2. Project Description

2.1 Introduction

The OWTF 2 Project is a key part of the Hong Kong Government's drive to increase the sustainability of waste management in the HKSAR. The purpose of the facility is to treat large volumes of source-separated organic waste (principally food waste) from Commercial, Institutional and Industrial facilities in order to recover reusable materials and energy, such as compost and biogas, and minimise the volume of waste disposed of at Hong Kong's landfills.

The construction of the Project will involve demolition and removal of the existing above ground structures of the Sha Ling Livestock Waste Composting Plant (SLCP), construction of superstructure for an administration building and enclosed waste reception area, installation of treatment facilities including waste pre-treatment equipment, digesters, biogas holding tanks, composting, wastewater treatment, air treatment systems, and facilities for biogas processing, utilisation and transmission, etc.

When operational, the plant will process around 300 tonnes of organic waste per day to produce biogas and soil enhancement products (e.g. soil conditioner / compost). The organic waste will be source separated and delivered to the OWTF 2 by road directly from the producers. The plant will either supply biogas directly to the gas network, or use it to generate renewable electricity on site. Surplus power may be exported to the grid. Treated wastewater will be discharged to the local sewerage network.

2.2 Site Location and History

The Project is located at Sha Ling in the North District, within the Frontier Closed Area (see **Figure 2.1**). The Site has an area of around 2.5 hectares, of which roughly 1.5 hectares has been previously developed. The former Sha Ling Livestock Waste Composting Plant currently occupies the site; although this facility was decommissioned in 2010. The Site is zoned as Government, Institution or Community (G/IC) landuse in the approved Fu Tei Au and Sha Ling Outline Zoning Plan No. S/NE-FTA/12 dated October 2010. EPD has use of the site by way of Temporary Government Land Allocation (TGLA) No. TDN 265.

The Site consists of a platform located adjacent to Kong Nga Po Road in Man Kam To. The platform is relatively flat with a formation elevation of approximately 38mPD and was formed by cutting into an existing natural hillside. The platform is surrounded by natural slope at the northern portion and the southern portion is mainly formed by man-made cut slopes. Vehicular access to the Site is located at the south-eastern end of Kong Nga Po Road.

2.3 Need for the Project

Table 2.1 shows the quantity of Municipal Solid Waste (MSW), that is Domestic and Commercial and Industrial (C&I), waste arising in Hong Kong in 2011 in each of its main regions. Of the approximately 9 million tonnes of MSW arising in that year, around 52% was estimated to be recovered. The remaining 3.27 million tonnes of MSW was sent to Hong Kong's three major landfills. A further 1.3 million tonnes of Construction Waste and 408,000 tonnes of Special Waste were also sent to landfill.

Table 2.1: Waste to Landfill in Hong Kong, by Region and by Type in 2011, Tonnes

	Domestic	C&I	MSW
Hong Kong Island	1,190	418	1,608
Kowloon	1,864	914	2,779
NT- Mainland Sub-total	2,794	1,550	4,344
NT-Outlying Islands	124	140	264
All Hong Kong	5,973	3,023	8,995

Source: EPD (2011) Monitoring Solid Waste in Hong Kong

Organic waste represented the largest portion of the MSW horizon in 2011, accounting for around 4,000 tonnes per day, or 44% of total material disposed of to landfills by weight. C&I Waste accounted for 34% of total MSW arisings, with around 3,023 tonnes per day. Of this amount, around 1,126 tonnes was organic waste (28% of all organic waste). More than 88% of the organic waste in MSW is food waste, with the remainder made up from yard waste and other organic materials. Special Wastes such as animal, agricultural, and grease trap waste, and sewage sludge are treated separately, and further add to the quantity of organic wastes requiring disposal.

The Hong Kong Government recognises a pressing need to pursue more sustainable alternatives to present waste treatment and disposal practices in Hong Kong. Continuation of the current disposal system in Hong Kong is not considered to be a sustainable option as a result of diminishing landfill capacity, and in light of social, economic and environmental issues. According to the Environment Bureau's recently published Planning Strategy Report, 'Hong Kong: Blueprint for Sustainable Use of Resources 2013-2022', Hong Kong's three major landfill facilities are expected to reach capacity by 2015 (SENT), 2017 (NENT) and 2019 (WENT). Further expansion of existing facilities or the development of new landfill sites is highly constrained by issues of land availability, the high opportunity costs of developing land, and planning constraints/local opposition.

In December 2005, EPD published 'A Policy Framework for the Management of Municipal Solid Waste in Hong Kong (2005-2014)' (Policy Framework), setting out policy tools and initiatives to be implemented for the sustainable management of MSW in Hong Kong. The Policy Framework targeted an increase in recovery rates to 50%, and reduction in the total amount of MSW disposed of in landfills to less than 25% by 2014. Achieving these targets requires reduced reliance on landfill through the application of new waste treatment technologies. An Advisory Group on Waste Management Facilities was subsequently set up to investigate the most appropriate treatment and disposal solutions. The Group recommended the development of OWTFs as part of an integrated strategy for recovering organic wastes from the C&I Sector. Investment in the OWTFs is also a Key Action highlighted in the Government's Hong Kong Blueprint for Sustainable Use of Resources 2013-2022 published in May 2013.

The OWTFs are to be developed in two phases, with Phase 1 located at Siu Ho Wan in Northern Lantau Island, and Phase 2 (OWTF2, this project) at Sha Ling, Northern New Territories, on the site of the former Sha Ling Livestock Waste Composting Plant. The two phases of OWTF facilities are planned to use anaerobic digestion with composting to treat a combined 500 tonnes of organic waste daily, 300 tonnes of which will be treated at OWTF 2. The OWTF projects will reduce the volume of material requiring disposal, and together could reduce the quantity of C&I waste requiring landfill by more than 16%, at present rates.

OWTF 2 is important, not only to mitigate the depletion of available landfill space, but also in order to conserve resources through the recovery of compost and biogas that would be otherwise unused. Compost (or other soil improvement products) can be used as a sustainable input for landscaping, farming and horticulture, while biogas is a source of renewable energy. The OWTF 2 will therefore represent a valuable contributor to Hong Kong Government's climate change and energy security objectives.

2.4 Project Design Outline

2.4.1 Overview of the Project

Various organic waste treatment options have been assessed for their feasibility and suitability to the project site. A combination of Anaerobic Digestion (AD) and composting has been selected as the most appropriate waste treatment solution for the project. This is an established and cost-effective process, with minimal environmental impacts, which maximises energy and resource recovery. The AD process breaks down pre-treated organic waste, in the absence of oxygen, releasing biogas and converts other material to digestate. The solid fraction of the digestate can then be composted. By this process, biodegradable organic wastes are converted to energy while the digestate is recycled and reused as a soil improver/compost. Biogas generated will be supplied directly to the gas network, or used to generate renewable electricity on site, and/or to supply surplus power to the power network.

