of soil and 5,900$m^3$ of non-inert material will be disposed of by KTE.

The C&D surplus materials are mainly generated from station construction in early stage of the Project (Year 2012 ~ 2014). The fill materials are used for backfilling on top of station and stabling sidings at later stage (Year 2015 ~ 2016). Scheduling of construction programme to minimise spoil materials is therefore not feasible. With the programme mismatch of excavation and backfilling, and the lack of sufficient temporary stockpile area in urban city area, surplus materials are required to be disposed of off-site. The construction programme, however, will be reviewed during the detailed design stage to maximize the quantity of on-site reused of surplus C&D material when there is opportunity arisen.

Certain amount of surplus materials will be used by other projects in Hong Kong such as Hong Kong Boundary Crossing Facilities (HKBCF), Hong Kong Link Road (HKLR) and Tuen Mun – Chek Lap Kok Link (TM-CLKL) or disposed to Mainland and Fill Banks. Coordination has been made with Highways Department for the disposal arrangement of surplus C&D materials from SCL (TAW –HUH) (see HyD's letter included in **Appendix 11.1A**).

The combination of the urban setting and the nature of the physical constraints have limited the availability of alternative schemes for the station and tunnel construction (see **Section 3**). The current design is to use embankment and viaduct at Tai Wai to Hin Keng portal, drill and blast tunnelling below Lion Rock and at Ho Man Tin; bored tunnelling along Wong Tai Sin Road and Ma Tau Wai Road; cut-&-cover techniques for stations and other tunnel sections.

Measures have been adopted to minimise the generation of C&D materials at the outset during the design stage. As excavation cannot be avoided, only limited measures can be taken to minimise the quantity of C&D materials, including:

- Adoption of tunnelling construction techniques (e.g. bored tunnelling along Wong Tai Sin Road and Ma Tau Wai Road) that would minimise the amount of excavation as far as possible;
- Reduction of the size and the number of offline plant rooms;
- Minimisation of the overall size of the plant buildings and tunnel box sections through effective structural scheming for plant building and tunnel layout; and
- Efficient use of the space for station layout to minimise the overall width of the station and tunnel box sections.

**On-site sorting of C&D material**

All C&D materials arising from the construction of SCL (TAW-HUH) will be sorted on-site to recover the inert C&D materials and reusable and recyclable materials prior to disposal off-

site. All inert C&D materials will be broken down according to the Dumping Licence conditions before disposal to public filling outlets by barges.

The Contractor will be responsible for devising a system to work for on-site sorting of C&D materials and promptly remove all sorted and processed material arising from the construction activities to minimise temporary stockpiling on-site. It is recommended that the system should include the identification of the source of generation, estimated quantity, arrangement for on-site sorting and/ or collection, temporary storage areas, and frequency of collection by recycling Contractors or frequency of removal off-site.

It has been assumed that inert C&D materials (e.g. soil, building debris, concrete) will be sorted out from C&D materials at source to avoid double handling. Silty/ clayey materials from alluvium and marine sediments will be identified at source. Non-contaminated alluvial and marine sediments will be transported by leak proof trucks to eliminate water leakage during transportation to the barging facility for open sea disposal. The trucks should also be covered with impervious sheeting to prevent any dust emissions.

In order to identify materials which are not suitable to use as aggregate in structural concrete (e.g. volcanic rock, Aplite dyke rock, etc), geological assessment would be carried out by competent persons on site during excavation. Volcanic rock and Aplite dyke rock will be separated at the source sites as far as practicable and stored at designated stockpile areas preventing them from delivering to crushing facilities. The crushing plant operator would also be reminded to set up measures to prevent unsuitable rock from ended up at concrete batching plants and be turned into concrete for structural use. Details regarding control measures at source site and crushing facilities will be submitted by the Contractors for the Engineer to review and agree. In addition, site records will also be kept for the types of rock materials excavated and the traceability of delivery will be ensured with the implementation of Trip Ticket System and enforced by site supervisory staff as stipulated under DEVB TC(W) No. 6/2010 for tracking of the correct delivery to the rock crushing facilities for processing into aggregates. Alternative disposal option for the reuse of volcanic rock and Aplite Dyke rock, etc will also be explored.

