

9. REQUIREMENTS FOR WASTE COLLECTION DURING SHELTERED BOAT ANCHORAGE OPERATION

9.1 Introduction

In accordance with the Study Brief, this chapter examines the specific requirements for a refuse collection point to serve the Tai O sheltered boat anchorage. In addition, opportunities and recommendations are presented for the management of floating and littoral refuse during the anchorage operation. Issues related to the management of liquid wastes are addressed in Chapter 5.

Issues relating to the management and disposal of construction wastes are specifically excluded from this Study. Notwithstanding this, given the remote location of the site, and the historical occurrence of fly-tipping in South Lantau, it is recommended that the Contractor specify the intended location of all construction wastes transported off-site for the approval of the Employers Representative (ER). In addition, in order to minimise volumes for disposal, construction wastes should be segregated to maximise the opportunities for re-use on site. When disposing of wastes off-site, the Contractor shall obtain receipts identifying the relinquishment of responsibility for waste disposal. It is anticipated that this would occur at either the Mui Wo Refuse Transfer Station or West New Territories (WENT) Landfill. All receipts shall be copied to the ER on site.

9.2 Refuse Collection and Management

9.2.1 Legislation and Applicable Standards

The following ordinances and regulations are applicable to the control and management of waste in Hong Kong:

- the Waste Disposal Ordinance (Cap. 354);
- the Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws (Cap. 132);
- the Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354); and
- the Water Pollution Control Ordinance (Cap.358)

Unauthorised littering and fly-tipping both on land and in Hong Kong waters is an offence and punitive measures can be taken against offenders (currently a fine of HK\$10,000 and 6 month's imprisonment).

There are no legislative standards governing the requirements for litter collection facilities in Hong Kong. However, general standards for the provision of refuse collection points in rural areas such as Tai O are presented in Chapter 9 of the Hong Kong Planning Standards and Guidelines (HKPSG). These include standards for a village-type refuse collection point of 7.8m x 6.4m (about 50m²) in size. It is recommended that 1 refuse collection point is provided to serve one or more adjoining villages up to a maximum population of about 1,000 people.

9.2.2 Waste Monitoring in Hong Kong

Waste arisings are monitored routinely and reported annually by EPD. Hong Kong is divided into 18 waste arising districts (WADs), which are then further sub-divided into a total of 54 Waste Arising Areas (WAAs). Future waste arisings are projected according to different categories of waste as described below:

Domestic waste: Waste generated from daily activities in residential premises and refuse collected from public cleansing services. Public cleansing waste includes dirt and litter collected by the two Provisional Municipal Councils, marine refuse collected by the Marine Department and waste from country parks collected by the Agriculture and Fisheries Department.

Commercial waste: Waste arising from commercial activities taking place in markets, shops, restaurants, hotels and offices etc. Such waste is collected mainly by private waste collectors. However, some commercial waste is mixed with domestic waste and collected by the Municipal Councils.

Industrial waste: Waste arising from industrial activities and does not include chemical waste or Construction and Demolition (C&D) waste. Industrial waste is usually collected by private waste collectors. However, some industries may deliver their own waste directly to landfills for disposal.

These categories are based upon their source and the arrangements for collection and disposal (EPD 1997).

The Marine Department is principally responsible for the collection of floating refuse. Marine Department currently collects approximately 5,000 tonnes of floating refuse a year.

There are no data on the existing volumes of domestic waste arisings from current boat users at Tai O or from Tai O village itself. Waste arisings for Tai O are included as part of the EPD figures for the wider Outlying Islands WAD/WAA.

9.2.3 Responsibilities for Collection and Disposal of Wastes

The Regional Services Department (RSD) is responsible for the collection and disposal of litter on land (including the shoreline), whilst the Marine Department has principal responsibility for the collection of floating refuse. RSD's responsibility for collection of shoreline litter generally only applies to gazetted beaches. As this distinction does not apply to the shoreline at Tai O, special provision may need to be determined for the collection of litter along the waterfront. The role of the Provisional Municipal Councils is currently under review by the Legislative Council. It is, therefore, likely that the existing roles and responsibilities in relation to waste collection will change in the future.