2.4.2 Site Layout

The preliminary design includes the following main elements listed in **Table 2.2** and shown in **Figure 2.2**.

Table 2.2: Main Project Facilities and Systems

Aspect	System / facility
Main structure	• Waste reception and preparation area • Administration area • Environmental Education Centre • Pre-treatment system
Composting	• Composting tunnels • Maturation, treatment / storage area
Anaerobic Digestion	• Buffer Tank • Digesters • Separator / Dewatering Unit • Hygieneisation Unit
Biogas Use	• Gas Cleaning • Gas Holders • Compressors • Flare stack • Combined Heat and Power Unit (if required);
Water system	• Water supply system • Wastewater Treatment Plant • Effluent retention tank • Connection to the main sewer • Drainage system

Aspect	System / facility
Emissions/Odour Treatment	• CHP Exhaust treatment system • Odour treatment system • Chimney
Ancillary Facilities	• Weighbridge • Vehicle Washing Facilities • Maintenance Workshop and Utility Area • Continuous Emission Monitoring System • Power Supply System • Instrumentation, Control and Monitoring System • Security / registration

The preliminary design is based on the best available information. The assessment adopts the conservative approach in terms of the design options presented[1]

The final selection of the process system, facilities and biogas utilisation options will be determined at the tender stage. The performance specifications for each element will be set out in the contract documents and therefore will not impact the assessment outcome.

2.4.3 Organic Waste Collection and Reception at the Site

It is assumed that organic waste is collected and delivered to the treatment site 7 days a week between 7 am to 9 pm (14 hours). The waste will be delivered to the site in bags or containers.

The organic waste will be transported to the treatment facility in dedicated Refuse Collection Vehicles (RCVs). These vehicles have typical carrying capacity in the range of 5 to 10 tonnes each. Conservatively, this would translate to a daily average of about 30-60 vehicles per day. Each incoming and outgoing RCV will be weighed on a weighbridge for registration of the amount of organic material delivered to the plant.

Offloading of organic waste from the RCVs will be undertaken in an enclosed reception building. There will be two reception lanes in separated sections of the building. The unloading procedure will take place within the building. The unloading area will be provided with air extraction equipment to avoid creating odour in the vicinity of the plant. Extracted air will pass through an odour treatment system before discharge to the atmosphere. Vehicle washing facilities will be provided for vehicles exiting the site to avoid contamination of the external road.

Organic waste is highly degradable and will be processed immediately it arrives on the site. Waste will be received continuously in alternate sections of processing and receiving waste. This will buffer supply to the next stage of the process, evening out delivered waste (non-continuous) and treatment of waste (continuous).

[1] The worst case has been assumed when assessing compliance against the requirements of relevant legislation Air Pollution Control Ordinance, Water Pollution Control Ordinance, Waste Disposal Ordinance, etc.

2.4.4 Description of OWTF 2 Process Flow

The key components for the OWTF 2 facilities are identified in the Process Flow Diagrams (PFD) (**Figure 2.3)**, that include potential gas utilisation options. A brief description of each numbered element in the PFDs is given in **Table 2.3** below.

Table 2.3: Description of Key Components and Process Flow

Process Element	Description	Scale
1. Reception	The source-separated organic waste arriving at OWTF 2 is tipped from the organic waste collection vehicles into an enclosed reception pit.	Gross area 522m^2
2. Preparation	From the reception pit, the waste is conveyed to a bag opener/shredder so that the material is accessible for the further treatment.	
3&4. Pre-treatment	• The waste is then conveyed to a pulper, where the material is combined with water and subject to pulping to separate inorganic and oversized materials, reduce particle size and combine the waste into slurry. • Recirculated process water (i.e. centrifuge and treated waste water) is added to the pulper. • Light and heavy fractions of the waste are separated out in the pulper. • The slurry is passed to a separate tank where grit is settled out from the mixture and removed regularly.	Gross area 474 m^2
5. Buffer Tank	The homogenised material is passed from the pulper to a balancing tank with a buffer capacity of one day, in order to stabilise the rate of flow of materials through the system.	Volume = 1,000m^3
6&7. Heat Exchange	• Integrated heat exchangers for recovery and heating. • Heat is recovered from the CHP or boiler and used to maintain the temperature of the digesters and process air in the composting plant.	Gross area 50m^2 Height 4m
8. Hygienisation	Before entering the digesters, the waste is heated to 70 degrees C in three hygieneisation tanks for four hours.	3 tanks of 4m diameter and 4m height
9. Dewatering (Separator)	• Outgoing material from the digester is passed into a separator (centrifuge or similar) in order to separate the liquid and solid fractions. • Part of the separated liquid fraction is pumped back to the mixing tank to be recycled in the pre-treatment process. The remaining liquid fraction is pumped to the wastewater treatment system. • The solid fraction is conveyed to the composting system.	Elevated within composting facility
10. Composting system	• The digestate from the centrifuge is received in a mixing cell, where it is combined with sludge and fresh and recovered bulking agents. The material is then transferred to enclosed composting tunnels where it is arranged in aerated static piles. • Controlled aeration is provided through a controlled air injection system in the floor of the tunnels, which uses fans to push and/or pull air through the composting mass. • The material resides in the composting tunnels for 8 days. This process takes place continuously, with one row being removed as a new row is added. • The material removed from the tunnels is matured for a further 14 days in a covered area in order to complete the stabilisation process. At the end of the maturation period the compost is taken for final screening.	Gross area of composting building = 3,204m^2 Building height 16.5m
11&12. Wastewater	• The remaining liquid from the separator is pumped to the WWTP.	Gross area 729m^2

