



6. WASTE MANAGEMENT IMPLICATION

6.1 Introduction

6.1.1 This section identifies the types of wastes that are likely to be generated during the construction and operation phases of the Project and evaluates the potential environmental impacts that may result from these wastes. The primary waste arising generated during the construction phase will mainly be Construction and Demolition (“C&D”) materials from the sewerage construction works. During the operational phase, general refuse and sewage sludge will be expected. Mitigation measures and good site practices, including waste handling, storage and disposal, are recommended with reference to the applicable waste legislation and guidelines.

6.1.2 This assessment has based on the criteria and guidelines stated in Annexes 7 and 15 of the EIAO-TM for evaluation and assessment of waste management implications and have covered the scope outlined in Section 3.4.5 of the EIA Study Brief.

6.2 Relevant Legislation Standards & Guidelines

6.2.1 In carrying out this assessment, reference has been made to the following relevant Hong Kong legislations governing waste management and disposal:

- The Waste Disposal Ordinance (“WDO”) (Cap. 354) and subsidiary legislation such as the Waste Disposal (Chemical Waste) (General) Regulation and Waste Disposal (Charges for Disposal of Construction Waste) Regulation that set out requirements for the storage, handling and transportation of all types of wastes
- EIAO (Cap. 499), EIAO-TM, Annexes 7 and 15;
- Public Health and Municipal Services Ordinance (Cap. 132) – Public Cleansing and Prevention of Nuisance Regulation – control of disposal of general refuse; and
- Land (Miscellaneous Provisions) Ordinance (Cap. 28).

6.2.2 Other relevant documents and guidelines that are applicable to waste management and disposal in Hong Kong include:

- Development Bureau Technical Circular (Works) (TC(W)) No. 6/2010, Trip Ticket System for Disposal of Construction & Demolition Materials;
- Development Bureau TC(W) No. 8/2010 Enhanced Specification for Site Cleanliness and Tidiness;
- ETWB TC(W) No. 19/2005, Environmental Management on Construction Sites;
- ETWB TC(W) Nos. 22/2003 and 22/2003A, Additional Measures to Improve Site Cleanliness and Control Mosquito Breeding on Construction Sites;
- ETWB TC(W) No. 34/2002, Management of Dredged/Excavated Sediment,
- ETWB TC(W) No. 33/2002, Management of Construction and Demolition Material Including Rock;
- Works Bureau TC No. 12/2002, Specification Facilitating the Use of Recycled Aggregates;
- Works Bureau TC Nos. 25/99, 25/99A and 25/99C, Incorporation of Information on Construction and Demolition Material Management in Public Works Subcommittee Papers; and
- Works Bureau TC No. 2/93, Public Dumps.



Waste Management

- 6.2.3 The WDO prohibits the unauthorised disposal of wastes. Construction waste is defined as any substance, matter or thing that is generated from construction work and abandoned, whether or not it has been processed or stockpiled before being abandoned, but does not include any sludge, screenings or matter removed in or generated from any desludging, desilting or dredging works. Under the WDO, wastes can be disposed of only at designated waste disposal facilities.
- 6.2.4 Under the WDO, the Chemical Waste (General) Regulation 1992 provides regulations for chemical waste control, and administers the possession, storage, collection, transport and disposal of chemical wastes. The EPD has also issued a guideline document, the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992), which details how the contractor should comply with the regulations on chemical wastes.
- 6.2.5 Public Cleansing and Prevention of Nuisance Regulation provides control on illegal tipping of wastes on unauthorised (unlicensed) sites.
- 6.2.6 The Land (Miscellaneous Provisions) Ordinance provides control on dumping of public fill. The inert portion of construction waste (also called public fill) may be taken to public fill reception facilities which are operated by the Civil Engineering and Development Department ("CEDD"). The Land (Miscellaneous Provisions) Ordinance requires that dumping licences be obtained by individuals or companies who deliver public fill to public filling areas. The CEDD issues the licences under delegated powers from the Director of Lands.
- 6.2.7 Under the licence conditions, public fill reception facilities will only accept inert earth, soil, sand, rock, boulder, rubble, brick, tile, concrete, asphalt, masonry or used bentonite. In addition, in accordance with Development Bureau TC(W) No. 6/2010, the Public Fill Committee will advise on the acceptance criteria (e.g. no mixing of construction waste, nominal size of the materials less than 250mm, etc) for disposal of C&D materials at public fill facilities.

Construction and Demolition Material

- 6.2.8 The current policy related to the disposal of C&D materials is documented in the Works Branch TC No. 2/93, 'Public Dumps'. It is required that C&D materials that are wholly inert, namely public fill, should not be disposed of to landfill, but taken to public filling areas, which usually form part of reclamation schemes.
- 6.2.9 Under the Waste Disposal (Charges for Disposal of Construction Waste) Regulation, enacted in January 2006, 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 materials.
- 6.2.10 The ETWB TC(W) No. 19/2005 "Environmental Management on Construction Sites" includes procedures on waste management requiring contractors to reduce the C&D materials to be disposed of during the course of construction. The ETWB TC(W) No. 33/2002, "Management of Construction and Demolition Material Including Rock" to enhance the management of C&D materials, and to minimize its generation at source, submission of C&D Material Management Plan ("C&DMMP") is not required for less than 50,000m³ of C&D materials from Designated Projects and less than 300,000m³ from non-Designated Projects. Under ETWB TC(W) No. 19/2005, the contractor is required to prepare and implement an Environmental Management Plan ("EMP") and the Waste Management Plan ("WMP") becomes part of the EMP.