**Reuse of C&D Materials**

Due to the nature of the project, it is not possible to achieve cut and fill balance for individual construction contracts and the SCL (TAW-HUH) project. With the limited space of project sites, it is also not practicable to stockpile the excavated materials at individual worksites for subsequent backfilling. Some of the excavated materials have to be exported off-site.

A summary of the reused materials is given in **Tables 11.4a-b** below.

**Table 11.4a:** Summary of C&D material generated, reused and disposed [1] [2]

| C&D Materials | | Quantity of C&D Materials, $m^3$ | | |
|---|---|---|---|---|
| | | **Generated** | **Reused** | **Disposed** |
| **Soil Material** | | 3,489,600 | 455,000 | 3,034,600 |
| **Rock** | All grades | 452,200 | - | 452,200 |
| **Artificial hard material (AHM)** | bituminous / concrete pavement | 80,000 | - | 80,000 |
| **Subtotal** | | **4,021,800** | **455,000** | **3,566,800** |

Note:

[1] Quantities of C&D materials from HUH are: soil material 138,000$m^3$, and 52,600$m^3$ sediment.

[2] Quantities of C&D materials from HOM are: rock 678,500$m^3$, AHM 8,200$m^3$, soil material 403,400$m^3$, and non-inert 5,900$m^3$.

[3] The quantities shown above are estimates only and will be subject to further review during the detailed design and construction stage.

**Table 11.4b:** Summary of sediments generated, reused and disposed [1] [2]

| Materials | | Quantity of C&D Materials, $m^3$ | | |
|---|---|---|---|---|
| | | Generated | Reused | Disposed |
| **Sediments** | Land-based and Marine-based Sediment | 278,400 | - | 278,400 |
| **Subtotal** | | **278,400** | **-** | **278,400** |

Note:
The quantities shown above are estimates only and will be subject to further review during the detailed design and construction stage.

The reused C&D materials would consist of fill Grade IV and V decomposed granite materials. It is anticipated that the excavated Grade IV and V decomposed granite materials consists of mainly Grade V, which is suitable for backfilling. Concrete debris will not be used as an on-site backfill material due to its relatively large size, except for those less than 150mm in diameter which can be used as fill when mixed with general fill materials. It is also difficult to control the quality of compaction using concrete debris as fill. The actual amount of reused C&D material will depend on the content and quality of the excavated materials.

**Disposal Programme for C&D Material**

The estimated disposal programme of surplus C&D material is shown below:

**Table 11.5a:** Summary of annual disposal quantities of C&D materials[1]

| Waste Type | | Annual Disposal Quantities, $m^3$ | | | | |
|---|---|---|---|---|---|---|
| | | 2012 | 2013 | 2014 | 2015 | 2016 |
| **Soft Material** | | 150,750 | 1,293,600 | 1,630,130 | 373,760 | 41,300 |
| **Rock** | All grades | 18,120 | 75,060 | 150,700 | 202,600 | 5,700 |
| **Artificial Hard Material (AHM)** | Bituminous/ Concrete fragment | 52,180 | 22,780 | 5,000 | - | - |
| **Subtotal** | | **221,050** | **1,391,440** | **1,785,830** | **576,360** | **47,000** |

Note:
[1] Excluding the quantities of C&D materials at HOM and HUH (see **Table 11.5c**).
[2] The quantities shown above are estimates only and will be subject to further review during the detailed design and construction stage.

**Table 11.5b:** Summary of annual disposal quantities of sediments

| Waste Type | | Annual Disposal Quantities, $m^3$ | | | | |
|---|---|---|---|---|---|---|
| | | 2012 | 2013 | 2014 | 2015 | 2016 |
| **Sediments** | Land-based and Marine-based Sediment | 69,180 | 117,000 | 54,960 | 37,100 | 140 |
| **Subtotal** | | **69,180** | **117,000** | **54,960** | **37,100** | **140** |

Note:
The quantities shown above are estimates only and will be subject to further review during the detailed design and construction stage.