Process Element	Description	Scale
Treatment Plant (WWTP)	• Treated wastewater is proposed to be discharged to the local sewerage system, and residual biomass/sludge recycled to the process.	
13. Digestion	From the pre-treatment phase the waste is conveyed to the digestion tanks. Screw pumps are recommended to convey the material due to its density. It is recommended that the pre-treatment area and digesters are in close proximity to each other to reduce the pumping distance.	Total volume of digesters 16,023 m^3 Height 25 m
14. Emergency flare	An emergency gas flare system is in place to safely dispose of biogas from the digesters under extraordinary circumstances.	Height 20 m
15. Gas cleaning system	Biogas from the digester is conveyed to a gas cleaning unit where it is treated to remove impurities such as hydrogen sulphide, water and particulates. For export to the gas network, further gas cleaning equipment would be required in order to upgrade the biogas from approximately 62% methane to Synthetic Natural Gas (SNG) quality (80%+ methane content).	Gross area 160 m^2
16. Gasholders	After the gas cleaning process biogas will be stored in two gasholders as a buffer to even out variations in biogas production/use.	Storage capacity equal to 1 hours' production capacity
17. Gas Compressor	The biogas is compressed to the required supply pressure prior to export or use on site.	
18. Combined Heat and Power (CHP) or Boiler	• Biogas can be delivered to the gas network and / or used in a CHP plant. The electricity produced in the CHP may be used for the plant process with surplus electricity exported to the power grid. Heat generated can be reused in the process (e.g. maintaining the temperature in the digesters). • Under the gas export option, process heat would be generated in a boiler.	CHP = 2 stacked Standard Container Units (SCU) (Area 96m^2) Boiler (Area 60m^2)
19, 20, 21 & 22. Ventilation and Odour treatment	• All the plant process steps will be enclosed and ventilated so that the operational spaces are under (negative) pressure in the process units, preventing odour escaping to the environment. • Process air is passed through a scrubber to adjust pH. • The ventilation air is directed to and treated in an odour treatment system (e.g. Ozone/UV and carbon filter).	Equipment mainly located within the composting and treatment buildings
23. Chimney	• The exhaust from the odour treatment plant and CHP (if required) are discharged from a chimney. The maximum chimney height is assumed to be 30m depending on the requirements of the detailed design and relevant planning approvals. Current planning restrictions at the site restrict the height of structures to 13m above ground level; therefore the height of the chimney requires relaxation of this requirement to be agreed with the Planning Department. In addition, the emissions should be dispersed upwards and the height of the chimney should exceed, by at least 3m, the height of nearby buildings and structures.[2] • If CHP is installed, exhaust gas from may be treated by thermal and catalytic treatment (selective catalytic reduction / catalytic oxidation) and filters (18), to meet emission standards.	Chimney height 30m

[2] Refer to Chimney Heights - Third Ed of the 1956 Clean Air Act Memorandum (1981) published by the UK Department of Environment, for guidelines.

2.4.5 Composting

A composting system will be used to treat the digestate produced by the AD process, as well as sludge from the WWTP. To achieve efficient aerobic digestion the composition of the material transferred to the composting system should be in accordance with the following criteria:

- 30% dry matter Total Solids (TS),
- Carbon: Nitrogen (C:N) ratio of 1: 18-28, and
- Density of 650-700 kg/m^3.

In order to achieve the above criteria, a bulking agent may be added to the digestate at the start of the composting process. Reusable bulking materials can be recovered from the downstream screening stage. Fresh bulking material is required to account for unrecovered inert materials.

The dewatered digestate will be conveyed from the centrifuge to a mixing cell, where it will be combined with fresh and recovered bulking agents. From the mixing cell the material will be transferred to the composting system, for the final stage of post treatment. An enclosed tunnel composting system with forced aeration is recommended, as this will allow greater environmental and process control. Within the tunnels, controlled aeration is provided through an air injection system in the floor of the tunnels, which forces air through the composting mass. The aeration system is digitally monitored and controlled to allow the temperature (55-70°C) and moisture content to be optimised during the composting process.

The material will reside in the composting tunnels for 8 days. This process takes place continuously, with one row being removed as a new row is added. The material removed from the tunnels is matured for a further 14 days in a covered area in order to complete the stabilisation process. Drying and temperature control will again be achieved through an air injection system. Building ventilation air may be recycled for this purpose.

At the end of the maturation period the compost is taken for final screening. Screened bulking material will be taken to the mixing unit and returned to the composting process. Final storage of the end compost material prior to collection will take place on site, in an area sufficient to hold 14 days' production.

Table 2.4 below provides an indicative overview of the flow and mass balance of the main elements within the composting system.

Table 2.4: Overview of Material Flow and Mass Balance within the Composting Process

	Digestate	Fresh Bulking	Recovered Bulking	Composting	Maturing, Screening	Final Compost
Air nozzles capacity [$m^3/m^2/h$]	-	-	-	100	50	-
Air amount needed [m^3/h]	-	-	-	45,000	150,000	-
Total amount [tonne/year]	34,310	1,716	17,155	53,181	38,843	15,321
Dry matter content [% TS]	33	60	65	42	56	65
Evaporation/conversion [tonne/year]	-	-	-	14,338	6,367	-
Process time [days]	-	-	-	8	14	-
Storage time [days]	-	-	-	-	-	14

2.4.6 Wastewater

A waste treatment system will be employed at the OWTF 2 to treat the digestate liquid and other effluents such as domestic wastewater, wash water, and leachate arising at the site.

2.4.6.1 Wastewater Arising

Table 2.5 below shows average and peak wastewater treatment requirements at the OWTF 2 by source.

Table 2.5: Estimated Wastewater Treatment Requirements at the OWTF 2

	Average Flow (m^3 / day)	Peak (L / s)
From separator to WWTP	229.18	5.31
From other sources to WWTP	39.40	0.91
Total to WWTP	268.58	6.22

2.4.6.2 Effluent Control System

There is a lack of information on the characteristics of incoming wastewater quality to select the most appropriate treatment technology at this stage. However, digestate produced from the anaerobic digestion of organic waste are usually high in nitrates/nitrites/ammonia. In the absence of a market for nitrogen rich digestate liquor, multistage separation (i.e. ultrafiltration and Reverse Osmosis (UF & RO)) may not be appropriate.[3] Therefore, it is recommended that a biological oxidation process such as Sequencing Batch Reactors (SBR), ANAMMOX or SHARON wastewater treatment technologies are employed. This will reduce the Biological Oxygen Demand (BOD) and ammonia present in the digestate liquor and allow effluent from the OWTF 2 to attain an appropriate standard for discharge to the public sewer and processing at the Shek Wui Hui Sewage Treatment Works.

The wastewater treatment system at the OWTF 2 has been sized according to a maximum peak flow rate of 6.22l/s. The design wastewater flow shall be confirmed during the detailed design stage. The flow rate of effluent though the wastewater treatment system is predicted to be relatively stable with buffering of inputs to the system of one day, and buffering of sewage outflows of 6 hours.

2.4.7 Ancillary Facilities

In addition to the elements outlined above, the OWTF 2 facility is planned to incorporate the following ancillary facilities.

[3] Should the production of digestate liquor at OWTF 2 become feasible at a later stage in the design process (i.e. a market is identified), the UF & RO process may be considered as an alternative, as this would offer a more compact wastewater treatment option.

Weighbridge System

On arrival at OWTF 2, RCVs will be directed to the weighbridge station, facilitated by the provision of sign posting, road markings, traffic signals and site traffic controllers. The weighbridge system will be located at the main entrance of the facilities but separate from the non-commercial vehicle entrance. The vehicles will be weighed on both entry and exit. The weighbridges will be cleaned regularly to ensure materials do not accumulate in the weighbridge pits, leading to odour nuisance.

Administration Building

An administration building will be provided for staff including a reception, general administration area, control room and technical rooms to facilitate daily operation and control of the plant. The administration building will be close to the entrance to reduce the need for any visitors, or wholly office based staff, or vehicles not accessing the processing area to travel into the site.