Chemical Waste

- 6.2.11 Under the Waste Disposal (Chemical Waste) (General) Regulations, all producers of chemical waste must register with the EPD as a Chemical Waste Producer (“CWP”) and treat their wastes, either utilising on-site plant licensed by the EPD, or arranging for a licensed collector to transport the wastes to a licensed facility. The regulation also prescribes the storage facilities to be provided on site, including labelling and warning signs, and requires the preparation of written procedures and training to deal with emergencies such as spillages, leakages or accidents arising from the storage of chemical wastes.

Marine Sediment

- 6.2.12 The ETWB TC(W) No. 34/2002 sets out procedures for seeking approval to dredge/excavate sediment and the management framework for marine disposal of such sediment. This Technical Circular outlines the requirements to be followed in assessing sediment quality and classifying the sediment and explains the marine disposal arrangement for the classified materials.
- 6.2.13 The sediment quality should be assessed according to sediment quality criteria in Appendix A of ETWB TC(W) No. 34/2002. As specified in the Technical Circular, sediments are classified into three categories based on their contaminant levels. The classification is as follows:
- Category L: Sediment with all contaminant levels not exceeding the Lower Chemical Exceedance Level (“LCEL”). The materials must be dredged, transported and disposed of in a manner which minimises the loss of contaminants either into solution or by resuspension.
 - Category M: Sediment with any one or more contaminant levels exceeding the LCEL and none exceeding the Upper Chemical Exceedance Level (“UCEL”). The material must be dredged and transported with care, and must be effectively isolated from the environment upon final disposal unless appropriate biological tests demonstrate that the material will not adversely affect the marine environment.
 - Category H: Sediment with any one or more contaminant levels exceeding the UCEL. The material must be dredged and transported with great care, and must be effectively isolated from the environment upon final disposal.
- 6.2.14 In case of Category M and Category H contamination, Tier III biological screening should be conducted in accordance with Section 3 of Appendix B of ETWB TC(W) No. 34/2002 to identify the appropriate disposal option for Category M and certain Category H sediments.
- 6.2.15 The sediment quality criteria for the classification of sediment are shown in **Table 6.1**.



Table 6.1 : Chemical Testing Parameters

Contaminants	LCEL	UCEL
Metals (mg/kg dry wt.)		
Cadmium (Cd)	1.5	4
Chromium (Cr)	80	160
Copper (Cu)	65	110
Mercury (Hg)	0.5	1
Nickel (Ni)*	40	40
Lead (Pb)	75	110
Silver (Ag)	1	2
Zinc (Zn)	200	270
Metalloid (mg/kg dry wt.)		
Arsenic (As)	12	42
Organic-PAHs (µg/kg dry wt.)		
Low Molecular Weight PAHs	550	3160
High Molecular Weight PAHs	1700	9600
Organic-non-PAHs (µg/kg dry wt.)		
Total PCBs	23	180
Organometallics (µg TBT/L in Interstitial water)		
Tributyltin (1)	0.15	0.15

Note:

1) The contaminant level is considered to have exceeded the UCEL if it is greater than the value shown.

- 6.2.16 For biological screening, the test endpoints and decision criteria are summarized in **Table 6.2**. The sediment is deemed to have failed the biological test if it fails in any one of the three toxicity tests.

Table 6.2 : Test Endpoints and Decision Criteria for Tier III Biological Screening

Toxicity Test	Endpoints Measured	Failure Criteria
10-day amphipod	Survival	Mean survival in test sediment is significantly different ($p \leq 0.05$)(1) from mean survival in reference sediment and mean survival in test sediment <80% of mean survival in reference sediment.
20-day polychaete worm	Dry Weight (2)	Mean dry weight in test sediment is significantly different ($p \leq 0.05$)(1) from mean dry weight in reference sediment and mean dry weight in test sediment <90% of mean dry weight in reference sediment.
48-96 hour larvae (bivalve or echinoderm)	Normality Survival (3)	Mean normality survival in test sediment is significantly different ($p \leq 0.05$)(1) from mean normality survival in reference sediment and mean normality survival in test sediment <80% of mean normality survival in reference sediment.

Notes:

- 1) Statistically significant differences should be determined using appropriate two-sample comparisons (e.g., t-tests) at a probability of $p \leq 0.05$.
- 2) Dry weight means total dry weight after deducting dead and missing worms.
- 3) Normality survival integrates the normality and survival end points, and measures survival of only the normal larvae relative to the starting number

- 6.2.17 The species to be used for each type of biological test and the test conditions are listed in **Table 6.3**.



Table 6.3 : Test Species for Biological Screening

Test Types	Species	Reference Test Conditions
10-day burrowing amphipod toxicity test	<i>Ampelisca abdita</i> <i>Leptocheirus plumulosus</i> <i>Eohaustorius estuaris</i>	US EPA (1994) ⁽¹⁾ / PSEP (1995) ⁽²⁾ US EPA (1994) US EPA (1994) / PSEP (1995)
20-day burrowing polychaete test	<i>Neanthes arenaceodentata</i>	PSEP (1995)
48-96 hour larvae (bivalve or echinoderm) toxicity test	Bivalve: <i>Mytilus spp.</i> <i>Crassostrea gigas</i> Echinoderm: <i>Dendraster excentricus</i> <i>Strongylocentrotus spp.</i>	PSEP (1995) PSEP (1995) PSEP (1995) PSEP (1995)

Note: ⁽¹⁾ U.S.EPA (U.S. Environmental Protection Agency) 1994. Methods for assessing the toxicity of sediment-associated contaminants with estuarine and marine amphipods. Office of Research and Development. U.S. Environmental Protection Agency, Cincinnati, OH. EPA/600/R94/025.