Subject to the above, the current arrangements for waste collection are expected to be continued and the development of the design of the mangrove planting area should consider methods that minimise the impact of floating refuse and littoral refuse.

9.2.4 Current Waste Collection and Disposal Practices at Tai O

There are numerous RSD refuse bins throughout the Tai O village area. Litter from these bins, as well as domestic refuse within Tai O and the surrounding villages, is collected by RSD and transferred to the temporary refuse collection point located near Tin Ning House - refer to **Figure 9.1**. A refuse collection vehicle then takes waste to the refuse transfer station at Mui Wo before compaction and onward transfer by boat for disposal at the West New Territories, (WENT) landfill.

9.3 Estimates of Solid Waste Generation at the Sheltered Boat Anchorage

In order to determine the need for a new refuse collection point, it is necessary to identify the likely scale of waste arisings that will be generated during operation of the sheltered boat anchorage. Sources of wastes will include the following:

- redundant equipment used for fishing, (e.g. discarded nets, pots, traps etc);
- wastes generated by shore-based visitors to the anchorage and to the mangrove planting area;
- boat maintenance wastes (including chemical wastes) from routine maintenance of fishing vessels; and
- domestic wastes produced by boats using the anchorage.

The likely volume of wastes arising from these sources, and their characteristics, are considered below.

9.3.1 Redundant Fishing Equipment

Normal fishing activities will result in fish catch residues, however such material is generally discarded offshore during fishing operations. These are not considered to require on-land management.

Discarded fishing equipment has the potential to impact upon marine life as well as cause a nuisance to boat users, such material should be disposed of to an appropriate waste collection facility. There are no data relating to the likely volumes of solid wastes arising from redundant fishing equipment - however, it is assumed that the volume of such wastes will be low and only produced sporadically. This material could be disposed of at any waste collection facility associated with the reclamation area boat maintenance facilities.

9.3.2 Land-Based Anchorage Visitor Waste

The ongoing Study on the Revitalisation of Tai O by Planning Department has identified that at present, there are approximately 0.3 million visitors to Tai O annually (ERM 1999). When implemented, the recommendations from the Revitalisation Study will result in an overall increase in tourism to Tai O. The small volumes of waste currently generated by visitors are collected through the provision of numerous waste bins strategically located within and around Tai O.

The effect of the sheltered boat anchorage and mangrove habitat on visitor numbers is uncertain. Whilst subject to the findings of the Study on the Revitalisation of Tai O, it is possible that a visitor centre will be located on the eastern reclamation. In order to cater for the wastes generated by visitors, extra waste bins should be placed in areas of public access. However, the volumes of additional visitors arising directly as a result of the anchorage and the mangrove area are likely to be very small in relation to the overall increase in visitor numbers that is hoped to be achieved under the Revitalisation Study. The scale of provision for this element of waste arisings will need to be examined further in the context of the wider plans to stimulate tourism in Tai O under the Revitalisation Study.

9.3.3 Boat Maintenance Waste

Although a layout has not been established at this stage, it is proposed that the western reclamation will be used for boat maintenance facilities. Any boat maintenance facilities are likely to generate a variety of solid wastes, including waste wood, plastics, metals etc. In addition, chemical wastes such as waste oils, air and oil filters, spent batteries, solvents etc. may be generated.

Given the close proximity of this area to the mangrove habitat and the waters of the anchorage, any chemical wastes will need to be carefully managed to ensure that no offsite leakages occur. If chemical wastes are to be generated, the operator(s) of the premises will need to register with EPD as a chemical waste producer. All chemical wastes would need to be managed, stored and disposed of in accordance with the Waste Disposal (Chemical Waste) (General) Regulation. Further guidance is given in the EPD documents:

- a Guide to Chemical Waste Control Scheme;
- a Guide to the Registration of Chemical Waste Producers; and
- the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.

