**Drainage Services Department** 

# Port Shelter Sewerage, Stage 3 – Sewerage Works at Po Toi O

**Executive Summary** 

(Version 3.1)

Certified By	pha
	(Project Director)

REMARKS:

The information supplied and contained within this report is, to the best of our knowledge, correct at the time of printing.

CINOTECH accepts no responsibility for changes made to this report by third parties

CINOTECH CONSULTANTS LTD Room 1710, Technology Park, 18 On Lai Street, Shatin, NT, Hong Kong Tel: (852) 2151 2083 Fax: (852) 3107 1388 Email: info@cinotech.com.hk

# **Table of Content**

1.	INTRODUCTION	1
1.1.	Background	1
2.	PROJECT DESCRIPTION	2
2.1.	Need and Environmental Benefit of the Project	2
2.2.	Site Location, Construction Method & Works Sequence	4
2.3.	Normal Operation	5
2.4.	Emergency Plant Breakdown	5
2.5.	Concurrent Projects	5
3.	<b>KEY FINDINGS FROM ENVIRONMENTAL IMPACT</b>	
ASS	SESSMENT	6
3.1.	Air Quality	6
3.2.	Noise	6
3.3.	Water Quality	7
3.4.	Terrestrial Ecology	8
3.5.	Marine Ecology	9
3.6.	Fisheries	9
3.7.	Waste Management and Land Contamination 1	0
3.8.	Landscape and Visual	1
3.9.	Built Heritage 1	. 1
4.	ENVIRONMENTAL MONITORING AND AUDIT 1	2
5.	CONCLUSION1	2

# LIST OF FIGURE

Figure 1 Layout Plan of Proposed Sewerage Works in Po Toi O (comprising 1A & 1B)

Figure 2 Locations of Sensitive Receivers

# LIST OF TABLE

Table 2-1Summary of the Preferred Option

## 1. INTRODUCTION

#### 1.1. Background

#### Environmental Enhancement Project in Nature

- 1.1.1. The proposed sewerage works at Po Toi O is an environmental enhancement project that aims to improve environmental hygiene in the Po Toi O area.
- 1.1.2. Po Toi O is located in the southern part of Sai Kung District, next to Clear Water Bay. There is a small settlement called Po Toi O village around the bay. The village is currently not served by public sewerage system. Sewage and wastewater generated by local residents and local restaurants are treated by septic tanks/soakaway system (STS).
- 1.1.3. Provision of proper sewerage system to unsewered villages is a general government policy. Without centralized public sewage treatment facility, villagers have to regularly desludge the STS to maintain the cleaning performance and to avoid overflow of sewage. However, the desludging process may bring along potential hygiene and associated odour issues. Under the Port Shelter Sewerage Master Plan (SMP), Drainage Services Department (DSD) has proposed sewerage works at Po Toi O. In addition to improving local hygiene conditions and removing associated odour problem, the provision of sewerage is a preventive measure to avoid potential environmental problems due to insufficient desludging or structural defect of the STS. This can also relieve villagers' burden to maintain their STS (e.g. desludging).
- 1.1.4. The proposed sewerage works at Po Toi O comprise sewage collection, treatment and disposal facilities at Po Toi O under Port Shelter Sewerage, Stage 3 Sewerage Works at Po Toi O (hereinafter referred to as "the Project"). The location and details of the facilities are illustrated in **Figure 1** (comprising 1A and 1B).
- 1.1.5. The Project mainly comprises the following works:
  - Provision of village sewerage to Po Toi O. The works involve construction of about 800m of gravity sewers and 400m of rising mains;
  - Construction of a local sewage treatment plant (STP) with average dry weather flow (ADWF) of about 139m<sup>3</sup>/day; and
  - Construction of a submarine outfall of about 385m in length.