Visitors and Education Facilities

The OWTF 2 may be opened to the public, for the purposes of education and communicating sustainable waste management procedures. The visitors' centre will be accessible to members of the public while at the same time restricting access to the active processing areas. Viewing platforms shall be separated from operational areas, which are accessible via separate clearly marked separate walkways.

Vehicle Washing Facilities

Vehicle washing facilities will be provided for washing waste vehicles leaving the site, in order to avoid contamination of the external roadway. Washing water can be reused and then directed for treatmentIt is assumed that approximately 90% of washing water could be recirculated per day.

Maintenance Workshop and Utility Yard

An area for undertaking maintenance work for the plant's equipment and assets will be provided at the OWTF 2, within the main reception and pre-treatment building.

Continuous Emission Monitoring System

A Continuous Emission Monitoring System (CEMS) will be used to monitor air emissions. The CEMS monitors the gaseous atmospheric discharge and controls operating parameters to ensure continuous compliance of the emissions standard.

Instrumentation, Control and Monitoring System

A telemetric system will be in place to monitor all components of the treatment system in a single control room on schematic display boards. This will be supported by a comprehensive instrumentation system to control and monitor the entire treatment operation.

Electrical Power Supply System and Electricity Export Equipment (Option A)

Biogas can be used to drive a Combined Heat and Power (CHP) system producing heat and electrical power. Subject to agreement, surplus electricity could be exported to the electricity grid.

More details are provided in **Section 2.5** below

Gas Power Supply System and Gas Export Equipment (Option B)

Alternatively, biogas could be exported directly to the gas network for use as a fuel source. This option may or may not include on-site generation of power in a CHP to meet internal demand. The export of surplus biogas, would involve the construction of a 5.5km pipeline (approx.) connecting the OWTF 2 to an existing pipeline (to the south of the site) which transports Synthetic Natural Gas (SNG) from NENT Landfill to the Towngas Tai Po production plant.

More details are provided in **Section 2.5** below.

2.5 Consideration of Alternative Options

2.5.1 "Without Project" Alternative

A fundamental project alternative is the option not to implement the OWTF 2 Project, which is referred to as the "Do-nothing" option. Under the "Do-nothing" scenario, a continuation of the current organic waste management practices would be likely in the absence of alternative proposals. Therefore, the 300 tonnes per day predicted to be treated by the Project would continue to be disposed of by landfill, predominantly at the existing NENT landfill site. The operational capacity of the NENT landfill site will be reached around 2016/17, and other landfills in Hong Kong have a similar capacity issue.

Without the OWTF 2 project, the operational life of the NENT landfill site would be shortened, due to the additional input of approximately 109,500 tonnes per annum, and alternative provisions would need to be provided beyond 2016/17.

The Project is important, not only to mitigate landfill space depletion, but also to conserve resources and create new resource streams such as compost/soil conditioners and biogas (a renewable energy). Capturing landfill gas is considerably less efficient than the production of biogas from AD. Therefore, a significant opportunity for realising benefits for sustainability related to renewable energy production at the OWTF 2 site would be foregone under the "Do-nothing" Scenario. Biogas, if employed to generate electricity, could meet the electricity demand of some 2,000 to 3,000 households, or alternatively could offset around 20,000 to 30,000 m^3 of Towngas per day, contributing to a reduction in use of fossil fuel and greenhouse gas emissions.

In addition, digestate by-product produced at the OWTF 2 can be used as fertiliser/soil conditioner for landscaping, farming and/or horticulture. This would offset the use of imported compost products and artificial fertilisers, thereby contributing to sustainability objectives. Under the "Do-nothing" approach the organic residues are instead present as leachate, which requires management at landfill sites to avoid environmental pollution of soils and groundwater.

Therefore, the Project is considered as a positive contribution to the Hong Kong SAR Government's MSW Management Policy. The "Do-nothing" option is not considered to be an environmentally beneficial option to address long-term demand for organic waste management in Hong Kong.

2.5.2 Alternative Organic Waste Treatment Options

As part of the Project alternative organic waste treatment technologies were appraised in order to determine the most suitable option for adoption[4]. These alternative organic waste treatment technologies included:

- Incineration;
- Pyrolysis/gasification;
- Anaerobic digestion;
- Composting;
- Conversion to solid biofuel
- Conversion to liquid biofuel; and
- Conversion to animal/fish feed.

From the above options, Anaerobic Digestion with biogas generation and composting of digestate was selected as the preferred treatment option. This option was found to be the most suitable for wet biodegradable organic waste, and the option has the greatest potential environmental benefits in terms of diversion of waste from landfill, and recovery of energy and resources from waste through production of compost / soil improvement products and renewable energy from biogas.

Composting is recommended to take place in enclosed tunnels with mechanical aeration, in order to control the process effectively and to minimise impacts to air quality (dust and odour), noise, and vermin.

A summary of the findings of the appraisal is provided in **Table 2.6** below, including the benefits, disbenefits and applicability of each option to the project.

Table 2.6: Summary of Appraisal of Organic Waste Treatment Technology Options

Option	Benefits	Disbenefits	Applicability to the Project	Suitability
Landfill	• Established waste disposal method • Suitable for all waste types • Recovery of landfill gas, for renewable energy production.	• Large area of land required and restricted land availability / planning restrictions • High carbon footprint (methane emissions) • Potential contamination of soil and groundwater by leachate • Odour control difficult to manage	• Does not comply with the objective of the Project to reduce the disposal at landfill • Not a sustainable measure as land resource is scarce • High moisture content in the source-separated biodegradable organic waste would increase the amount of leachate and hence contamination to soil and groundwater • Not strictly a "controlled" biological treatment technology	Not suitable