⁽²⁾ PSEP (Puget Sound Estuary Program) 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments.

- 6.2.18 Additional ancillary parameters including moisture content, grain size, total organic content, ammonia and salinity of pore water were also analysed. **Table 6.4** below presents the methodology used and the detection limits.

Table 6.4 : Biological Screening Ancillary Test Parameters

Parameters	Preparation Method US EPA Method	Determination Method US EPA Method	Reporting Limit
Grain Size Distribution	-	GEO Report No. 36 Test 2.9.2 & 2.9.5	0.1%
Total Organic Carbon	-	APHA 5310B	0.05%
Ammonia	-	APHA 4500 NH ₃ : G	0.01mg/l
pH	-	APHA 4500: B	0.1pH unit
Salinity of Pore Water	-	APHA 4500 Cl: B	1mg/l

- 6.2.19 All the chemical and biological screening results, the categories of sediment, estimated quantities of different categories and the corresponding types of disposal required were based on the chemical and biological screening results and ETWB TC(W) No. 34/2002.
- 6.2.20 The disposal of marine sediment is controlled under the Dumping at Sea Ordinance (“DASO”). The EPD controls dumping at sea by means of DASO permit which are issued to the Contractor responsible for the disposal of dredged/excavated sediment. The Contractor who will be undertaking the works must make a formal application to the EPD for a dumping permit, and if the permit is granted, it will be the Contractor’s responsibility to ensure that the dumping permit conditions are met to the EPD’s satisfaction. According to Section 7 of ETWB TC(W) No. 34/2002, applications for approval of dredging/ excavation sediment proposals and allocation of marine disposal space shall be made to the Secretary of Marine Fill Committee (“MFC”).

6.3 Assessment Methodology

- 6.3.1 The assessment of potential waste management implications includes the following tasks:

- Estimation of the types and quantities of waste arising;



- Evaluation of potential impacts from the handling, collection, transportation and disposal of waste; and
- Proposal of mitigation measures for the waste management.

6.4 Waste Generation and Potential Impacts

Construction Phase

6.4.1 The construction activities to be carried out for the Project include:

- trench excavation of pipe laying;
- trenchless excavation of pipe laying;
- construction of Fan Kwai Tong and Hang Mei SPSs;
- removal of surface and sub-surface materials unsuitable as fill;
- cutting and installation of new pipelines;
- upgrading of Tai O STW;
- construction of new submarine outfall; and
- reclamation works.

6.4.2 These construction activities will generate a variety of wastes which includes:

- C&D materials;
- site clearance wastes;
- chemical wastes;
- general refuse; and
- dredged marine sediment.

6.4.3 During the construction phase of the upgrading of Tai O STW, the existing Tai O STW will continue to function and the sludge handling arrangements would remain the same. The existing Tai O STW uses tanks for the settling of solid material. Once the material is settled, DSD barges are utilised for the collection and transportation of the solid materials for disposal at other DSD facilities. During the construction works associated with the upgrading of the Tai O STW, no changes to the practices will take place and the same practices will be followed by means of tanks in the western portion of the site once the new reclaimed land is available. The nature of each type of waste to be arisen and an evaluation of the potential environmental impacts associated with generation, handling, storage and transport of the waste are provided as below.

Dredged Marine Sediment

6.4.4 The construction of the new submarine outfall at Tai O STW and rising mains underneath the Tai O Creek will require the excavation and dredging of marine sediments. For this EIA purpose, a Sediment Sampling and Testing Plan ("SSTP") for assessing the sediment quality has been prepared and submitted to the EPD for approval prior to sampling works. The endorsed SSTP is included in **Appendix 6.1**. Based on the SSTP, 7 sampling locations (namely D7 – D13) were proposed for the new submarine outfall at Tai O STW and 2 sampling locations (R1 and R2) were proposed for the rising mains underneath the Tai O Creek.

6.4.5 During the course of the design, the new submarine outfall alignment has been revised to a shorter extent. The dredging extent for the new submarine outfall at Tai O STW was therefore reduced and only 4 sampling locations (D7 – D10) remained relevant. D7 could not be reached by marine craft due to shallow water, thus sampling at D7 could not be conducted. D12 and D13 were cancelled since they



were outside the dredging extent. D11 was outside the dredging extent, however, samples were still collected at D11 for reference.

- 6.4.6 Sampling at R1 and R2 at Tai O Creek could not be completed as these locations could not be safely accessed to by drilling equipment provided by the contractor. Therefore, it was infeasible to carry out the sediment sampling. In order to reduce the disturbance to the adjacent water of Tai O Creek, two drillholes (R1 and R2) and the associated sediment sampling and testing works for Tai O Creek are proposed to be undertaken during the construction of the trenchless sewer.
- 6.4.7 Sediment sampling was conducted from 29th December 2011 to 31st December 2011. Sediment samples were collected at four locations (namely D8 – D11 in Figure 1.1 of Appendix 6.1). Sediment samples were collected along the vertical profile of the proposed dredging layers at 0.9m, 1.9m, 2.9m, 5.9m and 7.9m or until reaching the rock bed.
- 6.4.8 The sediment samples were then tested in accordance with the requirements stipulated in the ETWB TC (W) No. 34/2002. The chemical testing results are summarised in **Table 6.5**. The laboratory report is provided in **Appendix 6.2**. It should be noted that the study of marine sediments addressed in this EIA Report is solely for the purpose of the EIA study and is independent of the further requirements of other authorities such as DASO.