Need for Environmental Impact Assessment

- 1.1.6. The Project consists of the following designated projects under Part I, Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO):
  - Item Q.1 A sewage treatment plant and portion of sewer alignments in a conservation area;
  - Item C.12 (a), (v) and (vii) A dredging operation which is less than 500m from the nearest boundary of an existing fish culture zone and coastal protection area; and
  - Item F.6 A submarine sewage outfall

- 1.1.7. A project profile (PP-483/2013) has been submitted to Environmental Protection Department (EPD) in February 2013 and a study brief (ESB- 258/2013) has been issued to DSD in April 2013.
- 1.1.8. Cinotech Consultants Limited (Cinotech) has been commissioned by DSD in January 2014 to conduct an environmental impact assessment (EIA) for the Project in order to investigate the environmental acceptability during construction and operation of the proposed sewerage works. Black & Veatch Hong Kong Limited is the consulting engineer employed by DSD to design the proposed sewerage facilities in this Project, among other tasks. Urbis Limited and LWK & Partners (HK) Limited provided expert input in assessing landscape and visual impacts and built heritage impact respectively.

### 2. **PROJECT DESCRIPTION**

#### 2.1. Need and Environmental Benefit of the Project

#### Need of the Project

2.1.1. As mentioned in **Section 1.1.2**, the village is currently not served by public sewerage and the sewage in the area is treated using septic tanks and/or soakaway system (STS). Desludging of the STS may bring along potential hygiene and odour issues. Also, ineffective treatment or overflow of sewage from unmaintained STS may result in leakage of raw or partially treated sewage into nearby water bodies (e.g. sea and streams). Water pollution may affect villagers and the fish culture zone in the bay. These potential hygiene and environmental problems cannot be fully rectified without proper collection and treatment of sewage.

#### Environmental Enhancement and Benefits

- 2.1.2. The proposed sewerage works in Po Toi O is an environmental enhancement project by nature. Through replacement of STS by a public sewerage system, hygiene and associated odour nuisance from routine desludging will be eliminated. In addition, the provision of sewerage is a preventive measure to avoid potential environmental problems due to insufficient desludging or structural defect of the STS. This can also relieve villagers' burden to maintain their STS (e.g. desludging).
- 2.1.3. Sewage will be properly collected and treated by membrane bioreactor process (MBR) up to the effluent discharge standard of Port Shelter Water Control Zone. Treated effluent will be discharged via a submarine outfall at a diffuser installed at seabed in outer Po Toi O Bay, and will be at least 326m, 185m and 100m away, respectively, from the nearest fish culture zone, a coral-lined rocky shore and an amphioxus habitat.

<u>Various Green Measures in the Project</u> (Mainly by Avoidance and Minimization of Potential Impacts)

2.1.4. Po Toi O has scenic seashore embraced by hilly terrain overgrown with shrubs and trees. Village settlements along the shore and fish farming in the bay give Po Toi O a unique rural landscape. This EIA Study has identified and fully considered the potential constraints imposed by this special environ, and has developed a number of green initiatives at this planning stage. In addition to improving environmental hygiene in the Po Toi O area, this Project targets to achieve environmental friendliness in sewerage, construction and operation designs. The green measures and the associated environmental benefits of this Project are summarized as follows:

#### Green Measures in Sewerage System Design

- Minimization of loss of ecologically sensitive habitats by locating the STP on a cut slope (disturbed shrubland) and laying gravity sewers and rising mains along existing footpaths as far as possible from developed area;
- Avoidance of destruction of coral-lined rocky shore and major amphioxus habitat by locating the treated effluent discharge location over 100m away from the coral-lined shore and species of conservation importance (amphioxus);
- **Minimization of fisheries impact** by discharging the treated effluent at about 326m away from the fish culture zone;
- **Maximizing effluent dispersion** by placing the diffuser on seabed at >10m depth and at outer Po Toi O bay where current flows are fast;
- **Minimization of the footprint of the STP** by constructing most of the STP structure underground and adopting a less land demanding sewage treatment technology (MBR);
- **Minimization of odour and noise nuisance** by keeping a sufficient buffer distance between the STP and village houses;
- Minimization of visual impact by embedding the STP into the existing cut slope;
- Maintenance of visual entity with surrounding undisturbed landscape by provision of appropriate façade treatment (e.g. adopting recessive colours on STP wall that blend in with the natural tones of the landscape backdrop), compensatory tree planting and vertical greening;
- Avoidance of impact on built heritage resources (e.g. Grade 3 historic building Hung Sing Temple) by laying gravity sewers and rising mains over 5m away from its footprint;