**Table 11.5c:** Summary of annual disposal quantities of C&D materials at HUH and HOM [1]

| Waste Type | Annual Quantity Generated, $m^3$ | | | | | | Total, $m^3$ |
|---|---|---|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | |
| **Hung Hom Station** | | | | | | | |

| Waste Type | Annual Quantity Generated, $m^3$ | | | | | | Total, $m^3$ |
|---|---|---|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | |
| **Soft Materials** | 0 | 16,000 | 81,000 | 41,000 | 0 | 0 | **138,000** |
| **Hom Man Tin Station** | | | | | | | |
| **Rock** | 18,300 | 612,800 | 47,400 | 0 | 0 | 0 | 678,500 |
| **AHM** | 6,600 | 1,600 | 0 | 0 | 0 | 0 | 8,200 |
| **Soft Material** | 296,200 | 105,800 | 1,400 | 0 | 0 | 0 | 403,400 |
| **Non-inert** | 4,600 | 300 | 500 | 500 | 0 | 0 | 5,900 |
| **Subtotal** | **325,700** | **736,500** | **130,300** | **41,500** | **0** | **0** | **1,234,000** |

Note:

[1] Construction of HOM and HUH will be implemented under other Designated Project

[2] The quantities shown above are estimates only and will be subject to further review during the detailed design and construction stage.

The Project Proponent shall notify CEDD of the estimated spoil volumes to be generated, and liaise and agree with the Public Fill Committee for the disposal of surplus inert C&D materials including good quality rock during the detailed design phase of the project.

Surplus of rock and spoils materials would be accepted by other projects, including Hong Kong Boundary Crossing Facilities (HKBCF), Hong Kong Link Road (HKLR) and Tuen Mun Chek Lap Kok Link (TMCLKL). Discussions with relevant government departments and parties have been made for disposal of surplus materials from railways projects including SCL (TAW-HUH).

The C&D materials include those from the construction of the stations, cut-&-cover tunnels and bored tunnel. The spoil from the mucking out points will be transported by dump trucks to the barging facilities for final disposal. Barging points at Kai Tak Runway and Freight Pier at Hung Hom (shared with Kwun Tong Line Extension) have been proposed for SCL (TAW-HUH). The barging facilities for SCL (TAW – HUH) would operate from 2012 to 2016, 12hours per day. Locations of barging facilities are shown in **Figure 11.1**.

It is estimated that about 452,200$m^3$ of Grade III or better rock will be produced and a 4ha of land for stockpile dedicated facilities for stockpiling are recommended for SCL (TAW-HUH). Locations of stockpile are shown in **Figure 11.2**.

About 80,000$m^3$ of artificial hard materials (AHM) will be generated. Broken asphalt will be recycled where practicable, whereas broken concrete will be disposed of at the public fill. These hard materials are proposed to be disposed of by trucks to the Tuen Mun Area 38 or Tseung Kwan O Area 137, as directed by CEDD or to local recycling facilities.

#### 11.4.1.2 C&D Waste

C&D waste will be generated throughout the construction works from general site clearance works, tree felling, piling works and earthworks for construction of various structures. These C&D non-inert materials will be disposed of at NENT Landfill (see **Appendix 11.2**).

#### 11.4.1.3 Imported Fill Material

It is estimated by the Engineer that an amount of 1,224,000$m^3$ of fill materials will need to be imported. The imported fill materials are used for backfilling on top of station and stabling sidings. With the programme mismatch of excavation and backfilling and the lack of sufficient temporary stockpiling area in urban city area, surplus materials will be disposed of off-site. And some of the backfilling materials will have to be imported. The project proponent shall review the programme during the detail design stage and maximize the quantity of on-site reused of surplus C&D material.