Table 6.5 : Chemical Testing Results for Marine Sediments

Sampling Location	Sampling Depth (m below seabed)	Metals and Metalloids (mg/kg)									Total PCBs (µg/kg)	Low Molecular Weight PAHs (µg/kg)	High Molecular Weight PAHs (µg/kg)	Tributyl Tin (µg TBT/L)	Classification of Sediment
		Ag	As	Cd	Cr	Cu	Ni	Pb	Zn	Hg					
LCEL	--	1	12	1.5	80	65	40	75	200	0.5	23	550	1700	0.15	--
UCEL	--	2	42	4	160	110	40	110	270	1	180	3160	9600	0.15	--
Reference Sediment	Grab sample	0.1	7	<0.2	34	14	22	31	88	<0.05	<18	<550	<1700	<0.015	L
D8	0.00 – 0.90	<0.1	<u>15</u>	<0.2	33	13	22	24	77	<0.05	<18	<550	<1700	<0.015	M
	0.90 – 1.90	<0.1	<u>16</u>	<0.2	16	115	9	19	59	0.16	<18	<550	<1700	<0.015	H
	1.90 – 2.90	<0.1	<u>38</u>	0.2	40	12	29	28	97	<0.05	<18	<550	<1700	<0.015	M
D9	0.00 – 0.90	<0.1	<u>24</u>	<0.2	43	12	29	24	94	<0.05	<18	<550	<1700	<0.015	M
	0.90 – 1.90	<0.1	<u>22</u>	<0.2	42	12	29	23	92	<0.05	<18	<550	<1700	<0.015	M
	1.90 – 2.90	<0.1	43	<0.2	44	14	30	27	97	<0.05	<18	<550	<1700	<0.015	H
	4.90 – 5.90	<0.1	83	<0.2	36	14	23	59	83	<0.05	<18	<550	<1700	<0.015	H
D10	6.90 – 7.90	0.2	188*	<0.2	28	15	11	210	54	<0.05	<18	<550	<1700	<0.015	H (>10 time LCEL)
	0.00 – 0.90	<0.1	<u>14</u>	<0.2	48	17	32	31	107	<0.05	<18	<550	<1700	<0.015	M
	0.90 – 1.90	<0.1	11	<0.2	47	16	32	29	105	<0.05	<18	<550	<1700	<0.015	L
	1.90 – 2.90	<0.1	9	<0.2	48	16	32	29	106	<0.05	<18	<550	<1700	<0.015	L
	4.90 – 5.90	<0.1	<u>21</u>	<0.2	47	17	32	31	108	<0.05	<18	<550	<1700	<0.015	M
D11	6.90 – 7.90	<0.1	44	<0.2	44	17	29	34	97	0.05	<18	<550	<1700	<0.015	H
	0.00 – 0.90	0.2	<u>23</u>	<0.2	54	40	34	48	138	0.15	<18	<550	<1700	<0.015	M
	0.90 – 1.90	0.2	<u>27</u>	<0.2	61	43	39	51	150	0.13	<18	<550	<1700	<0.015	M
	1.90 – 2.90	0.2	30	<0.2	66	52	42	54	158	0.16	<18	<550	<1700	<0.015	H
	4.90 – 5.90	<0.1	10	<0.2	46	16	30	30	102	<0.05	<18	<550	<1700	<0.015	L
D11	6.90 – 7.90	<0.1	<u>15</u>	<0.2	48	18	32	32	108	0.05	<18	<550	<1700	<0.015	M

Notes:

- 1) Underlined, bold and Italic results indicate exceedance of LCEL.
 - 2) Underlined, bold and shaded results indicate exceedance of UCEL.
- * indicate exceedance of 10 times LCEL.



6.4.9 It can be seen from **Table 6.5** that 15 marine sediment samples are classified as Category M or Category H sediments. To determine the disposal method for the dredged sediments, 5 composite samples were made up for biological screening testing. The details are as below:

- A composite sample of Category M for D8 (i.e. mixing of 2 samples)
- A composite sample of Category M for D9 (i.e. mixing of 2 samples)
- A composite sample of Category M for D10 (i.e. mixing of 2 samples)
- A composite sample of Category M for D11 (i.e. mixing of 3 samples)
- A composite sample of Category H for D9 with one or more contaminant levels exceeding 10 times the LCEL shall be mixed with 9 portions of reference marine sediment (i.e. 1 sample).

6.4.10 Based upon the chemical screening results and in accordance with ETWB TC(W) No. 34/2002, Tier III biological screening was necessary for all Category M and Category H sediment samples collected, in order to determine the appropriate disposal method. The sediment samples requiring biological testing are detailed in **Table 6.6** below:

Table 6.6 : Sediment Samples Requiring Biological Testing

Borehole No.	Sample Depth (m)	Category	Continuous Vertical / Horizontal Profile (Yes / No)
D10	0.00 – 0.90 & 4.90 – 5.90	M	No
D11	0.00 – 0.90 & 0.90 – 1.90 & 6.90 – 7.90	M	No
D8	0.00 – 0.90 & 1.90 – 2.90	M	No
D9*	6.90 – 7.90	H (>10xLCEL)	No
D9	0.00 – 0.90 & 0.90 – 1.90	M	Yes

Note: *- Sample was mixed with 9 portions of reference sediment.