#### **Green Measures in Construction Design**

- Avoidance of open dredging to minimize water quality, marine ecological and fisheries impacts by adopting (1) horizontal directional drilling for submarine outfall below seabed and (2) enclosed dredging within a cofferdam for the diffuser;
- Avoidance of concurrent construction activities by designing a separate works programme for noisy works (carrying out rock breaking works for STP prior to laying of gravity sewer and rising mains and drilling for submarine outfall). Also, adopting three workfronts during pipe laying in village, each of short section and at least 100m away from each other.

#### **Green Measures in Operation Design**

- Improvement of environmental hygiene and removal of associated odour nuisance in the Po Toi O area by eliminating the need of desludging STS;
- Avoidance of emergency discharge of raw sewage into waterbodies by a number of design features or arrangements in case of emergency plant failure, such as notification to the operator by a supervisory control and data acquisition (SCADA) system, provision of standby equipment in the STP, provision of sufficient capacity of emergency storage of incoming sewage and provision of tankers for continuous removal of sewage to other STP for treatment.
- **Minimization of odour nuisance from STP** by provision of an odour removal system with 99.5% efficiency in the STP;
- **Minimization of noise disturbance from STP** by storing noisy plant equipment underground.

#### 2.2. Site Location, Construction Method & Works Sequence

#### Site Location & Construction Method

2.2.1. Various site locations and construction methods were considered in the Study. After evaluation, the preferred option (**Table 2-1**) was selected for maximum environmental benefits (see **Section 2.1.4**). The preferred site location can be found in **Figure 1**.

Component	Location	Existing Condition	Construction Method	
Sewage Treatment Plant	SewageCut slope next to Poeatment PlantToi O Chuen RoadShrubland		Excavation and Bored Piling	
Gravity Sewers/	Between STP and Po Toi O Village	Cut slope / Paved road	Trenchless/ Open Trench Excavation	
Kising Mains	Po Toi O Village	Concrete paved footpath	Open Trench Excavation	
Submarine Outfall	Along Po Toi O Bay channel	Below seabed	Horizontal Directional Drill (HDD)	
Diffuser	Outer PTO Bay	Seabed with no record of corals/amphioxus	Dredging in fully enclosed cofferdam	

#### Table 2-1: Summary of the Preferred Option

#### Works Sequence

- 2.2.2. Construction works will be divided into three major parts:
  - sewage treatment plant (STP),
  - gravity sewers and rising mains and
  - submarine outfall and diffuser installation.
- 2.2.3. The construction works are expected to commence in mid 2017 for completion in 2021 with one more year for defect correction.
- 2.2.4. After site clearance, the construction works for STP will commence. Pipe laying will be carried out after the completion of major noisy works for STP (i.e. excavation of

STP). The submarine outfall will be constructed near the completion of civil works on the STP, and will be followed by the diffuser installation.

#### 2.3. Normal Operation

2.3.1. Sewage from Po Toi O will be collected through the gravity sewer in Po Toi O STP for MBR treatment. Treated effluent will be pumped through the submarine outfall and discharged at the diffuser at the outer part of Po Toi O Bay. The average dry weather flow (ADWF) of the STP is designed at 139m<sup>3</sup>/day.