#### 11.4.1.4 Excavated Contamination Materials and Marine Sediment

**Contaminated Soil**

A Contamination Assessment Plan (CAP) has been prepared to set out the requirements for a contamination evaluation of the SCL (TAW-HUH) and works areas. With the subsequent change of design information, a revised CAP has been re-submitted in November 2010 and endorsed by EPD on 10 December 2010. Subsequently, the project boundary, at grade works sites and off site works areas have been updated. A supplementary CAP is prepared and submitted to EPD on 21 January 2011 to reflect the latest changes of the project. The final endorsed CAP and supplementary CAP to be approved by EPD is shown in **Appendix 12.1 of Section 12**. They collected historical information and existing site conditions as the basis for land contamination assessment. So far approximately 39$m^3$ of soil is confirmed to be contaminated at Site L4 (see **Section 12**). The detailed assessment findings are reported in the Contamination Assessment Report (CAR), which has been endorsed by EPD on 22 December 2009. "Excavation and Landfill Disposal" is considered as the most suitable and cost effective remediation method for this relatively small volume of contaminated soil. None of the contaminants exceed the TCLP limits, so the remediation method of "Excavation and Landfill Disposal" is feasible. Off-site disposal of treated contaminated should be considered as the last resort/ option. A Remediation Action Plan (RAP) which includes details of proposed remediation methods has been endorsed by EPD on 22 December 2009. A supplementary CAR has been prepared to reflect the latest changes of the project. The endorsed CAR and RAP and supplementary CAR are attached in **Appendix 12.2 of Section 12**.

**Sediments**

A summary of the generation of sediments is given in **Table 11.6**.

**Table 11.6:** Summary of annual generation of sediments [1]

| Waste | Annual Disposal Quantities, $m^3$ | | | | | |
|---|---|---|---|---|---|---|
| | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
| Land based sediment and marine based sediment | 69,180 | 117,000 | 54,960 | 37,100 | 140 | 278,380 |

Note:

[1] Excluding land based sediment from HUH amount 52,600$m^3$.

[2] The quantities shown above are estimates only and will be subject to further review during the detailed design and construction stage.

A Sediment Sampling and Testing Plan (SSTP) has been submitted and approved by EPD. Sediment Quality Report(s) will be prepared as per the requirements given in the ETWBTC No 34/2002 "Management of Dredged / Excavated Sediment" and will be submitted to the DASO Team of EPD during the application of dumping permit. SSTP of the project is shown in **Appendix 11.3**.

Based on the available testing results, field sampling was collected during 2009 for marine-based sediment at Kai Tak involving 19 drillholes, and land-based sediment at Hung Hom and Kai Tak involving 18 drillholes.

***Land Based Sediments***

A total of 34 samples had been collected and tested. Results indicate that 26 samples registered in Category L (≤ Lower Chemical Exceedance Level); 1 contained Heavy Metal compounds registered in Categories M (Material > Lower & ≤ Upper Chemical Exceedance Level) and 7 samples were within Category H.

For the samples classified as Category H, none of the contaminant levels tested exceeding 10 times LCEL. Therefore, no samples classified as Category H required biological

screening tests. Only the sample classified as Category M is required for biological screening tests.

The chemical screening and biological screening tests revealed that 22 samples are classified as Type 1 - Open Sea Disposal, 1 sample is classified as Type 1 - Open Sea Disposal (Dedicated Sites) and 3 samples area classified as Type 2 - Confined Marine Disposal. A summary of chemical screening results are presented in **Table 11.7**.

**Table 11.7:** Summary of Chemical Screening Results

| Location | Category | No of Samples | Remarks |
|---|---|---|---|
| Ho Man Tin | L (≤LCEL) | 3 | |
| Kai Tak | L (≤LCEL) | 19 | |
| | M (> LCEL & ≤ UCEL) | 1 | Exceedance of LCEL in Hg |
| | H (> UCEL) | 3 | Exceedance of UCEL in heavy metals |
| Hung Hom | L (≤LCEL) | 4 | |
| | H (> UCEL) | 4 | |

Quantity estimation of marine sediment for excavation and sea disposal was given in the Sediment Quality Report. The quantities of sediment are estimated by multiplying the surface area requiring excavation by the depth of sediment. The estimated quantities of sediment to be excavated are summarized in **Table 11.8**.