6.4.11 All biological tests were conducted by a HOKLAS accredited laboratory (ALS Technichem (HK) Pty) and include appropriate QA/QC such as negative control and positive control. Samples of reference sediment were also collected at the EPD sediment monitoring station PS6 located in Port Shelter, Sai Kung. All biological screening was conducted within the holding times specified in ETWB TC(W) No. 34/2002.

6.4.12 The summary results of the biological screening are presented in **Table 6.7**. The full laboratory report including water quality test data, details of the sample preparation procedures, source of test species, QA/QC and statistical table is provided in **Appendix 6.3**.

Table 6.7 : Biological Screening Summary Results and Decision Criteria based on ETWB TC(W) No. 34/2002

Sample ID	Sample Depth (m)	Category Based on Chemical Testing	10-Day Amphipod Survival Test	20-Day Polychaete Survival and Growth Test	48-96 hour Bivalve Survival and Normality Test	Overall Result
Reference Sample	n/a	Category L	n/a	n/a	n/a	n/a
D10	0.00 – 0.90 4.90 – 5.90	Category M	Fail	Pass	Pass	<u>FAIL</u>
D11	0.00 – 0.90 0.90 – 1.90 6.90 – 7.90	Category M	Pass	Pass	Pass	<u>PASS</u>



Sample ID	Sample Depth (m)	Category Based on Chemical Testing	10-Day Amphipod Survival Test	20-Day Polychaete Survival and Growth Test	48-96 hour Bivalve Survival and Normality Test	Overall Result
D8	0.00 – 0.90 1.90 – 2.90	Category M	Fail	Pass	Pass	<u>FAIL</u>
D9*	6.90 – 7.90	Category H (>10 time LCEL)	Pass	Pass	Fail	<u>FAIL</u>
D9	0.00 – 0.90 0.90 – 1.90	Category M	Fail	Pass	Pass	<u>FAIL</u>

Note: * - Sample was mixed with 9 portions of reference sediment.

6.4.13 With reference to ETWB TC(W) No. 34/2002, the proposed disposal option is provided in **Table 6.8**.

Table 6.8 : Final Disposal Option based on ETWB TC(W) No. 34/2002

Sampling Location	Sampling Depth (m below seabed)	Classification of Sediment	Biological Testing Result	Disposal Option
D8	0.00 – 0.90	M	Fail	Type 2 – Confined Marine Disposal
	0.90 – 1.90	H	NA	Type 2 – Confined Marine Disposal
	1.90 – 2.90	M	Fail	Type 2 – Confined Marine Disposal
D9	0.00 – 0.90	M	Fail	Type 2 – Confined Marine Disposal
	0.90 – 1.90	M	Fail	Type 2 – Confined Marine Disposal
	1.90 – 2.90	H	NA	Type 2 – Confined Marine Disposal
	4.90 – 5.90	H	NA	Type 2 – Confined Marine Disposal
	6.90 – 7.90	H (>10 time LCEL)	Fail	Type 3 – Special Treatment / Disposal
D10	0.00 – 0.90	M	Fail	Type 2 – Confined Marine Disposal
	0.90 – 1.90	L	NA	Type 1 – Open Sea Disposal
	1.90 – 2.90	L	NA	Type 1 – Open Sea Disposal
	4.90 – 5.90	M	Fail	Type 2 – Confined Marine Disposal
	6.90 – 7.90	H	NA	Type 2 – Confined Marine Disposal
D11	0.00 – 0.90	M	Pass	Type 1 – Open Sea Disposal (Dedicated Sites)
	0.90 – 1.90	M	Pass	Type 1 – Open Sea Disposal (Dedicated Sites)
	1.90 – 2.90	H	NA	Type 2 – Confined Marine Disposal
	4.90 – 5.90	L	NA	Type 1 – Open Sea Disposal
	6.90 – 7.90	M	Pass	Type 1 – Open Sea Disposal (Dedicated Sites)

6.4.14 The approximate extent of each category of sediment that requires disposal is shown on **Figure 6-1**. The total sediment arising from the construction of the new submarine outfall at Tai O STW and rising mains underneath the Tai O Creek are estimated to be 26,700m³ and 100m³ respectively.

6.4.15 Since sampling works locations R1 and R2 were not carried out during these sampling works, the sediment encountered during construction of rising mains underneath the Tai O Creek will be disposed of assuming the worst case scenario. These sediments will be disposed of as Type 3 unless further sediment data to be taken at R1 and R2 shows discrepancy.

6.4.16 The estimated volume of sediments suitable for Type 1 open sea disposal is approximately 1,300m³ and the estimated volume of sediments requiring Type 2 confined marine disposal is approximately 23,650m³. The volume of sediments



requiring Type 3 special treatment/disposal is estimated to be approximate 1850m³. The detail breakdown of the estimated volume of sediment was presented in **Table 6.9**.