# 2.4. Emergency Plant Breakdown (Avoidance of Emergency Discharge to Po Toi O Bay)

- 2.4.1. The plant cannot operate in case of power or equipment failure. However, no emergency discharge of raw sewage into Po Toi O bay is expected as further elaborated below.
- 2.4.2. Considering the project scale, risk of emergency condition, construction difficulties and cost, the following provisions are the most appropriate and practical mitigation measures:
  - Delivery of an emergency generator to PTO STP within 4 hours from plant failure;
  - Provision of dual power by CLP;
  - Provision of a SCADA, which signals to the operation and maintenance personnel for emergency attendance in case of plant failure;
  - Provision of a standby pump and screen at the PTO STP;
  - Provision of emergency storage of 4-hr ADWF sewage retention time;
  - Arrangement of tankers for removing incoming sewage to other sewage treatment plants for treatment continuously to ensure a sufficient buffer for emergency storage.
- 2.4.3. Based on these provisions, emergency discharge is not anticipated, and thus no adverse impact on water quality, marine ecology or fisheries due to emergency discharge is anticipated.

#### 2.5. Concurrent Projects

- 2.5.1. There may be two potential concurrent projects in the area:
  - roundabout near the minibus terminal; and
  - fish culture zone (FCZ) dredging and relocation
- 2.5.2. During the course of the study, there was no information on the works programme for the roundabout.

2.5.3. Besides, Civil Engineering and Development Department (CEDD) has confirmed that there was no programme for the fish culture zone dredging and relocation.

#### 3. KEY FINDINGS FROM ENVIRONMENTAL IMPACT ASSESSMENT

### 3.1. Air Quality

- 3.1.1. The overall air quality impact on air sensitive receivers in the vicinity of the proposed sewerage works (e.g. houses in Po Toi O area as shown in **Figure 1**) is considered <u>acceptable</u> for the reasons below:
- 3.1.2. In the construction phase, dusty activities should be scheduled in different phases, and good site practices (e.g. regular watering, minimize excavation area as far as possible, and proper handling and storing of dusty materials) should be implemented to minimize dust emissions from excavation and site formation works (i.e. the major source of air quality impact). Since the Project is small scale, construction dust emissions impacts are anticipated to be acceptable.
- 3.1.3. In the operational phase, proposed mitigation measures (e.g. installing and regularly maintaining odour removal system at 99.5% efficiency or higher in the STP, and enclosing all odour sources shall be adopted to minimize odour nuisance (i.e. the major air quality issue). According to the assessment result from the Gaussian model ISCST3 (a computational model for air quality assessment), the predicted odour levels at air sensitive receivers are well below the odour criterion (5-OU in 5-second averaging time) and thus odour impacts from operation of the sewage treatment plant are anticipated to be acceptable.
- 3.1.4. With implementation of mitigation measures, <u>no residual impact</u> is anticipated in both construction and operational phases. Regular site inspection and dust monitoring are required in the construction phase under the Environmental Monitoring and Audit Programme. No monitoring in the operational phase is proposed.

#### 3.2. Noise

- 3.2.1. The overall noise impact on noise sensitive receivers in the vicinity of the proposed sewerage works (e.g. houses in Po Toi O area as shown in **Figure 1**) is considered <u>acceptable</u> for the reasons below:
- 3.2.2. During the construction, noisy activities should be scheduled in different phases, and good site practices (e.g. using silenced plants or quality powered mechanical equipment (QPME), using mobile barriers, and regularly servicing and maintaining all plants) should be implemented to minimize noise emission/transmission from the operation of powered mechanical equipment (PME) (i.e. the major source of noise impact). By anlayzing typical construction method, sequence of works, plant inventory, effective sound power level of PME, and distances between notional noise sources and noise sensitive receivers, construction noise levels at all noise sensitive receivers are

expected to comply with the noise criterion (75 dB(A)) in non-restricted hours and no residual impact is anticipated.