Given that there is no information at this stage regarding the layout of the boat maintenance facilities, it is difficult to estimate the volume of any chemical (or other) waste arisings. However, the EIA for the River Trade Terminal (RTT) situated near Tuen Mun, estimated that the RTT facility is likely to generate approximately 6m³ waste oils/solvents and around 40L of waste battery liquids per month (Scott Wilson 1996). These volumes are considered to be small and would not present an undue hazard assuming the relevant guidelines as define above are followed. Given that the RTT is considerably larger than the Tai O anchorage (as it was designed to accommodate a maximum of 60 cargo vessels at 50m berths at any one time), the volumes of chemical wastes arising from the sheltered boat anchorage are expected to be very small.

The specific requirements for the management of chemicals waste and general wastes at any boat maintenance facilities needs to be considered following definition of the reclamation land uses, however, should such facilities be proposed, a waste collection facility is expected to be required. Design recommendations to ensure that there are no water pollution impacts arising from uncontrolled discharges from the reclamation areas are discussed in Chapter 5.

9.3.4 Boat Generated Domestic Waste

The volume of domestic waste generated from boats during sheltered boat anchorage operation is dependent upon the number and type of moored vessels. The number of fishing vessels in Tai O in 1997 was reported in **Table 7.11** which illustrated that there were some 129 vessels, comprising the following:

- 99 - P4/7 type craft;
- 21 - mixed category (including small craft used for hand-lining, long-lining gill-netting and miscellaneous craft); and
- 9 - shrimp-trawlers.

Domestic wastes (of any reasonable quantity) are only likely to be generated by vessels on which fishers permanently reside. Of the existing boats in Tai O, the P4/7 and those craft categorised as "mixed" are considered to be too small for permanent habitation. This leaves only 9 shrimp trawlers on which fishers could reside, although it should be recognised that of these boats, some fishers may live in Tai O village.

There are no data available to indicate how the breakdown of vessels may change during sheltered boat anchorage operation. However, as the purpose of the anchorage is to promote the local fishing industry through the provision of mooring for 220 boats/fishing vessels, it is considered likely that the relative proportion of the different vessels using the anchorage will remain largely unchanged. Therefore, assuming a proportional increase in vessel types, when at full capacity of 220 boats, the sheltered boat anchorage may be used by the following:

- 169 - P4/7 type craft;
- 36 - mixed category boats; and
- 15 - shrimp-trawlers.

As noted above, there are no data available regarding the existing volumes of domestic waste arisings from current boat users moored at Tai O. However, using the figures generated by EPD (1997), **Table 9.1** estimates the future anticipated waste volumes arising from the sheltered boat anchorage. This is based on the assumption that all shrimp trawlers have a permanent, live-aboard family crew of four people.

Table 9.1: Predicted Domestic Waste Arisings from Fishing Vessels with Permanent Residents in the Tai O Sheltered Boat Anchorage.

Year	No Shrimp Trawlers	Total No of Permanent Residents	Per Capita Generation Rate ¹ (kg/person/day)	Total Volume of Domestic Waste (kg/day)
1997	9	36	1.04	37.44
2006	15	60	1.11	66.6
2011	15	60	1.15	69

Notes:

¹ Domestic waste generation rates from EPD (1997) (figures for 1997 are actual recorded numbers)

Table 9.1 illustrates that if there is a proportional increase in habitable vessels using the sheltered boat anchorage, approximately 66 - 69 kg/day of domestic waste may be generated by anchorage residents. This volume is considered small and capable of being handled by the existing refuse collection facility.

The projected figures for domestic waste arisings following operation of the sheltered boat anchorage are considered to be indicative given that the numbers of individuals living on the boats are best estimates. It should also be noted that although the *per capita* waste generation rates derived by EPD are recognised as including marine wastes, the majority of data used for compilation of projected waste generation rates are from conventional terrestrial homes. Lifestyle differences between the two types of dwellings are such that *per capita* generation rates for boat dwellers are likely to be lower. Notwithstanding these limitations, it is considered that the volumes of domestic waste produced by vessels during the operation of the sheltered anchorage are likely to be small.