Table 6.9 : Disposal Quantity for Marine Sediment

Disposal Options	Corresponding Category	Estimate Quantity (m ³)
Type 1 – Open Sea Disposal	Category L Sediment	1,300 (New submarine outfall at Tai O STW: 1,300) (Rising mains underneath the Tai O Creek: 0)
Type 1 – Open Sea Disposal (Dedicated Sites) at disposal site(s) allocated by MFC	Category M Sediment (passed the biological screening)	NIL
Type 2 – Confined Marine Disposal at disposal site(s) allocated by MFC	Category M Sediment (failed the biological screening) and Category H Sediment (does not require biological screening or passed in biological screening)	23,650 (New submarine outfall at Tai O STW: 23,650) (Rising mains underneath the Tai O Creek: 0)
Type 3 – Special Treatment / Disposal	Category H Sediment (failed in biological screening)	1,850 (New submarine outfall at Tai O STW: 1,750) (Rising mains underneath the Tai O Creek: 100)

- 6.4.17 Based upon the methods currently used in Hong Kong region, sediments that meet the requirements laid out in ETWB TC(W) No. 34/2002 for Type 1 – Open Sea Disposal, can be disposed of at suitable locations such as South Cheung Chau and East Ninepin. However, any contract documents for project should provide sufficient flexibility, should it be necessary to divert from one disposal site to another during the construction process.
- 6.4.18 The sediments that are anticipated to require Type 2 – Confined Marine Disposal after EPD and MFC approval, can be disposed of at the mud pits at East Sha Chau. As for Type 1 – Open Sea Disposal (Dedicated Sites), the contract documents, should provide an allowance for disposal of sediments at this location or another as required by the EPD or MFC. Additionally, sediments that are proposed to be disposed of at East Sha Chau, via trailer hopper dredgers must use a down-a-pipe disposal method, the design of which must be approved in advance.
- 6.4.19 For Type 3 – Special Treatment / Disposal, the Project Proponent shall be responsible for identifying and agreeing with the DEP the most appropriate treatment and/or disposal arrangement. The determination of the appropriate disposal options shall be based on the sediment classification and if necessary, the biological screening results.
- 6.4.20 Possible arrangement for Type 3 disposal is by geosynthetic containment. A geosynthetic containment method is a method whereby the sediments are sealed in geosynthetic containers and, at the disposal site, 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, thereby meeting the requirements for fully confined mud disposal. The technology has been currently adopted as disposal arrangement for Type 3 sediment under *Wan Chai Development Phase II and Central-Wan Chai Bypass Project* (Application No.: EIA-141/2007).
- 6.4.21 The rationale for the sediment removal has been presented to and agreed by Secretary of the MFC. The correspondence from the MFC is provided in **Appendix 6.4**. The final disposal site and arrangement will be determined by MFC and dumping permit under the DASO will be obtained from EPD prior to commencement of the dredging works.



6.4.22 For allocation of sediment disposal sites and application of marine dumping permit, separate SSTP has to be submitted to the Marine Dumping Section of EPD for agreement under DASO following the procedure in ETWB TC(W) No. 34/2002. Additional site investigation, based on the SSTP, will be carried out in order to confirm the disposal arrangements for the proposed sediments removal. A Sediment Quality Report (SQR) shall then be required for EPD agreement under DASO discussing in details the site investigation, testing results as well as the delineation of each of the categories of excavated materials and the corresponding types of disposal.

C&D Materials

6.4.23 C&D materials would be generated from the excavation works for the sewer construction, proposed works of Fan Kwai Tong and Hang Mei SPS and upgrading works of Tai O STW. The total quantity of C&D materials generated from the works is estimated to be approximately 25,300m³. The quantity of inert C&D materials to be generated from excavation (soil, rock, sand and concrete) is estimated to be approximately 25,250m³ while the quantity of non-inert C&D waste generated is estimated to be approximately 50m³.

6.4.24 During the course of the construction works associated with the upgrading of the Tai O STW, fill materials will be imported for the reclamation work that is required from an appropriate source (i.e. public fill bank). As the construction progresses and excavation works commence, it is anticipated that C&D materials from the excavation would be exported to public fill bank that material was imported from for the reclamation works. The C&D materials generated during the excavation works associated with the upgrading of the Tai O STW will be managed onsite so that they are reused as quickly as possible and that the space taken by the C&D materials onsite is minimised as much as possible.

6.4.25 It is anticipated that after the exporting of the C&D materials generated by the excavation works, that the remaining estimated quantity of inert C&D materials to be disposed of will be approximately 250m³. Final source of the fill material to be imported for the reclamation works and the final destination of the inert C&D materials will be determined to the availability of public filling facilities and are subject to agreement with the CEDD.

6.4.26 The breakdown of the amount of C&D materials details are shown in **Table 6.10**.

Table 6.10 : Summary of Estimated C&D Materials Generation

Type of Construction	Total C&D Materials (m ³)	Inert C&D Materials (e.g. soil, rock, concrete) (m ³)	Non-inert C&D Waste (m ³)	Inert C&D Materials to be reused (m ³)	Volume of inert C&D Materials to be Disposed of (m ³)
Sewers	15,100	15,100	0	15,000	100
Proposed works for SPSs (Fan Kwai Tong and Hang Mei)	2,200	2,200	0	1,000	1,200
Upgrading of Tai O STW	8,000	7,950	50	9,000	-1,050*
Total	25,300	25,250	50	25,000	250#

Note: * - For the upgrading of the Tai O STW and due to the construction phasing of the Project, it will be necessary to import C&D materials.

#- The remaining total volume of 250m³ of C&D materials may be taken to public fill reception facilities, subject to the agreement of the CEDD

6.4.27 The upgrading of the Tai O STW and the associated require onsite storage. Provided that construction works will generate only a small amount of C&D materials that will proper management for C&D materials and adoption of good site practices are implemented, it is anticipated that the impact on space requirements at the Site



due to C&D materials arising from the Project would be insignificant as the C&D materials will be generated during the course of the construction programme rather than at one point in time.