- 3.2.3. During the operation phase, mitigation measures (e.g. storing noisy plant equipment underground or enclosed by concrete structure) shall be adopted to minimize noise disturbance. Since the proposed STP will have sufficient buffer distances of at least 59m from village houses (i.e. noise sensitive receivers), the operational noise impact is anticipated to be acceptable.
- 3.2.4. With implementation of mitigation measures, <u>no residual impact</u> is anticipated in both construction and operational phases. Regular site inspection and noise monitoring are required in the construction phase under the Environmental Monitoring and Audit Programme. No monitoring in the operational phase is proposed.

### 3.3. Water Quality

- 3.3.1. The overall water quality impact on water sensitive receivers in the vicinity of the proposed sewerage works of this Project is considered <u>acceptable</u> for the reasons below.
- 3.3.2. The major water sensitive receivers (WSRs) identified near the proposed sewerage works include the Po Toi O Fish Culture Zone within the Po Toi O Bay, coral communities along the rocky shore in the Po Toi O Bay and an amphioxus habitat at the outer Po Toi O Bay channel. Their locations can be found in **Figure 2**.
- 3.3.3. During the construction, horizontal directional drilling for the submarine outfall alignment and confined dredging and filling within a fully enclosed cofferdam for diffuser installation are proposed. Also, good site practices such as covering exposed soil and open stockpile by impermeable sheeting, provision and regular maintenance of chemical toilet should be adopted. These mitigation measures can minimize water quality impacts (e.g. elevation in suspended solids) from both land-based and marine-based works to acceptable levels.
- 3.3.4. The Delft3D suite of computational models predicted no substantial change in suspended solids (SS), dissolved oxygen (DO), *E. coli*, total inorganic nitrogen (TIN) and unionized ammonia (UIA) in the Po Toi O Bay during the normal operation of the proposed STP. All water quality parameters would comply with the water quality objectives (WQO) except TIN. As the major source of TIN (fish rafts) remains as before, the TIN concentrations would still exceed the WQO criteria under normal operation.
- 3.3.5. In case of power/equipment failure in the operational phase, mitigation measures mentioned in **Section 2.4** (e.g. provision of sufficient capacity of emergency storage of incoming sewage, and provision of tankers for continuous removal of sewage to other STP (e.g. Tseung Kwan O Preliminary Treatment Works) for treatment) have been adopted to avoid emergency discharge of raw sewage into waterbodies. No emergency discharge of untreated sewage to Po Toi O Bay is expected and thus no water quality impact is anticipated in case of plant/equipment failure.

3.3.6. With implementation of mitigation measures, residual impact is anticipated to be <u>acceptable</u> in both construction and operational phases. Regular site inspection and water quality monitoring are required in the construction phase under the Environmental Monitoring and Audit Programme. Regular effluent monitoring and first-year operational water quality monitoring are proposed in operational phase to ensure that effluent discharge will not cause adverse impact on nearby WSRs.

## **3.4.** Terrestrial Ecology

- 3.4.1. The overall impact on the terrestrial ecology in the vicinity of the proposed sewerage works is considered **acceptable** for the reasons below:
- 3.4.2. Mitigation measures (e.g. locating the STP, gravity sewers and rising mains on disturbed habitats as much as possible, and minimizing the footprint of the STP) were adopted in the design stage to minimize the loss of ecological sensitive habitats. A small area of shrubland on cut slope (893 m<sup>2</sup>), which is not of high ecological value, will be lost permanently at the proposed STP location. The proposed sewage treatment plant will occupy about 2/3 of the affected shrubland area while the remaining area is for associated road facilities, which was designed to meet the minimum traffic requirements. One individual of a plant species of conservation importance (*Gnetum luofuense*) growing on this shrubland will be directly affected by the Project. Removal of this climbing plant cannot be avoided as the possibility of successful transplanting is low. However, the loss is considered insignificant due to its commonness in the Po Toi O area and in Hong Kong.
- 3.4.3. To facilitate construction works, small areas of secondary woodland (350 m<sup>2</sup>) and rocky shore above high tide level (750 m<sup>2</sup>) will be temporarily affected for horizontal direction drilling of submarine outfall. Laying of gravity sewer and rising mains will also transiently occupy 2,100 m<sup>2</sup> developed area. However, these habitats will be reinstated afterwards. Also, no species of conservation importance is located in the above areas.
- 3.4.4. Bright colour fencing shall be erected along the boundary of the undisturbed region of the shrubland and woodland, and around *Diospyros vaccinioides* (a plant species of conservation importance) near the work boundary. This specific terrestrial ecological protection measure can remind workers not to trespass or occupy these areas, and to be careful during operation of equipment. Also, by adopting mitigation measures and good site practices mentioned in **Sections 3.2** and **3.3**, indirect noise and water quality impacts on habitats and wildlife in the Po Toi O area would be acceptable in both construction and operational phases.
- 3.4.5. With implementation of mitigation measures, the residual impact is anticipated to be <u>acceptable</u> in both construction and operational phases. Regular site inspection is required in the construction phase under the Environmental Monitoring and Audit Programme. No specific terrestrial ecological monitoring in both construction and operational phases is proposed.

