MOTT MACDONALD

Proposed Interim Sewage Treatment Plant and Effluent Reuse Facility at Wo Shang Wai, Yuen Long

Environmental Impact Assessment

June 2018

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1 Introduction

1.1 Background

In March 2005, the Project Proponent, Profit Point Enterprises Limited, acquired a development site in Yuen Long at Wo Shang Wai. A comprehensive residential development was proposed at the site, of which the Environmental Impact Assessment (EIA) report was approved on 31 July 2008 (AEIAR-120/2008). An environmental permit (EP) was granted on 9 September 2008 (EP-311/2008) for the construction and operation of the development.

Under the approved EIA report, it is understood that a number of sewage projects have been proposed to upgrade the existing system in North West New Territories. As such, it was anticipated that domestic effluent generated from the development would be discharged via public sewer and a dedicated sewage treatment plant (STP) on-site was considered not necessary. However, the implementation programme of the government sewerage system is currently uncertain. Therefore, a 1-storey high building structure with a footprint of approximately 225m^2 with basement is proposed to house an interim STP on-site. This proposed interim STP is a temporary measure to handle the sewage generated from the development before the availability of public sewerage connection, which is considered to be the long term measure for the residential development. The reclaimed water is expected to be fully reused on-site for toilet flushing and irrigation. The Project will be decommissioned after the development is connected to the planned public sewerage system.

A Project Profile for the “Proposed Interim Sewage Treatment Plant and Effluent Reuse Facility at Wo Shang Wai, Yuen Long” (hereafter as the Project) was submitted to the Environmental Projection Department (EPD) on 10 September 2015 under Section 5(1)(a) of the Environmental Impact Assessment Ordinance (EIAO). On 20 October 2015, EPD issued an Environmental Impact Assessment (EIA) Study Brief for the Project (ESB-289/2015).

This document is the EIA report for the Project, which was conducted in accordance to the EIA Study Brief Requirements (ESB-289/2015) with reference to the Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO).

1.2 Designated Projects under the EIA Ordinance

As stated in the Project Profile and the EIA Study Brief, the Project consists of one Designated Project (DP) under Part I, Schedule 2 of the EIAO: An activity for the reuse of treated sewage effluent from a treatment plant (Item F.4, Part I, Schedule 2).

1.3 Purpose of the EIA Study

In accordance with Clause 1.5 of the EIA Study Brief, the purpose of the EIA Study is to provide information on the nature and extent of environmental impacts arising from the construction, operation and decommissioning of the Project and associated works that will take place concurrently. This information will contribute to decisions by the Director on:

i. The overall acceptability of any adverse environmental consequences that are likely to arise as a result of the Project;
ii. The conditions and requirements for the detailed design, construction, operation and decommissioning of the Project to mitigate against adverse environmental consequences wherever practicable; and
iii. The acceptability of residual impacts after the proposed mitigation measures are implemented.

1.4 Objectives of the EIA Study

In accordance with Clause 2.1 of the EIA Study Brief, the objectives of the EIA are:

i. To describe the Project and associated works together with the requirements and environmental benefits for carrying out the Project;
ii. To identify and describe the elements of the community and environment likely to be affected by the Project and/or likely to cause adverse impacts to the Project, including both the natural and man-made environment and the associated environmental constraints;
iii. To identify and quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;
iv. To identify and quantify any potential losses or damage to flora, fauna and natural habitats;
v. To identify and evaluate any potential landscape and visual impacts and to propose measures to mitigate these impacts;
vi. To identify any potential human health impacts and to propose measures to mitigate these impacts;
vii. To propose the provision of infrastructure or mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction, operation and decommissioning of the Project;
viii. To investigate the feasibility, effectiveness and implications of the proposed mitigation measures;
ix. To identify, predict and evaluate the residual (i.e. after practicable mitigation) environmental impacts and the cumulative effects expected to arise during the construction, operation and decommissioning phases of the Project in relation to the sensitive receivers and potential affected uses;
x. To identify, assesses and specify methods, measures and standards, to be included in the detailed design, construction, operation and decommissioning of the Project which are necessary to mitigate these residual environmental impacts and cumulative effects and reduce them to acceptable levels;
xi. To identify the party responsible for the construction, operation and decommissioning of the Project, and to propose a mechanism to ensure proper operation;
xii. To design and specify the environmental monitoring and audit requirements; and
xiii. To identify any additional studies necessary to implement the mitigation measures or monitoring and proposals recommended in the EIA report.