[4] Working Paper 1 - Technology Evaluation and Key Elements of the OWTF

Option	Benefits	Disbenefits	Applicability to the Project	Suitability
Incineration	• Fast process rate • Very little residual material remaining after combustion, particularly when the organic fraction is high, reducing waste directed to landfill. • Renders waste inert. • Potential to recover energy from waste. • Reduces greenhouse gas emissions compared to do nothing approach.	• High capital cost • High operation cost: high temperature maintenance • Not suitable for waste with high moisture content • Likely local opposition on perceived health grounds due to emissions • Significant control measures required for pollution control • Landscape impacts associated with required chimney can be a significant issue. • Additional waste disposal required for ash residue. • Handling of organic wastes requires consideration of odour mitigation/treatment.	• Not suitable for source separated biodegradable organic waste because of the high moisture content • Most of the thermal energy is used to remove the water content • The energy recovery is marginal in view of the characteristic of the target waste	Not Suitable
Pyrolysis/ Gasification	• Fast process rate • Very little residual material remaining after combustion, particularly when the organic fraction is high. • Renders waste inert. • Potential to recover energy from waste. • Reduces greenhouse gas emissions compared to do nothing approach.	• High capital cost • High operation cost: high temperature maintenance • Not suitable for waste with high moisture content • Additional waste disposal required for char residue. • Handling of organic wastes requires consideration of odour mitigation/treatment	• Not suitable for source separated biodegradable organic waste because of the high moisture content • Most of the thermal energy is used to remove the water content • The energy recovery is marginal in view of the characteristic of the target waste • Not a biological treatment technology	Not Suitable
Anaerobic Digestion	• Highly suitable for wet biodegradable organic waste • Reduces waste directed to landfill. • Production of digestate by-product which can be used as compost, liquid fertiliser, or other soil improvement product. • Production of biogas by-product which can be used to provide heat and/or power to the facility and excess can be used to provide renewable energy. • Reduces greenhouse gas emissions compared to do nothing approach.	• Longer start-up time to develop high biomass inventory • Relatively slow process rate • Only limited to biodegradable waste • Need to provide phytosanitary provisions for treating animal by-products. • Waste water requires on-site treatment prior to disposal. Associated sludge requires removal and appropriate treatment and disposal. • Handling of organic wastes requires consideration of odour mitigation/treatment.	• A promising biological treatment technologies with wide applications worldwide • Highly suitable for source separated biodegradable organic waste • Results in useful end products in the form of compost and biogas • In line with the Policy Framework	Suitable
Aerobic Composting	• Suitable for various types of biodegradable organic waste. • Useful end product in the form of compost.	• Longer start-up time to develop high biomass inventory • Relatively slow process rate • Limited to biodegradable waste • Relatively large area requirement • Need to provide phytosanitary provisions for treating animal by-products • Waste water requires on-site treatment prior to disposal.	• A promising biological treatment technologies with wide applications worldwide • Specific treatment process targeting at biodegradable waste • Result in useful end products in the form of compost • In line with the HK Government's Policy Framework	Suitable

Option	Benefits	Disbenefits	Applicability to the Project	Suitability
		• Associated sludge requires removal and appropriate treatment and disposal. • Handling of organic wastes requires consideration of odour mitigation/treatment. • Compost/soil improvement products from food waste are likely to be of limited quality. No guaranteed market for compost. • No renewable energy produced	•	
Conversion to solid biofuel	• Energy and resource recovery • Can be employed as a supplementary fuel in conventional boilers • Very little residual material remaining after combustion, particularly when the organic fraction is high. • Reduces waste directed to landfill. • Reduces greenhouse gas emissions compared to do nothing approach	• High operation cost • Not cost effective for source separated biodegradable organic waste • No markets identified for refuse derived solid fuels • High moisture content of food waste would require drying/and or addition of dry biomass material, reducing energy efficiency. • Quality control of the outputs is also a key consideration, as a consistently high quality of product would be required by end users. • The ash residue remaining after combustion requires disposal at an appropriate facility. • The solid biofuel derivative is relatively inefficient to transport, over long distances. Therefore, the viability of production is dependent on the availability of end-uses/markets within economic distances.	• Excessive drying required as organic waste has a high moisture content. • Without local markets to supply, excessive transport costs, mean that the option would not be cost-effective • Long transport distances would also reduce carbon efficiency.	Not Suitable
Conversion to liquid biofuel	• Sustainable use of resources • Replacement for fossil transport fuels or used to generate heat and power on site • Reduces waste directed to landfill. • Reduces greenhouse gas emissions compared to do nothing approach.	• High operation cost • Not cost effective for source separated biodegradable organic waste • Advanced / complex technologies required, some of which are still experimental • Not considered to be an efficient option for recovering energy from waste as it is process energy intensive and due to distance to end user. • Potential storage and use of significant quantities of chemical substances on site for the biomass to fuel conversion process	• Conversion to liquid biofuel is not considered to be viable for the Project, due to the characteristics of the waste stream, the costs associated with the technology and the difficulty in attracting contractors for potentially complicated and unproven technology.	Not Suitable
Conversion to Animal/ Fish Feed	• Useful end product in the form of animal / fish feed • Reduces waste directed to landfill.	• Potential spreading of infectious animal diseases and difficulty in managing quality control and phytosanitary standards.	• Potential risk of spreading of infectious animal disease • Limited to food waste which the sources and compositions	Not Suitable

Option	Benefits	Disbenefits	Applicability to the Project	Suitability
	• Reduces greenhouse gas emissions compared to do nothing approach	• Only limited to food waste with known sources and compositions • Long-term market potential uncertain. • More suitable for smaller scale organic waste treatment projects.	are certified with acceptable accuracy • Limited market size for animal feed in Hong Kong may affect cost-effectiveness	

2.5.3 Options for Recovery and Use of Biogas

2.5.3.1 Overview of Biogas Utilisation Options

Two potential biogas use options have been identified in relation to the OWTF 2:

- Combined Heat and Power (CHP) equipment for onsite generation of electricity and heat that can be used for on-site processes and facilities, with export of surplus electricity to the China Light and Power (CLP) electricity network.
- The export of biogas directly to the Towngas grid, via a connection to the NENT Landfill gas pipeline. This option requires a biogas cleaning processes to be installed at the site to meet Towngas quality requirements.

Option A comprises onsite generation of electricity (and heat) in a Combined Heat and Power Plant (CHP) for use in on-site processes and facilities, and the export of surplus electricity to the CLP network.

Option B comprises two potential sub-options with regard to on-site heat and power production, as follows:

- Option B (i) – Biogas export with no onsite power production
- Option B (ii) – Biogas export with onsite power production to meet internal demand

Option B would involve the construction of a new 5.5 km (250 mm diameter Polyethylene) pipeline along the Kong Nga Po Road and Man Kam To Road to connect to the existing gas pipeline from NENT Landfill to Towngas's Tai Po production plant. The pipeline would be constructed and operated by Towngas.

The proposed pipeline is not included in the EPD Study Brief No. ESB-226/2011 and would be the subject of separate permitting for which the pipeline operator Towngas would be the Proponent. Construction of the pipeline is expected to take up to two years and its completion should be timed to coincide with the commencement of operations at the OWTF 2 in 2017. Potential cumulative impacts related to the potential pipeline construction works will be considered in this assessment.

An assessment of Environmental Benefits and disbenefits of each option is presented in **Appendix 2.1** and is summarised below.

2.5.3.2 Summary of Environmental Performance for Biogas Utilisation Options

Air quality impacts at the OWTF 2 would be slightly higher under Option A as a result of the exhaust gasses from the CHP plant. However, it is expected that impacts to ambient air quality will be minor (i.e. all

values for SO_2, TSP, RSP, NO_2, and CO etc. are within the allowable range). Impacts on landscape are likely to be more pronounced under this option as a result of a flue stack (up to 30m max height) required for dispersion of emissions from the CHP plant.