#### 3.5. Marine Ecology

- 3.5.1. The overall impact on marine ecology in the vicinity of the proposed sewerage works is considered **acceptable** for the reasons below:
- 3.5.2. Mitigation measures (e.g. shifting the treated effluent discharge location away from shore to the outer Po Toi O Bay, as compared with the proposed location in the Project Profile and EIA Study Brief) were adopted in the design stage to avoid destruction of the coral-lined rocky shore and major amphioxus habitat, which are over 100m away from the proposed diffuser location (see **Figure 2**). Only a small area of muddy seabed where the diffuser will be located (5m<sup>2</sup>) will be lost permanently.
- 3.5.3. In the construction phase, mitigation measures proposed in **Section 3.3** (e.g. horizontal directional drilling for submarine outfall alignment and confined dredging and filling within a fully enclosed cofferdam for diffuser installation) should be implemented to minimize water quality impact, hence impact on marine ecology. Specific mitigation measures proposed for marine ecological impact include backfilling the dredged seabed, except where the diffuser is located, to original seabed level. With the implementation of mitigation measures, impact on marine ecology due to dredging and backfilling works is anticipated to be acceptable.
- 3.5.4. As sewage will be collected and treated before discharge, modelling results predicted no substantial change in water quality in the Po Toi O Bay during normal operation of the STP. In case of power/equipment failure in the operational phase, mitigation measures mentioned in **Section 2.4** (e.g. provision of sufficient capacity of emergency storage of incoming sewage, and provision of tankers for continuous removal of sewage to other STP (e.g. Tseung Kwan O Preliminary Treatment Works) for treatment) have been adopted in the contingency plan to avoid emergency discharge of raw sewage into waterbodies. Thus no water quality impact, hence impact on marine ecology, is anticipated in case of plant/equipment failure.
- 3.5.5. With implementation of mitigation measures, the residual impact is anticipated to be <u>acceptable</u> in both construction and operational phases. Besides, regular site inspection in the construction phase and regular water quality monitoring in both construction and operational phases are required under the Environmental Monitoring and Audit Programme. No specific marine ecological monitoring in both construction and operational phases is proposed.

#### 3.6. Fisheries

- 3.6.1. The overall impact on fisheries resources in the vicinity of the proposed sewerage works is considered **acceptable** for the reasons below:
- 3.6.2. Mitigation measures (e.g. discharging treated effluent complying with Water Pollution Control Ordinance standard at about 326m away from the fish culture zone via a submarine outfall) were adopted in the design stage to minimize impact on fisheries. Only 5m<sup>2</sup> of benthic spawning ground will be lost permanently for the diffuser installation. No direct impact on Po Toi O Fish Culture Zone is anticipated.