**Table 11.8:** Estimated quantity of different type of sediment

| Disposal Options | Category | Estimated Volume (x 1000 $m^3$ ) | | | |
|---|---|---|---|---|---|
| | | Ho Man Tin & Kai Tak | Hung Hom | Total | % |
| Type 1 Open Sea Disposal | Category L | 181.1 | 33.4 | 214.5 | 78.0% |
| Type 1 Open Sea Disposal (Dedicated Sites) | Category M (pass biological screening test) | 14.7 | 0 | 14.7 | 5.4% |
| Type 2 Confined Marine Disposal | Category M (failed biological screening), Category H | 26.5 | 19.2 | 45.7 | 16.6% |
| Sub-total | | 222.3 | 52.6 | 274.9 | 100% |

***Marine Based Sediments***

A total of 35 samples had been collected and tested. Results indicate that 1 sample was within Category L. 1 sample contained Heavy Metal compounds registered in Category M (Material > Lower & ≤ Upper Chemical Exceedance Level). 33 samples were within Category H (Material > Upper Chemical Exceedance Level) and exceeding 10 times of Lower Chemical Exceedance Level (LCEL). The chemical screening and biological screening tests revealed that 18 samples are classified as Type 2 – Confined Marine Disposal and 15 samples as Type 3 – Special Treatment/ Disposal. A summary of chemical and biological screening results are presented in **Table 11.9**.

**Table 11.9:** Summary of Chemical and Biological Screening Results

| Location | Category | No of Samples | Biological Screening | Remarks |
|---|---|---|---|---|
| Kai Tak | L (≤LCEL) | 1 | N/A | Type 1 – Open Sea Disposal |

| Location | Category | No of Samples | Biological Screening | Remarks |
|---|---|---|---|---|
| Dredging Area | M (> LCEL & ≤ UCEL) | 1 | Fail | Type 2 – Confined Marine Disposal |
| | H (> UCEL) | 33 | 18 samples – Pass | Type 2 – Confined Marine Disposal |
| | | | 15 samples - Fail | Type 3 – Special Treatment Disposal |

With 56,000 $m^3$ marine based sediment, it is estimated that about 100$m^3$ sediment requires Type 1 - Open Sea Disposal, 26,700$m^3$ sediment requires Type 2 – Confined Marine Disposal Open Sea Disposal, and 29,200$m^3$ requires Type 3 – Special Treatment/ Disposal. Detailed testing results for chemical and biological tests and disposal classification are presented in **Appendix 11.4**.

#### 11.4.1.5 Chemical Waste

Chemical wastes likely to be generated from the construction activities for the SCL (TAW-HUH) and associated facilities will include:

- Scrap batteries or spent acid/alkali from their maintenance;
- Used paint, engine oils, hydraulic fluids and waste fuel;
- Spent mineral oils/cleansing fluids from mechanical machinery; and
- Spent solvents/solutions, some of which may be halogenated, from equipment cleansing activities.

Chemical waste 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 Packing, Labelling and Storage of Chemical Waste. These hazards may include:

- Toxic effects to workers;
- Adverse effects on air, water and land from spills; and
- Fire hazards.

It is difficult to quantify the amount of chemical waste as it will be highly dependent on the Contractor's on-site maintenance practice and the quantities of plant and vehicles utilized. However, it is anticipated that the quantity of chemical waste, such as lubricating oil and solvent produced from plant maintenance will be small and in the order of few hundred litres per month.

Chemical waste, irrespective of the likely small amount, would pose serious environmental, health and safety hazards if not properly managed. Such hazards would include:

- Toxic effects to workers;
- Adverse effects on water quality from spills;
- Fire hazards; and
- Disruption of sewage treatment works should the chemical waste enter the sewerage system.

The amount of chemical waste arising from the construction activities would depend on the contractor's on-site maintenance practices and the amount of plant and number of vehicles deployed. Relatively small quantity of chemical waste, such as lubricating oil and solvent,

produced from plant maintenance would be anticipated, which would be collected by licensed collectors for subsequent disposal at licensed waste disposal facilities, such as the Chemical Waste Treatment Centre in Tsing Yi. With the implementation of proper preventive and mitigation measures for handling, transport and disposal, no insurmountable environmental impacts would be anticipated.

#### 11.4.1.6 General Refuse

The presence of a construction site with workers and site office will result in the generation of a variety of general refuse requiring disposal. General refuse will mainly consist of food waste, aluminium cans and waste paper.