1.5 Scope of the EIA Study

This EIA report addresses all key potential environmental issues associated with the construction and operation phases of the Project, which are as specified under Clause 3.2 of the EIA Study Brief:

i. Potential air quality impact on sensitive receivers due to construction, operation and decommissioning of the Project and associated works;
ii. Potential noise impact on sensitive receivers due to the Project and associated works, including impact from construction equipment during construction and decommissioning, and operational noise impact;
iii. Potential water quality impact during construction, operation and decommissioning of the Project, including the scenario when there is emergency sewage overflow;
iv. Potential waste management issues and impacts during construction, operation and decommissioning of the Project;
v. Potential ecological impact during construction, operation and decommissioning of the Project;
vi. Potential landscape impact arising from the Project and potential visual impact arising from the above-ground structures of the Project;
vii. Potential human health impact during the effluent reuse activities;
viii. Potential hazard to life impact if chlorine gas containers will be stored and used in the Project; and
ix. Potential cumulative impacts of the Project, through interaction or in combination with other existing, committed and planned developments in the vicinity of the Project, and that those impacts may have a bearing on the environmental acceptability of the Project.

1.5.1 Potential Hazard to Life

According to Item viii. under Clause 3.2 of the EIA Study Brief and summarised above, this EIA report is to address the potential hazard to life impact if chlorine gas containers will be stored and used in the Project. Since the submission of Project Profile, the Project Proponent has confirmed that sodium hypochlorite will be used and no chlorine gas containers will be store and used in the Project. As such, this EIA report will not include a hazard to life impact assessment as stipulated in the Study Brief.

1.6 Structure of the EIA Report

This EIA report has been structured as follows:

Chapter 1 – Introduction presents the background, designated project, purpose and scope of the Project.

Chapter 2 – Project Description presents a description of the Project including concurrent projects.

Chapter 3 – Air Quality Impact presents the approach, findings and recommendations from the air quality impact assessment.

Chapter 4 – Noise Impact presents the approach, findings and recommendations from the noise impact assessment.

Chapter 5 – Water Quality Impact presents the approach, findings and recommendations from the water quality impact assessment.

Chapter 6 – Waste Management Implications presents the approach, findings and recommendations from the waste assessment and investigation for potential land contamination.

Chapter 7 – Ecological Impact (Terrestrial and Aquatic) presents the approach, findings and recommendations from the ecology impact assessment.

Chapter 8 – Landscape and Visual Impacts presents the approach, findings and recommendations from the landscape and visual impact assessment.

Chapter 9 – Conclusions summaries the findings and recommendations from the EIA.

Chapter 10 – Environmental Monitoring and Audit summaries the environmental monitoring and audit requirements specified in Chapters 3 to 9.

Chapter 11 – Implementation Schedule summaries the schedule for implementation of mitigation measures specified in Chapters 3 to 10.

2 Project Description

2.1 Introduction

This section provides a description of the proposed interim sewage treatment plant (STP) and effluent reuse facility, which includes details relating to the need for and environmental benefits of the Project, design and the layout of the Project, background information on the alternatives considered, as well as indicative construction methods and tentative programme details.