- 3.6.3. During the construction, mitigation measures proposed in **Section 3.3** (e.g. horizontal directional drilling for the submarine outfall alignment and confined dredging and filling within a fully enclosed cofferdam for the diffuser installation) should be implemented to minimize water quality impact, hence impact on fisheries. To facilitate construction works, relatively small areas of fishing and spawning ground in Po Toi O bay will be temporarily occupied by the fully enclosed cofferdam for installation of the diffuser. However, they will be released once the cofferdam is removed. With the implementation of mitigation measures, the impact on fisheries due to dredging and backfilling works is anticipated to be acceptable.
- 3.6.4. As sewage will be collected and treated before discharge, modelling results predicted no substantial change in water quality in the Po Toi O Bay during normal operation of the STP. In case of power/equipment failure in the operational phase, mitigation measures mentioned in **Section 2.4** (e.g. provision of a sufficient capacity of emergency storage of incoming sewage, and provision of tankers for continuous removal of sewage to other STP (e.g. Tseung Kwan O Preliminary Treatment Works) for treatment) have been adopted in the contingency plan to avoid emergency discharge of raw sewage into waterbodies. Thus no water quality impact, hence no impact on fisheries, is anticipated in case of plant/equipment failure.
- 3.6.5. With implementation of mitigation measures, residual impact is acceptable in both construction and operational phases. Besides, regular site inspection in construction phase and regular water quality monitoring in both construction and operational phases are required under the Environmental Monitoring and Audit Programme. No specific fisheries monitoring in both construction and operational phases is proposed.

#### 3.7. Waste Management and Land Contamination

- 3.7.1. The overall impact arising from waste management and land contamination due to this Project is considered **acceptable** for the reasons below:
- 3.7.2. During the construction, good site practices (e.g. storage and handling of waste properly, provision of sufficient waste collection points, and removal of waste regularly) shall be implemented to minimize environmental impacts arising from generation of construction and demolition (C&D) materials, chemical waste, bentonite slurry and general refuse from workforce from land-based works; and dredged sediment (classified as Cat L) from marine-based works. In addition, all wastes shall be disposed of properly (e.g. sorted inert C&D materials to public fill, and non-inert C&D materials and general refuse to landfill, dredged marine sediment to designated dumping ground). With implementation of good site practices, no residual impact in construction phase is anticipated.
- 3.7.3. During the operation, all wastes shall be removed regularly and disposed of properly (e.g. sludge to a nearby STP for dewatering, and debris from screening process and general refuse to landfill). No residual impact in operational phase is anticipated.

- 3.7.4. By reviewing historical and current land uses, site inspection and government records, it has been concluded that land contamination in work boundary demarcated in **Figure 1** are highly unlikely.
- 3.7.5. With implementation of mitigation measures, <u>no residual impact</u> is anticipated in both construction and operational phases. Regular site inspection, and preparation of site specific Waste Management Plan with regular revision by the future contractor are required in the construction phase under the Environmental Monitoring and Audit Programme. No monitoring in the operational phase is proposed.

#### **3.8.** Landscape and Visual

- 3.8.1. The overall landscape and visual impact within the study boundary of this Project is considered **acceptable** for the reasons below:
- 3.8.2. Mitigation measures (e.g. embedding the STP into existing cut slope, and provision of appropriate façade treatment, compensatory tree planting and vertical greening) were adopted in the design stage to maintain visual entity with surrounding undisturbed landscape, and to minimize visual impact. Measures (e.g. reduction of construction period to minimum, and minimization of unnecessary light spill and glare) shall also be implemented in construction and operational phases to mitigate landscape and visual impacts.
- 3.8.3. Due to the relatively small scale of the proposed Project, none of the landscape and visual sensitive receivers will experience substantial residual impacts. Operational impact will become none to slight after 10 years following full establishment of compensatory planting within the work boundary.
- 3.8.4. With implementation of the mitigation measures, the overall residual landscape and visual impacts are **acceptable** during the construction and operation phases. Regular site inspection for ensuring the implementation of mitigation measures is required in the construction phase under the Environmental Monitoring and Audit Programme. Checking on the implementation of mitigation measures in the operational phase is also required during the landscape establishment period by the Contractor during the first year after construction, and subsequently by the future maintenance agent (building operator) to ensure that intended mitigation effects are realized.