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 waster 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 cleared regularly. In addition, disposal of wastes at sites other than approved landfills, can also lead to similar adverse impacts at those sites.

The number of work force (clerical and workers) to be employed for the project is not available at this stage, but is anticipated to be over 1,000 staff. On this basis, the total refuse generated per day would be about 650kg/day, assuming the refuse generated rate is 0.65kg/head/day. Provided that the mitigation measures are adopted, the potential environmental impacts caused by the storage, handling, transport and disposal of general refuse are expected to be minimal. It is recommended that general refuse should be collected on a daily basis for disposal. Given the small quantity of general refuse, adverse impacts to the operation of the landfills are not expected.

### 11.4.2 Operational Phase

During the operational phase, the station and the associated facilities will generate the following wastes:

- General refuse;
- Industrial waste; and
- Chemical waste.

#### 11.4.2.1 General Refuse and Industrial Waste

General refuse will arise from the public, station employees and commercial operators within the stations. Waste would include food, paper, wood, plastic, office waste, metal containers etc. The storage and handling of these wastes may give rise to environmental impacts.

Maintenance activities of the station and tracks will generate industrial waste including scrap materials from rail and carriage maintenance, used fluorescent tubes, used welding rods, cleansing materials and discarded electronic equipment.

A reputable waste collector should be employed to remove general refuse and industrial waste from the stations, separately from chemical wastes, on a daily basis to minimise odour, pest and litter impacts.

#### 11.4.2.2 Chemical Waste

Similar to industrial waste, lubricants, paints, used batteries, mineral oil, coolants, and solvents will be generated during the operational phase within the stations and alignment areas. These wastes may pose significant environmental, health and safety hazard if they are not properly managed.

The requirements given in the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes should be followed in handling of these chemical wastes. A trip-ticket

system should be operated in accordance with the Waste Disposal (Chemical Waste) (General) Regulation to monitor all movements of chemical wastes which will be collected by a licensed collector to a licensed facility for final treatment and disposal.

## 11.5 Mitigation Measures

### 11.5.1 Construction Phase

The requirements as recommended in ETWB(W) No. 19/2005 Environmental Management on Construction Sites and its latest version, and other relevant guidelines, should be included in the Particular Specification for the Contractor as appropriate.

The Contractor should incorporate waste management recommendations into a comprehensive on-site Environmental Management Plan (EMP) based on the Construction and Demolition Material Management Plan (C&DMMP). The EMP shall be submitted to the Engineer for approval after commencement of construction. This should include all factors dependent on individual work sites including designation of areas for the segregation and temporary storage of materials for future use or recycling. Such provision cannot be specified at this stage. Contractors should follow the recommendations of ETWBTC (Works) No. 19/2005 for on-site separation of waste, and DEVBTC (Works) No. 6/2010 for trip-ticket system for disposal of construction and demolition material. The EMP shall also define clearly the hierarchy for waste management on and off-site as well as a complete list of mitigation measures for handling excavated materials.

Waste management options with less environmental impacts are preferred. The waste management hierarchy should be as follows:

- Avoidance and minimization;
- Reuse of materials;
- Recovery and recycling; and
- Treatment and disposal.

This hierarchy should be used to evaluate the waste management options to allow 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 raw materials and disposing of wastes. Records of quantities of wastes generated, recycled and disposal (locations) should be properly kept.

A trip-ticket system should be established and will comply with the Waste Disposal (Charges for Disposal of Construction Waste) Regulation to monitor the disposal of public fill 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 Contractor. The Engineer shall 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 phase. The Contractor should provide training 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.

#### 11.5.1.1 C&D Material

The Project Proponent shall notify CEDD of the estimated spoil volumes to be generated, and liaise and agree with the Public Fill Committee (PFC) for the disposal of any surplusinert C&D materials including good quality rock during detailed design of the project. A C&DMMP had been submitted to and subsequently endorsed by PFC on 12 August 2011. The PFC endorsement letter was attached in **Appendix 11.5.** The Project Proponent will ensure all the mitigation measures mentioned in the C&DMMP and conditions stated in the

endorsement memo will be complied with. Wherever practicable, C&D materials should be segregated from other wastes to avoid contamination and ensure acceptability at public filling areas or reclamation sites. The surplus C&D material would be reused within the site as much as possible. The project proponent shall obtain confirmation from PFC on the proposed disposal arrangement before the commencement of the construction works. No construction work is allowed to proceed until all issues on management of C&D materials have been resolved and all relevant arrangements have been endorsed by the relevant authorities including PFC and EPD.