2.2 Project Location and History

2.2.1 Project Location

The Project lies within an area designated for "Other Specified Uses (Comprehensive Development to include Wetland Restoration Area)" under the approved Mai Po & Fairview Park Outline Zoning Plan (S/YL-MP/6). The proposed STP is located within the Comprehensive Development at Wo Shang Wai, Yuen Long (hereafter referred as WSW development). The STP, the effluent reuse system and associated works will be located on the basement level within the WSW development. The WSW development is bounded by Castle Peak Road – Mai Po and San Tin Highway to the east, with fish ponds to the north, Wo Shang Wai Village to the south-west, and residential developments (i.e., Royal Palms and Palms Spring) to the south. The location of the Project is shown in **Figure 2.1b**.

2.2.2 Site History

In the 1940s and 1950s, the surrounding of the Project site comprised of brackish rice paddies and were converted to fishponds in the 1960s. The ponds were progressively filled from around 1987 due to increased demand in open storage facilities in the North West New Territories. From the aerial photo taken on 18 August, 1990, it is evident that about 90% of the ponds in the site were filled. Around Year 2000, the Project site is filled and become grassland. The site became the WSW development construction site since Year 2010. Historical aerial photos of the site prior to becoming the WSW development is shown in **Figure 2.2**.

2.3 Project Components

The STP is a 1-storey high building structure with effluent reuse facility located in the basement of the building, the footprint of the STP building is about 225 m^2. The height of the building structure is anticipated to be approximately 11.40mPD with formation level to be approximately -4.9mPD. The basement level of the proposed interim STP is expected to connect with the basement level of the WSW Development. The effluent reuse facility will comprise of the following:

- Equalization tank;
- Reclaimed water storage tank;
- Anoxic tank;
- Aerobic / membrane tank;
- An ultraviolet (UV) steriliser;
- Sludge tank;
- Treated effluent collection tank;
- Emergency storage tank; and
- Associated pumping facilities and piping network.

The locations of the above components are shown in **Figure 2.3**, where the piping network is shown in **Figure 5.2**. The STP will be designed generally in accordance with EPD's Guidelines for the Design of Small Sewage Treatment Plant.

All pipes and fittings used for reclaimed water supply and associated distribution system will be in a specific colour (to be determined during detailed design stage) for distinguishing from the ones used for fresh water supply.

2.3.1 Effluent Treatment Process

Membrane Bioreactor (MBR) technology has been proposed for sewage treatment, with a capacity of 1,446m^3/d. MBR is a combined system of biological treatment and microfiltration process, which is capable of generating high quality effluent. Effluent that has gone through the MBR process will undergo ultraviolet (UV) disinfection, which will serve as second disinfection barrier to ensure *E.coli* level in the effluent be reduced to non-detectable level. Subsequently, sodium hypochlorite solution will be added to the UV-disinfected effluent so as to maintain the total residual chlorine level of above 1mg/L in accordance with the Water Supplies Department's (WSD) recommended water quality standard, prior to reuse the effluent on-site for toilet flushing and landscape irrigation[1]. Samples of reclaimed water will be taken regularly and tested to ensure compliance with reuse criteria. Furthermore, regular checking/inspections of the reclaimed water supply and associated distribution systems with the use of non-toxic dye will be carried out, to identify any possible cross connection to the fresh water supply and distribution system.

All reclaimed water will be fully reused for toilet flushing and irrigation of landscape areas. To enable the reclaimed water to be safely reused, the onsite STP will be designed to meet stringent treatment standards. The treatment standards adopted are based on the reuse water quality standards recommended in the "Water Supplies Department Inter-departmental Working Group on the Implementation of Reclaimed Water Supply in Sheung Shui and Fanling" for non-portable uses. Details of the criteria are summarised in **Table 2.1** below and presented in **Section 5.5.2.3**.