- 6.4.28 Residual inert C&D material and non-inert C&D waste after the completion of the construction works will be sorted on-site and disposed of properly. Non-inert C&D waste will be disposed of at strategic landfill and inert C&D materials will be disposal of at public filling reception facilities. Based on the current design information, it is planned to import materials from a public fill bank for reclamation and then dispose of excavated C&D materials during the construction programme via the use of barges, to transport the C&D waste materials from the barging point of Tai O STW to the designated disposal facilities once per day. The general layout of the Tai O STW and the proposed barging points are shown on **Figure 2-2**. The proper management of C&D materials and the use of good site practices will be implemented to minimise the potential environmental impacts.

General Refuse

- 6.4.29 The construction workforce will generate a small amount of refuse such as waste papers, plastic packaging and possibly food wastes. Such refuse will be collected on-site on a regular basis, separately from C&D materials by an appropriate waste collector to be employed by the contractor.
- 6.4.30 Prior to disposal off-site, such wastes will have to be temporarily put in suitably covered storage areas/bins where they will have to be regularly cleaned and maintained to avoid attracting vermin and pests. With proper on-site handling and storage as well as regular disposal of the wastes, no adverse impacts are envisaged.

Chemical Waste

- 6.4.31 The maintenance and servicing of construction plant and vehicles may generate a small amount of chemical wastes such as waste oil/grease, spent solvents/detergents, empty fuel/lubricant drums; used oil filters and scrap batteries. The volume of chemical waste to be generated is difficult to estimate at this stage. It will depend on the total number of plant or vehicles to be used on-site and the frequency of maintenance by the future contractors. However, with consideration of the nature of the project, it is expected that the volume of chemical waste to be generated would be small. Should proper handling, storage and disposal of chemicals are implemented; no unacceptable environmental impacts are anticipated.

Operational Phase

- 6.4.32 During the operational phase of the project, wastes to be generated include screenings and chemical wastes from the Tai O STW and the SPS, silts and debris from the maintenance of sewers, general refuse from the office of the Tai O STW and dewatered sludge.
- 6.4.33 The screenings from Tai O STW and the SPSs, grits collected from grit chamber of Tai O STW, silt and debris from the maintenance of sewers and general refuse from the Tai O STW will be properly stored in a covered container and disposed of regularly to the designated landfill sites by a reputable waste collector employed by the operator to reduce the potential pest, odour and litter impacts. The estimated volume of waste to be generated from screenings and grits is about 80m³ per month. The screenings and grits will be removed on a daily basis by the operator.
- 6.4.34 The dewatered sludge will be generated from the sewage treatment process during the operation of the project. According to the design capacity of the upgraded Tai O



STW, the average quantity of dewatered sludge is about 24m³ per month. The dewatered sludge will be removed by barges around three times per week.

- 6.4.35 The maintenance works of Tai O STW will generate a small amount of chemical wastes which will be collected by a licensed collector and disposed of properly following standard practices.
- 6.4.36 Mitigation and control measures to minimise the potential environmental impacts generated from the waste management are provided in the following section.

6.5 Mitigation Measures

Construction Phase

- 6.5.1 During the planning stage, waste management measures will be implemented that will aim to recover, avoid and minimise the constructed waste generated on site by utilising the following general approach:
- Reduce wastage;
 - Reuse materials, where possible;
 - Recycle materials, where possible; and
 - Dispose of materials after all other options have been considered.
- 6.5.2 Adverse impacts from waste management are not expected, provided that good site practices are strictly followed. Recommendations for good site practices during the construction activities include:
- The Contractor shall prepare a WMP in accordance with the requirements set out in the ETWB TCW No. 19/2005, Waste Management on Construction Site, for the ER's approval. The WMP shall include monthly and yearly Waste Flow Tables that indicate the amounts of waste generated, recycled and disposed of (including final disposal site);
 - The Contractor's waste management practices and effectiveness shall be audited by the ER on regular basis;
 - The Contractor shall provide training for site staff for the concept of site cleanliness and appropriate waste management procedures, including waste reduction, reuse and recycling;
 - Sufficient waste disposal points and regular collection of waste shall be provided;
 - Trucks with covering for the open-box bed and enclosed container shall be used to minimise windblown litter and dust during transportation of waste;
 - Regular cleaning and maintenance programme for drainage systems, pumps and oil interceptors;
 - Separation of chemical wastes for special handling and appropriate treatment at a Chemical Waste Treatment Facility;
 - Encourage collection of aluminium cans, paper and plastic bottles by providing separate labelled bins to enable these wastes to be segregated from other general refuse generated by the workforce;
 - Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal;
 - A recording system for the amount of wastes generated, recycled and disposed (including disposal sites) should be proposed; and



- Plan and stock construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste.

C&D Materials

- 6.5.3 With good site management it can reduce the over-ordering of C&D materials such as concrete and mortars. Alternatives such as steel frameworks and plastic fencing can be considered to increase the chances for reuse.
- 6.5.4 In order to minimise the potential environmental impacts resulting from collection and transportation of C&D materials for off-site disposal, the excavated materials comprising fill materials should be reused on-site as backfilling materials as far as practicable.
- 6.5.5 C&D waste, such as wood, plastic, steel and other metals should be reused or recycled and, as a last resort, disposed of to landfill sites. A suitable area should be designated within the site for temporary stockpiling of C&D materials and to facilitate the sorting process. In order to monitor the disposal of C&D materials at the designated public fill reception facility and landfill and to control fly-tipping, a trip ticket system should be included. Reference can be made to Development Bureau TC(W) No. 6/2010 "Trip Ticket System for Disposal of Construction and Demolition Materials" for details.
- 6.5.6 The C&D materials to be disposed of at public filling reception facilities shall be materials only consist of brick, concrete, cement plaster, soil and inert building debris. The materials shall be free from plastics, chemical waste, industrial metals and other materials that are considered unsuitable at the facility.