The following mitigation measures should be implemented in handling the C&D materials:

- Maintain temporary stockpiles and reuse excavated fill material for backfilling and reinstatement;
- Carry out on-site sorting;
- Make provisions in the Contract documents to allow and promote the use of recycled aggregates where appropriate;
- Adopt 'Selective Demolition' technique to demolish the existing structures and facilities with a view to recovering broken concrete effectively for recycling purpose, where possible;
- Implement a trip-ticket system for each works contract to ensure that the disposal of C&D materials are properly documented and verified; and
- Implement an enhanced Waste Management Plan, which become a part of the Environmental Management Plan in accordance with "ETWBTC (Works) No. 19/2005 – Waste Management on Construction Site", to encourage on-site sorting of C&D materials and to minimize their generation during the course of construction.
- In addition, disposal of the C&D materials onto any sensitive locations such as agricultural lands, etc. should be avoided. The Contractor shall propose the final disposal sites to the Project Proponent and EPD to get their approval before implementation.

#### 11.5.1.2 C&D Waste

The following mitigation measures should be implemented in handling of C&D waste:

- Standard formwork or pre-fabrication should be used as far as practicable in order to minimise the arising of C&D materials. The use of more durable formwork or plastic facing for the construction works should be considered. Use of wooden hoardings should not be used, as in other projects. Metal hoarding should be used to enhance the possibility of recycling. The purchasing of construction materials will be carefully planned in order to avoid over ordering and wastage.
- The Contractor should recycle as much of the C&D materials as possible 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. Where practicable, concrete and masonry can be crushed and used as fill. Steel reinforcement bar can be used by scrap steel mills. Different areas of the sites should be considered for such segregation and storage.
- HKSAR has developed and implemented a charging policy for the disposal of waste to landfill. It 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.

#### 11.5.1.3 General Refuse

General refuse generated on-site should be stored in enclosed bins or compaction units separately 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 minimize odour, pest and litter impacts. Burning of refuse on construction sites is prohibited by law.

Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated and made easily accessible. Separate labelled bins for their deposit should be provided if feasible.

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 by the Contractor. In addition, waste separation facilities for paper, aluminium cans, plastic bottles etc., should be provided.

#### 11.5.1.4 Excavated Contaminated Materials and Land-based and Marine-based Marine Sediment

**Contaminated Soil**

About 39 $m^3$ of contaminated soil is identified (refer to **Section 12** for details). Given the small amount of volume, disposal in landfill site is recommended. Potential landfill site includes NENT. Details of the mitigation measures on handling of the contaminated soil shall be referred to **Section 12.11**.

**Land-based and Marine-based Sediment**

The total amount of land-based and marine-based sediments is estimated to be 278,500$m^3$. Normally, the contaminated sediment will require to be disposed of at confined contaminated mud pits such as East Sha Chau, while the uncontaminated marine and alluvial deposit will require open sea disposal, e.g. in South Cheung Chau, Nine Pin, etc. However, no dredging work is allowed to proceed until all issues on management of dredged sediments have been resolved and all relevant arrangements have been endorsed by the relevant authorities including MFC and EPD.

Possible mitigation measures to handle the contaminated/ uncontaminated sediment are summarized as follows:

- All construction plant and equipment shall be designed and maintained to minimise the risk of silt, sediments, contaminants or other pollutants being released into the water column or deposited in the locations other than designated location.
- All vessels shall be sized such that adequate draft is maintained between vessels and the sea bed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash.
- Before moving the vessels which are used for transporting dredged material, excess material shall be cleaned from the decks and exposed fittings of vessels and the excess materials shall never be dumped into the sea except at the approved locations.
- Adequate freeboard shall be maintained on barges to ensure that decks are not washed by wave action.
- The Contractors shall monitor all vessels transporting material to ensure that no dumping outside the approved location takes place. The Contractor shall keep and produce logs and other records to demonstrate compliance and that journeys are consistent with designated locations and copies of such records shall be submitted to the Engineers.
- The Contractors shall comply with the conditions in the dumping licence.
- All bottom dumping vessels (hopper barges) shall be fitted with tight fittings seals to their bottom openings to prevent leakage of material.