Works associated with the development of a new gas pipeline connecting the facility to the NENT gas pipeline may lead to additional environmental impacts during the construction stage (e.g. noise, air quality, waste). However, these impacts are temporary and are likely to be minor.

The environmental performance between the options is considered to be similar across all options. However, minor environmental benefits for Landscape and Air Quality impacts may be achieved for Options B (i) and B (ii) over Option A.

Either one of the above options may be adopted for OWTF 2. The final biogas utilisation option will be confirmed at later stage of the Project. However, both cases are considered in the EIA as a conservative approach, with the worst case scenario assumed for each assessment.

2.5.4 Compost Options

A number of composting options were considered for the OWTF 2 site, including, passive piles, turned windrows, aerated static piles and in-vessel systems. In vessel composting within enclosed tunnels is proposed for the solid digestate by-product from Anaerobic Digestion, followed by maturation in aerated static piles (indoor)was selected as the most appropriate option for the OWTF 2 for the following reasons:

- Good control of composting process with confinement and automation
- Able to handle large volumes
- Space-efficient
- Effective in controlling odours
- Protection from vermin
- Good product stabilisation
- Uniform product
- Protection from climate
- Low visibility
- Continuous process

The selected approach is effective when space is limited and the composting process must be completed quickly. More detail on the appraisal of composting options is presented in **Appendix 2.2**.

In the proposed system, the solid digestate and bulking materials are composted in aerated tunnels. Material is loaded into the tunnels either by vehicles or in an automatic conveyor system. To ensure that decomposition proceeds at high rates, temperature, moisture and oxygen levels must be closely monitored and controlled.

The residence time for the tunnels is 8 days. After this time the composting material is transferred to a maturation area for a further 7 days. Bulking materials are screened and recovered to be used again in the upstream composting process. Compost storage for 21 days production is provided at the site. The

compost may require additives (e.g. nutrients, humus etc.) to reach the required characteristics / standards appropriate for the end user (to be determined) depending on the quality of the compost produced.

The composting facility is completely enclosed and mechanically ventilated. An appropriate 2-stage odour control system such as UV/Ozone and carbon filter system or similar will be in place to treat ventilation air prior to venting to reduce / avoid odour impacts.

2.5.5 Site Selection

In 2006, EPD conducted a site selection study in conjunction with PlanD to identify appropriate facilities for treating organic wastes.

Prior to the formal site search exercise carried out by PlanD and relevant government departments, a preliminary site selection process was developed by the EPD and conducted to identify unsuitable areas associated with existing, potential and future incompatible uses. Based on the information obtained from site visits, interviews with office / site staff, web search, telephone conversations etc., unsuitable sites were excluded from the preliminary screening process.

A long list of 33 alternative sites was produced by compiling the feasible sites proposed by EPD after preliminary screening and feasible sites as recommended by PlanD. Sites 1-33 were the potential sites proposed by EPD while Sites 30-33 were also identified by PlanD. The long list was then further examined by PlanD to produce a revised long list for scoring and ranking in the Stage 2, Specific Site Selection of the Site Search Study.

The Specific Site Selection stage evaluated the revised long listed sites by applying a scoring system to generate a shortlist comprising the most feasible sites for development of large scale OWTFs (using various biological treatment processes). A ranking system was also developed to prioritize the suitability of sites under evaluation.

The assessment was undertaken by EPD to determine which of the sites would be appropriate for the development of large-scale OWTF, based on the following criteria:

- Environmental impact (Air, Noise, Visual and Landscape, Water Quality and Drainage, and Ecology);
- Engineering feasibility (e.g. accessibility, site constraints, time availability, etc.);
- Financial viability (e.g. capital cost and operational cost);
- Operability (e.g. proximity to users/producers, waste disposal and wastewater treatment, etc.); and
- Social issues (e.g. compatible with broad planning intention for site and surrounding landuse, etc.).

A score from 1 to 5 representing the suitability (from low to high) for OWTF development against the respective criteria for composting, Anaerobic Digestion and a combination of both technologies were awarded for each site. The highest scoring four sites were recommended for further assessment, as follows:

- Siu Ho Wan, North Lantau;
- Sha Ling Livestock Waste Composting Plant, Sheung Shui;
- EcoPark Phase II, Tuen Mun; and,

- Tseung Kwan O Area 137, Tseung Kwan O.

A summary of the results of the evaluation is provided in **Table 2.7** below.

Table 2.7: Summary of Assessment Results for Site Selection

Potential Site	Environmental	Engineering Feasibility	Financial	Operability	Social Issues
Sha Ling Livestock Waste Composting Plant	**	**	*	**	**
EcoPark Phase II	**	*	**	*	*
Siu Ho Wan	***	***	***	***	***
TKO Area 137	*	*	**	*	*

Source: EPD (2010) Pilot Plant Development of Biodegradable Waste Treatment Facilities (BWTF) – Investigation Final Report

Note: * Less Preferable, ** Preferable, *** Highly Preferable

Results of the assessment indicated that the Siu Ho Wan site is the most suitable for the development of OWTF, followed by the SLCP site. These two sites are considered more favourable in view of their relatively low environmental impacts, high engineering feasibility and operability, and less social issues.

The Siu Ho Wan site was chosen for the development of OWTF Phase 1 and the former Sha Ling Livestock Waste Composting Plant (SLCP) site was selected for the OWTF 2. The EIA Report for the Phase 1 project was approved by the Director of Environmental Protection on 24 February 2010, and the preparation works for the project are underway.

As shown in **Table 2.7** above, from the remaining sites, both the EcoPark Phase 2 and Sha Ling sites were found to be 'preferable' in terms of environmental impact. However, initial consultation with PlanD suggested that the development of large scale OWTF would not qualify as one of the twelve approved categories of recycling process activities assessed under the EIA designated for the EcoPark (Phase II) site. The Tseung Kwan O Area 137 site was considered to be 'less preferable' in terms of environmental impact in the assessment (due to potential water quality issues), and despite having a large enough available area, uncertainties about the site in terms of its availability and suitability of its neighbouring land uses, let to this site being recommended only as a 'fall-back' option for the development of large-scale OWTF.

The Sha Ling site is remote and does not have large population (and hence air, noise and visual sensitive receives) nearby. The site was used previously as the composting plant and does not encroach into any environmental sensitive areas. With the consideration of alternative layout (as in **Section 2.5.2**), the OWTF 2 could be constructed within the previously developed area to avoid large number of trees to be felled. Visual envelop is mostly confined by ridgeline of nearby hills with few visual sensitive receivers (as detailed in **Section 10.6.3**). Hence, there are no major environmental constraints for the development of OWTF 2 at Sha Ling.