#### **3.9.** Built Heritage

- 3.9.1. The overall impact on the built heritages in the vicinity of the proposed sewerage works (**Figure 2** shows one Grade 3 historic building Hung Shing Temple near the coast in the Po Toi O Village, and two built heritages and six cultural landscape features near footpath in the village) is considered as <u>acceptable</u> for the reasons below:
- 3.9.2. Mitigation measures (e.g. laying gravity sewers and rising mains away from the built heritage resources' footprint) were adopted in the design stage to avoid impact on built heritage resources. During the construction, mitigation measures (e.g. provision of protective covering and buffer zone) shall be implemented to minimize mechanical

vibration and prevent damages by construction tools or waste (i.e. the major impact on built heritage resources). With the implementation of mitigation measures, no residual impact is anticipated.

- 3.9.3. No impact is anticipated during the operational phase.
- 3.9.4. With implementation of mitigation measures, <u>no residual impact</u> is anticipated in both construction and operational phases. Regular site inspection, and vibration and settlement monitoring are required in the construction phase under the Environmental Monitoring and Audit Programme. No monitoring in the operational phase is proposed.

#### 4. ENVIRONMENTAL MONITORING AND AUDIT

4.1.1. In order to alleviate environmental impacts, detailed EM&A requirements have been formulated. Environmental Mitigation Implementation Schedule which lists out all mitigation measures and the proposed parties responsible for the implementation of these measures has been prepared. Regular site audit and/or monitoring on air quality, noise, water quality, landscape and visual, and built heritage have been proposed. In case of exceedance, further remedial measures should be implemented in accordance with the event and action plan. Detailed monitoring requirements and the event and action plan are provided in the Environmental Monitoring and Audit Manual.

# 5. CONCLUSION

- 5.1.1. The proposed sewerage works in Po Toi O is an environmental enhancement project by nature. In addition to the improvement of environmental hygiene in the Po Toi O area, green measures in sewerage system, construction and operation designs have been proposed to achieve other environmental benefits (e.g. minimization of loss of ecologically sensitive habitats, maintenance of visual entity of the STP with surrounding undisturbed landscape, and minimization of odour and noise nuisance).
- 5.1.2. The EIA study concludes that the Project will not cause any unacceptable impact (in terms of air quality, noise, water quality, terrestrial and marine ecology, fisheries, waste management, landscape and visual, and built heritage) during both the construction and operational phases, if proposed measures are implemented properly.

FIGURES



© The Government of the Hong Kong SAR, Map reproduced with permission of the Director of Lands



	ND			
	Proposed Work Boundary			
-	Proposed Sewer and Manhole Proposed Distance Main			
	Proposed Rising Main      Proposed Source by Tranchlose			
Method				
Proposed Sewage Treatment Plant				
— Proposed Submarine Outfall				
Proposed Diffuser				
	1:2000 @ A3 DATE Oct 15			
).	B.C. DRAWN H.T.			
	IA13070 1B 2			



© The Government of the Hong Kong SAR, Map reproduced with permission of the Director of Lands

Legend:				
	-	Proposed Sewage Treatment Plant and Pipe Alignment		
		Proposec Submarir	d Diffu ne Ou	iser and tfall
	M1	Coral Co	mmur	nities
	M2	Amphiox	us	
2	F1	Po Toi O	Fish	Culture Zone
	H1	Graded Historic Building		
	H2	Built Heritage		
	H3	Cultural L	_ands	cape Feature
.E	1:400	0 @ A3	DATE	Jun 16

			•••••	
¢	B.C.	DRAWN	H.T.	
0.		FIGURE N	No.	REV
	IA13070		2	-