- The material shall be placed into the disposal pit by bottom dumping.
- Contaminated marine mud shall be transported by split barge of not less than 750m$^3$ capacity and capable of rapid opening and discharge at the disposal site.
- Discharge shall be undertaken rapidly and the hoppers shall be closed immediately. Material adhering to the sides of the hopper shall not be washed out of the hopper and the hopper shall remain closed until the barge returns to the disposal site.
- For Type 3 special disposal treatment, sealing of contaminant with geosynthetic containment before dropping into designated mud pit would be a possible arrangement. A geosynthetic containment method is a method whereby the sediments are sealed in geosynthetic containers and, the containers would be dropped into the designated contaminated mud pit where they would be covered by further mud disposal and later by the mud pit capping at the disposal site, thereby fulfilling the requirements for fully confined mud disposal. The technology is readily available for the manufacture of the geosynthetic containers to the project-specific requirements. Similar disposal methods have been used for projects in Europe, the USA and Japan and the issues of fill retention by the geosynthetic fabrics, possible rupture of the containers and sediment loss due to impact of the container on the seabed have been addressed.
- Moreover, the geosynthetic containment has also been proposed for Type 3 disposal in the EIA Study under *Wan Chai Development Phase II and Central-Wan Chai Bypass (WDII)* (EIA 141/2007). Several field trials had been undertaken under WDII - Design and Construction to demonstrate the feasibility on the use of the geosynthetic containment. Report on the field trials concluded that disposal by sealing sediments in geosynthetic containers and dropping these containers into the contaminated mud pits at East Sha Chau has been shown to be a successful and viable disposal method. The use of a geosynthetic containment for special disposal was considered to be an effective system with negligible loss of contaminants to the marine environment during disposal.

#### 11.5.1.5 Chemical Waste

Chemical waste producers should be registered with EPD. For those processes which generate chemical waste, the Contractor shall identify any alternatives that generate reduced quantities or even no chemical waste, or less dangerous types of chemical waste.

Chemical waste 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 specification have been approved by 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:

- Be clearly labelled and used solely for the storage of chemical wastes;
- 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 the area, whichever is 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.

Disposal of chemical waste should:

- Be via a licensed waste collector; and
- Be to a facility licensed to receive chemical waste, such as the CWTC 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 EPD.

### 11.5.2 Operational Phase

#### 11.5.2.1 General Refuse and Industrial Waste

A reputable waste collector should be employed to remove general refuse and industrial wastes from the stations on a daily basis to minimise odour, pest and litter impacts.

#### 11.5.2.2 Chemical Waste

The requirements given in the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes* should be followed, where applicable, in handling of these chemical wastes. A trip-ticket system should be operated in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation* to monitor all movements of chemical wastes which would be collected by a licensed collector to a licensed facility for final treatment and disposal. The details of mitigation measures are as described in **Section 11.5.1.7**.

## 11.6 Residual Environmental Impacts

With the implementation of recommended mitigation measures, adverse residual impacts are not anticipated for both the construction and operational phases.

## 11.7 Conclusion

### 11.7.1 Construction Phase

The quantity and timing for the generation of waste during the construction phase have been estimated. Measures, including the opportunity for on-site sorting, reusing excavated fill materials (stored in stockpiles) etc, are devised in the construction methodology to minimise the surplus materials to be disposed off-site via the designated barging facilities. The annual disposal quantities for C&D materials and their disposal methods have also been assessed.

Recommendations have been made for the Contractor for implementation during the construction period to minimise the waste generation and any off-site disposal.

### 11.7.2 Operational Phase

The types and quantities of waste that would be generated during the operational phase have been assessed. Recommendations have been made to ensure proper treatment and disposal of these wastes.