9.4 Requirement for a New Refuse Collection Facility

As illustrated above, wastes may be generated from within the sheltered boat anchorage, the reclamation areas, as well as by site visitors. The total volume of waste generated from these activities cannot be readily estimated given the uncertainties regarding the number of visitors to the site, the reclamation area land uses and anchorage residents.

If waste collection facilities are provided for boat maintenance facilities in the reclamation area, such facilities should also be suitable for the collection of domestic wastes from the anchorage. Whilst the volume of waste received from boat occupants is unlikely to warrant a new Refuse Collection Point (RCP), following discussions (CED/MD/RSD/PlanD) it is considered the need for a new RCP to cater for the overall increase in wastes generated at Tai O resulting from both the revitalisation proposals and the sheltered boat anchorage should be considered in the revitalisation study. Provision for the RCP will need to be included in the Layout Plan being generated under the revitalisation study. In order to ensure appropriate management and disposal of both land and marine generated wastes, the RCP should be designed to ensure easy access from the sheltered boat anchorage area. This will limit the possibility of boat-generated refuse being illegally tipped into the anchorage and will encourage boat occupants to deliver wastes to the RCP. Easy boat access will also facilitate delivery to the shore from official collection services. The RCP should also be designed such that it is readily accessible from the road in order to allow easy access by refuse collection vehicles (RCVs). The RCP should be located such that there is adequate room for vehicle manoeuvring and bin emptying activities.

9.5 Control of Floating and Littoral Refuse

9.5.1 Introduction

Accumulations of floating refuse can cause both a visual intrusion and a hazard to vessels using the sheltered boat anchorage. Such wastes are likely to arise from two main sources:

- discarded refuse from boats using the anchorage; and
- existing flotsam from other areas transported by winds and surface currents, which becomes embayed within the sheltered boat anchorage and its surrounds.

In addition, there may be some floating refuse generated from the land-based reclamation areas. Whilst the detailed layouts for the reclamation areas have not been confirmed, it is reasonable to assume that any boat maintenance facilities located on the reclamation sites will not be a significant source of floating refuse within the anchorage, as suitable methods will be in place for the collection and disposal of solid wastes from these areas (refer to the above).

As identified in Chapter 5, waste best practices can be enhanced through the education of waste producers. Appropriate signs may be placed at the site of any boat yard areas to encourage waste segregation and therefore waste reduction at source.

Significant accumulations of floating and littoral refuse have been observed in the sheltered bays in and around the proposed mangrove planting during site visits, indeed Tai O residents have expressed concerns to government over floating debris within Tai O Creek. Areas illustrated to be of particular concern are the salt pan side of the existing outer seawall and the small beach area near Nam Chung Tsuen. These areas are affected by both flotsam and floating refuse. Existing locations of shoreline litter are shown in **Figure 9.1**. The incidence of floating refuse is likely to be exacerbated during the summer monsoon, when the prevailing winds are from a south-westerly direction. During this period winds are likely to blow flotsam directly into Tai O Bay. Given that the purpose of the sheltered boat anchorage is to increase the area of sheltered waters within Tai O Bay, it is considered necessary to undertake additional management measures to control and manage floating refuse, although the volumes of waste involved cannot be readily quantified.

9.5.2 Management of Floating and Littoral Litter

Floating Refuse

Littering of Hong Kong waters is an offence. However, the practical difficulties of identifying the source of floating refuse in particular, floating debris that originates outside of the sheltered boat anchorage, shows that this is not a suitable deterrent to obviate the need for management measures.

The principal method of managing floating (and littoral) debris is through reduction at source. To minimise the waste volumes arising from within the sheltered boat anchorage, suitable collection facilities have been recommended that are readily accessible to boat dwellers, to encourage anchorage users to take litter ashore. Similarly, measures for land-based refuse generated by visitors have been recommended.