As a former livestock waste composting plant, new large-scale facilities for treating organic waste can incorporate some of the existing features of the site, so that development can take place with fewer modifications, thereby reducing design and construction costs. In addition, the SLCP site falls within an

area zone of "Government, Institution or Community (G/IC)" on the Outline Zoning Plan (OZP) and PlanD has in principal no objection to the development of OWTF at Sha Ling.

Furthermore, the OWTF 2 design is planned to be a state-of-the-art facility, which offers improvements over the former SLCP in terms of visual impact, pollution and odour control. Therefore, it is anticipated that the OWTF 2 would be accepted by the local community.

2.5.6 Optimisation of Layout

The initial draft layouts for the OWTF 2 were developed to satisfy the following criteria:

- All OWTF 2 elements accommodated within the site boundary;
- The initial processing area adjacent to the digesters – an operations preference;
- Vehicle movements around the site to be simple with:
  - crossing conflicts minimised;
  - complex reversing movements minimised;
  - penetration into the site minimised; and
  - waiting / queuing areas optimised, given the highly constrained site;
- Activities grouped – initial processing, digestion, composting, gas treatment and administration; and
- Preferred to have digesters in a linear arrangement from an operations perspective.

Layouts with processing and digestion at the rear of the site and composting at the front were rejected as this increases the numbers of vehicles having to travel to the rear of the site. Therefore the initial layout was designed with the initial processing facilities at the front of the site, and the downstream composting at the rear.

The layout of the facilities on the OWTF 2 Project site was then optimised in the subsequent design development to maximise environmental benefits. In order to minimise the footprint of the OWTF 2 project, the original concept design was redesigned to cover a smaller area, by reducing the number of Digestion tanks from 5 to 3, changing the road layout, and altering the configuration of key structures (refer to **Figure 2.4**). In this way, the OWTF 2 site occupies the same area as the former SLCP facility, minimising disturbance around the site, including vegetated areas. These design changes have led to a reduction in the number of trees proposed to be felled from 153 trees in the original preliminary layout to around 14 trees in the latest amendment (a 91% reduction).

Other design optimisations included the inclusion of green roofs, vertical greening, and landscape screening to minimise visual impacts and to reduce stormwater runoff, and to increase amenity value for those working at the site.

2.5.7 Consideration of Alternative Construction Methods and Sequences of Works

2.5.7.1 Alternative Construction Methods

A number of alternative construction methods have been considered for the development of the OWTF 2 site with the aim of reducing environmental impacts. Piling works are required at the site for the main

buildings, the chimney, and the digesters and other heavy tanks. Both the percussion and bored types of piles were considered during the preliminary design.

Percussive piling works would lead to considerable noise impacts, whereas the noise impacts from bored piles are significantly lower. Therefore bored (socketed H-piles) have been recommended for load bearing piling works to minimise the potential noise impacts during the construction.

2.5.7.2 Alternative Sequence of Works

Programming 'Concurrent' construction works (i.e. different construction activities to take place simultaneously) would lead to environmental benefits by reducing the duration of the construction impacts. This strategy would also make the environmental benefits of the project, including renewable energy production and sustainable waste management, available earlier. However, concurrent construction activities could increase the magnitude of environmental impacts (e.g. construction dust, noise, etc.).

'Phased' construction activity (i.e. construction works taking place sequentially, one after the other) could also have environmental benefits by reducing the magnitude of environmental impacts, but this would also extend the duration of impacts over a longer construction programme.

In order to minimise the environmental impacts, maximise environmental benefits, and meet the targeted operation date, a balanced approach to the sequencing of construction works will be adopted. This strategy involves planning construction activities to maximise concurrent works where they are appropriate, and phasing construction activities to avoid concurrent activities that cause excessive combined impacts. For example, phased construction will be adopted for noisy construction works (e.g. sheet piling and use of hydraulic jackhammers).

2.6 Project Planning and Implementation

2.6.1 Contract

The Project is planned to be implemented through a Design, Build and Operate (DBO) contract. The Contractor will be selected through a competitive tendering exercise. Under the contract, the Contractor will be responsible for:

i. Detailed design of facilities for waste reception, treatment and recovery of resources, and Environmental Education Centre (EEC);
ii. construction, provision and installation of facilities;
iii. testing and commissioning of equipment and facilities;
iv. operation of facilities; and,
v. monitoring of operation;

2.6.2 Indicative Implementation Programme

It is anticipated that the construction works of the OWTF 2 will commence in mid-2015 and be fully completed by 2017. The construction stages and provisional project program are shown in **Table 2.8**.

Table 2.8: Indicative Milestones for Key Project Stages

Description	Tentative Date
Tender Phase	2014
Construction Start	2015
Construction End	2017
Operation Start	2017

2.6.3 Potential Activities not included in the Project Area

Construction works associated with the Project and outside the Project Area are expected to occur, including (i) the possible gas pipeline to be carried out by Towngas if the biogas export option stated in **Section 2.5.3.1** is chosen, (ii) minor road widening, (iii) junction improvements, and (iv) construction of rising main connecting to the existing sewerage network. Impacts associated with these activities have been assessed in terms of cumulative impact in this EIA study.

2.7 Project Interactions

2.7.1 Interactions with Existing Sites

The existing establishments adjacent to the Project include San Uk Ling Holding Centre, Rifle Range, Police Dog Unit and Force Search Unit Training School, Hong Kong Police Force Border District Headquarters, scattered village houses, and temples. Fish ponds, woodlands and plantations, watercourses, and agricultural lands are also located in the vicinity of the OWTF 2 site.

2.7.2 Statutory Planning Context

The OWTF 2 site falls within the Approved Fu Tei Au and Sha Ling Outline Zoning Plan (OZP) (No. S/NE-FTA/12) (see **Figure 2.5**). The general planning intention of the area "*is to promote and conserve the rural character through control on urban sprawl, minimisation of flood risk and preservation of agricultural land, and to achieve coherent planning and control of the open storage problem*" (Explanatory Notes attached to the Approved Fu Tei Au and Sha Ling OZP No. S/NE-FTA/12 refers).

2.7.3 Interfacing Projects

The following committed and planned nearby developments have been identified within the surrounding Statutory Planning Areas of Man Kam To Development Permission Area (DPA), Fu Tei Au and Sha Ling Outline Zoning Plan (OZP), Hung Lung Hang OZP:

- Kong Nga Po Comprehensive Development Area;
- Hung Lung Hang Residential Development;
- Columbarium, Crematorium and Related Facilities at Sandy Ridge Cemetery; and,
- Cement Plant.

These planned and committed developments are shown in **Figure 2.5** and discussed in relation to the project below.

Kong Nga Po Comprehensive Development Area

The Land Use Planning for the Closed Area Study completed in 2010, recommended Kong Nga Po to be zoned as a Comprehensive Development Area (CDA) to facilitate specific development control over the future residential development. This zone is intended for comprehensive development of the area for residential use with the provision of open space and other supporting facilities. The zoning is to facilitate appropriate planning control over the development mix, scale, design and layout of development, taking into account various environmental, traffic, infrastructural and other constraints.