General Refuse

- 6.5.7 General refuse should be stored in enclosed bins or compaction units separate from C&D materials. A reputable waste collector should be employed by the Contractor to remove general refuse from the site regularly, separately from C&D materials. An enclosed and covered area is preferred to reduce the occurrence of wind-blown light materials. In addition, a sufficient number of enclosed bins shall be provided on site for containment of general refuse to prevent visual impacts and nuisance to the sensitive surrounding.

Chemical Wastes

- 6.5.8 For the disposal of chemical wastes produced at the construction site, the Contractor is required to register with the EPD as a CWP and to follow the requirements stated in the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.
- 6.5.9 Good quality containers compatible with the chemical wastes should be used. Appropriate labels should be securely attached on each chemical waste container indicating the chemical characteristics of the chemical waste, such as explosives, flammable, oxidising, irritant, toxic, harmful, corrosive, etc. The Contractor shall also use a licensed waste collector engaged to transport and dispose of the chemical wastes in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.



Dredged Marine Sediment

- 6.5.10 Dredged marine sediments to be disposed of at different marine disposal sites should be stored separately to avoid cross contaminated. To minimise potential odour nuisance, covers should be provided for the storage tank or barges. Different category of marine sediments should be disposed of at the designated marine designated sites.
- 6.5.11 The testing results and sediment quantities for each category presented in this report are for EIA purposes only. For allocation of sediment disposal sites and application of marine dumping permit, another proposal for sampling and chemical testing of the sediment will be prepared and submitted to the EPD for approval following the procedures in ETWB TC(W) No. 34/2002. The approved detailed sampling and chemical testing will be carried out prior to the commencement of the dredging activities to confirm the sediment disposal methods. The contamination levels of the sediment to be dredged will be analysed and recorded. After carrying out the sampling and testing, a SQR will be prepared for EPD approval as required under the DASO to agree and confirm the quantities and extent of the contamination of the sediments prior to the dredging works. The SQR will include the sampling details, the chemical testing results, quality control records, proposed classification and delineation of sediment according to the requirements of ETWB TC(W) No. 34/2002.

Operational Phase

- 6.5.12 The major waste generated during the operational phase will be screenings, silt and debris, grits and dewatered sludge. The screenings, silt and debris and grits are considered similar in nature to general refuse and will be disposed of at landfill sites regularly by a reputable waste collector to reduce pest, odour and litter impacts. As the project is expected to be commissioned in 2019, it is anticipated that dewatered sludge will be disposed of at Sludge Treatment Facilities regularly.
- 6.5.13 For chemical waste generated during the operational phase, the handling procedures and disposal method are the same as those presented in **Section 6.5.8**.
- 6.5.14 **Table 6.11** provides a summary of the various types of waste to be generated during the construction and operational phases of the Project and the corresponding handling and disposal methods.



Table 6.11 : Summary of Waste Handling Procedures and Disposal Routes

Waste Type	Handling	Disposal
Construction		
C&D Materials	Where possible should be reused on-site. If off-site disposal is required, separate into: <ul style="list-style-type: none"> • Non-inert C&D waste • Inert C&D materials 	Non-inert C&D waste to Strategic Landfill Inert C&D materials (Public fill) to Public Filling Reception Facilities.
Chemical Wastes	Recycle on-site or by licensed companies. Store on-site within suitably designed containers	Chemical Waste Treatment Centre
General Refuse	Provide on-site refuse collection facilities	Employ a reputable hygiene company for collection and disposal of general refuse to landfill sites.
Dredged Marine Sediment	In accordance with the requirements of ETWB TC(W) No. 34/2002.	In accordance with the requirements of ETWB TC(W) No. 34/2002.
Operation		
Screenings, Silt and Debris from Operation and Maintenance	Off-site disposal required	Strategic landfill
Grits	Off-site disposal required	Strategic landfill
Dewatered Sludge	Off-site disposal required	Sludge Treatment Facilities
Chemical Waste	Off-site disposal required	Chemical Waste Treatment Centre

6.6 Residual Impacts

6.6.1 With the implementation of recommended mitigation measures, residual impacts are expected to be insignificant during the construction and operation of the Project.

6.7 Environmental Monitoring and Audit Requirements

6.7.1 The assessment has concluded that proper handling, storage, collection, transportation and disposal of waste materials generated during construction and operation of the Project will not give rise to any adverse impacts.

6.7.2 It is recommended that during the construction phase, site inspections and supervisions of waste management procedures and auditing of the effectiveness of implemented mitigation measures should be undertaken on a regular basis (e.g. weekly as a minimum). These tasks shall be scheduled in the WMP to be prepared by the Contractor, and a summary of the site audit findings shall be presented in the Environmental Monitoring and Audit (“EM&A”) reports.

6.7.3 No EM&A requirement is considered necessary during the operational phase.

6.8 Conclusion

6.8.1 The construction activities associated with the proposed works will generate a variety of wastes including site clearance waste, C&D materials, chemical waste, general refuse and dredged sediments. With implementation of good site practice and the recommended mitigation measures, there would be no adverse environmental impacts.

6.8.2 Major wastes to be generated from the operation of the Tai O STW include screenings, silt and debris, grits and dewatered sludge, and screenings from the operation of the SPSs. Provided proper handling procedures and disposal method are adopted, no unacceptable environmental impacts are anticipated.