Whilst emphasis should be placed on litter prevention, it is considered that a litter management programme should be implemented during the sheltered boat anchorage operation. The Pollution Control Unit of the Marine Department operates various schemes for the collection of floating refuse in Hong Kong. These include one “disfloater” and six “waterwitch” specialist collection vessels, which operate in the more congested waters of Hong Kong. Generally, it is not considered practical to use these specialist marine vessels in remote and relatively small areas such as Tai O. Therefore, it is recommended that floating debris be collected by a local private contractor under a refuse scavenging service using motorised sampans (Mopans). It is noted that Marine Department has informed the Consultants that they plan to hire a dedicated motorised sampan to enhance the refuse collection service at the Tai O sheltered boat anchorage area (Marine Department pers. comm. 1999). As detailed in Section 9.4, this will require the planned RCP to be located in a manner that allows easy marine access from the sheltered boat anchorage area.

If needed in the future, the refuse scavenging service could be coupled with a service to collect domestic wastes directly from boats (excludes chemical wastes, sewage etc.) within the sheltered boat anchorage (subject to the availability of resources). In this instance, users are provided with refuse bags by the contractor, these are then collected for removal overland.

Littoral Refuse

Floating refuse within the anchorage will naturally accumulate in areas of low flow. As such litter is likely to collect along the outer seawall of the mangrove planting area, predominantly in the interstitial spaces between rocks and around the high tide mark. Efficient litter collection can only be achieved by hand picking from the shoreline. For safety reasons, this should be carried out during low tide when the areas are exposed.

Construction of the mangrove planting area will include breaking of the outer seawall in places to improve water circulation. This will increase the likelihood of floating refuse entering the mangrove area. Opportunities for limiting the extent of litter accumulation in the mangrove planting area have been considered. Whilst transport of litter could be controlled by barriers such as metal grilles or nets across the seawall breaks, such barriers and the resultant accumulations of litter would impede the natural colonisation of the planting area by mangrove droppers, fish fry etc. carried on the tides. Such barriers would also prevent droppers from with the mangrove habitat from leaving the area and propagating in other mud flat areas. Therefore, barriers are not recommended and any accumulated refuse within the mangrove planting area should be collected by hand-picking. It is also noted that litter would still need to be periodically removed from such barriers. However, as the management planning requirements for the mangrove planting area are outside of the scope of the EIA Study, these recommendations are subject to review during the development of the design for the mangrove planting area.

9.5.3 Monitoring of Waste Arisings

Given the uncertainties over the likely volumes of wastes generated, it has been recommended and agreed that the volumes wastes should be monitored for the first year of sheltered boat anchorage operation. Marine generated wastes delivered to the RCP for onward disposal by RSD will be monitored by the Marine Department. Specifically Marine Department will be responsible for monitoring volumes of:

- wastes collected from the sheltered boat anchorage users as part of the boat collection service; and
- scavenged floating refuse from within the sheltered boat anchorage.

In addition, volumes of collected wastes generated on land will be monitored by RSD. Monitoring will allow determination of the overall quantities of wastes generated and facilitate decisions regarding future waste disposal management practices.

9.6 Overview of Disposal Facilities for Refuse Generated by the Sheltered Boat Anchorage and Associated Features

The operation of the sheltered boat anchorage will result in the following waste arisings, which will require collection and disposal:

- domestic refuse from boat anchorage occupants;
- refuse generated by the reclamation land users;
- floating litter arising from within and outside of the sheltered boat anchorage; and
- littoral refuse arising from within and outside of the sheltered boat anchorage.

The responsibility for collection of these wastes falls between the following organisations:

- RSD for land generated refuse; and
- Marine Department for floating refuse.

It is recommended that the volume of waste collected and delivered to the Tai O refuse collection point be monitored for at least the first year of sheltered boat anchorage operation. The waste disposal arrangements should be reviewed thereafter to determine whether the waste management provisions are adequate.

This review should take into account the proposals recommended in the Planning Department Study on the Revitalisation of Tai O and any changes to the administration that affect the existing responsibilities of the waste collection authorities. Chemical wastes and wastes generated by any reclamation area boat maintenance facilities will need to be specifically managed and controlled in accordance with specified government regulations and guidelines.