The planned Kong Nga Po CDA has a total development area of 18.9 ha, is located to the east of the OWTF 2 site, and is around 150 m away at its closest point. The CDA has a target population of 3,600, with planned land availability in 2020 and targeted population intake in 2023. A number of potential infrastructure works related to the Kong Nga Po CDA, are likely to be relevant for the OWTF 2 site, including widening of Kong Nga Po Road (1.9km), environmental Mitigation Measures (e.g. noise barriers) along Kong Nga Po Road, and drainage, sewerage and waterworks provisions along Kong Nga Po Road.

Hung Lung Hang Residential Development

The Land Use Planning for the Closed Area Feasibility Study Report refers to the proposals for residential development at Hung Lung Hang around 500 m to the east of the OWTF2 site and adjacent to the Kong Nga Po CDA, following the release of the Closed Area (see **Figure 2.5**).

According to the Report, land use and development proposals in the Hung Lung Hang Residential Area will be implemented by the private sector. Such proposals will depend on private initiatives and market circumstances. Therefore, the implementation programme of the Hung Long Hang Development is subject to private development applications under the statutory planning framework, and is yet to be confirmed.

The Approved Hung Lung Hang OZP No. S/NE-HLH/7 also refers to the intention to "*designate land for village development and expansion to meet the needs of the indigenous villagers*".

Man Kam To Development Corridor

The Land Use Planning for the Closed Area Feasibility Study Report, indicates that following the release of the Closed Area, the area within the Fu Tei Au & Sha Ling OZP adjacent to the southern side of Man Kam To Road, which is currently zoned as agricultural land, is intended to be rezoned as a Development Corridor, subject to Town Planning Board Approval. The Man Kam Development Corridor surrounds the OWTF 2 site to its northern, eastern and western boundary (see **Figure 2.5**).

According to the Land Use Planning for the Closed Area Feasibility Study Report, the planning intention for the area is to provide for enhancement of the local environment through the provision of non-polluting logistics, warehousing/distribution (including food processing) centres as well as other high-tech and creative industry uses and other services that will support cross-border activities and the local population.

The Study Report also states that land use and development proposals in the Man Kam Development Corridor will be implemented by the private sector. Such proposals will depend on private initiatives and

market circumstances. Therefore, the implementation programme of the Man Kam Development Corridor is subject to private development applications under the statutory planning framework, and is yet to be confirmed.

Development of Columbarium, Crematorium and Related Facilities at Sandy Ridge Cemetery

Around 10 hectares of land are planned for development of columbarium, crematorium and associated facilities at the Sandy Ridge Cemetery; around 200 m to the north-west of the OWTF 2 site (see **Figure 2.5**).

A Feasibility Study has been undertaken by CEDD on the site formation and associated infrastructural works for the development of columbarium facilities to provide at least 200,000 niches, a crematorium with 10 cremators, a funeral parlour with 30 service halls and a visitor service centre at Sandy Ridge Cemetery under Agreement No. CE 32/2010 (CE). The study was substantially complete in September 2012. Some elements in the Sandy Ridge Cemetery Project are designated projects under Schedule 2 of the EIAO and require EPs prior to their construction and operation. The Feasibility Study recommended site formation works to commence by phases with the handover of the formed land in 2019 at the earliest to suit the construction of building works of the columbarium and crematorium facilities for completion in 2022.

In September 2012, the project to undertake the site formation works was included in Category B of the Public Works Programme as PWP Item No. 5758CL - Site Formation and Associated Infrastructural Works for Development of Columbarium, Crematorium and Related Facilities at Sandy Ridge Cemetery. CEDD is currently preparing the new consultancy engagement for the investigation stage of the Project. The Project Proponent is Land Works Division, Civil Engineering Office, CEDD. The works of the Project mainly comprises the following:

i. site formation of about 10 hectares of land for development of C&C facilities at Sandy Ridge Cemetery;

ii. associated environmental mitigation measures, landscaping works, geotechnical works, drainage and sewerage works, waterworks, roadworks including tunnel, viaducts and ancillary works to existing road network in the North District (e.g. road widening works at Choi Yuen Road, Sheung Shui) and other utilities services, etc.; and

iii. a pedestrian walkway between Lo Wu MTR Station and the columbarium facilities at Sandy Ridge Cemetery and associated works.

Cement Plant

The Land Use Planning for the Closed Area Feasibility Study Report recommends a change of zoning for the existing Cement Plant within the Fu Tei Au & Sha Ling OZP from Agricultural ('AGR') to Other Use ('OU'). The Cement Plant site is less than 1 ha is size located at Sha Ling Road and Man Kam To Road approximately 250 m from the OWTF site (see **Figure 2.5**).

The site has been operated as a Cement Plant for more than 10 years. Planning applications submitted between 2006 and 2008 (A/NE-FTA/50 and A/NE-FTA/81) to extend the east of the Cement Plant site for Proposed Temporary Asphalt Production Plant for a Period of Three Years have been subsequently 'not accepted' or 'rejected'. No further information on future development or operation of the site is currently available.

2.7.4 Consultation with Potential Interfacing Project Proponents

To identify potential interfacing issues with the proposed developments in vicinity of the Project Site, letters were sent to relevant stakeholders/project proponents to request information on details of project status, implementation programme and layout drawings. Responses from these stakeholders/ proponents are summarised in **Table 2.9** below.

Table 2.9: Responses from Potential Interfacing Project Proponents

Stakeholder	Project Name	Summary of Response
Planning Department	Land Use Planning for the Closed Area – Feasibility Study [5]	• The 500m Assessment Area for the Study has been included in the scheme boundary of the Draft Man Kam To Development Permission Area Plan No. DPA/NE-MKT/2, the approved Fu Tei Au and Sha Ling Outline Zoning Plan (OZP) No. DPA/NE-FTA/12 and the approved Hung Lung Hang OZP No. S/NE-HLH/7 • Planned / existing developments should make reference to relevant statutory and departmental plans as appropriate.
	Hung Lung Hang Development	
CEDD	Site Formation and Associated Infrastructural Works for Proposed Development of Columbarium, Crematorium and Related Facilities at Sandy Ridge Cemetery	• Do not envisage any works within the Project Area but may be subject to the conclusion and recommendation including tentative implementation programme in the Feasibility Study
	Engineering Feasibility Study for Kong Nga Po CDA	• Tentative programme for proposed Kong Nga Po Development is in 2020 • Potential traffic impacts and need for road improvements along Kong Nga Po Road prior to 2020

[5] Land Use Planning for the Closed Area - Feasibility Study published by Planning Department, Agreement No. CE 60/2005 (TP)