Table 2.1: WSD Reuse Water Quality Standard for Non-Potable Uses

Water Quality Parameter	Unit	WSD Criteria (Irrigation & Non-Potable Uses)
pH	-	6-9
Turbidity	NTU	≤ 5
Total Suspended Solids	mg/l	≤ 5
BOD_5	mg/l	≤ 10
E. coli	cfu/100ml	Non-detectable
Total Residual Chlorine	mg/l	≥ 1 (out of treatment system) ≥ 0.2 (at point of use)
Dissolved Oxygen (DO)	mg/l	≥ 2
Colour	Hazen Unit	≤ 20
Threshold Odour Number (TON)	TON	≤ 100
Ammonia nitrogen	mg/l	≤ 1
Synthetic detergents	mg/l	≤ 5

Note: The water quality standards for all parameters shall be applied at the point of use, unless otherwise specified.

A reclaimed water storage tank with a minimum capacity of 1,180m^3 (3 times of the net daily production rate of reclaimed water) will also be constructed, in case of adverse weather condition (i.e., successive heavy rainy days) to store any excessive treated effluent, which will be progressively consumed in following period. Any further excessive reclaimed water will be tanked away to public sewage treatment works. According to the approved Sewerage Impact Assessment (SIA) for the Project (see **Appendix 2.1**), the buffer tank will be

[1] Water Supplies Department, Technical Specifications on Grey Water Reuse and Rainwater Harvesting, 1st Edition, May 2015, Table 1-1.

sized with adequate volume, including 1-day effluent storage capacity reserved as contingency, to cater for most of the extreme weather condition. Level sensors connected with alarm signalizing system will also be installed, to monitor the storage volume to avoid overflow of treated effluent. A warning signal will be generated automatically to alert the manager when the flow in the tank reached a pre-set level, allowing sufficient time for arranging tanker service to tank away excessive treated effluent.

Sludge produced in the process will be screened and dewatered, the dewatered sludge will be collected by a licensed collector at regular intervals for disposal of at landfill. The transfer of dewatered sludge to tankers will be carried out in the basement where forced ventilation will be provided.

The flow diagram of the operation of the facilities is shown in **Figure 2.4**.

2.3.2 Operation and Maintenance

A team of competent technicians will be assigned to operate the interim STP. Training workshops will be provided to all management and operation staff on the proper use of reclaimed water. An Operation and Maintenance (O&M) Manual will be drawn up detailing operating procedures and precaution measures, of which the technicians should be fully conversant with. In addition, the following will also be implemented:

- Maintaining the STP in a tidy state through regular hosing down, scraping of walkways, whitewashing walls, cleaning and painting metalwork and maintaining adequate lighting and ventilation;
- Hire qualified personnel to inspect and maintain the plant on a regular basis;
- Adequate spare parts will be stored and made readily available; and
- Requirements of Fire Services Department for bulk storage of sodium hypochlorite solution will be properly observed under the Dangerous Goods Ordinance (Cap. 295).

2.3.3 Measures for Effluent Reuse to avoid Potential Health Impacts

The use of reclaimed water during operation phase may potentially cause health impacts. However, as described above, reclaimed water will only be used for toilet flushing and landscape irrigation. Therefore, the greatest chance for potential health impacts to occur will be due to incorrect connection of the potable water and reclaimed water pipes at the toilets.

Pipes for reclaimed water will be easily differentiable from potable water pipes (i.e., watering signs, colour-coded, different pipe sizes) to avoid incorrect connections and contamination of potable water pipes. A range of other engineering and management measures will be adopted to prevent of cross contamination and misuse of reclaimed water, as described below.

Engineering Measures

- Water to be supplied for potable use, toilet flushing and irrigation should be stored in three different tanks in different colours and clearly labelled;
- All pipes and fittings used for reclaimed water supply and associated distribution system should be purple in colour (exact colour to be confirmed during detailed design stage) for distinguishing them from the pipes and fittings used for fresh water supply and its distribution system;
- Regular checking/inspections of the reclaimed water supply and associated distribution systems should be carried out to identify any possible cross connection to the fresh water supply and distribution system. Non-toxic dye may be used in the checking/inspections;
- Samples of treated effluent will be taken regularly through an easily accessible sampling point and tested to ensure compliance with reuse criteria;
- Non-return valves will be installed on both the inlet pipes feed from reclaimed water storage tank and fresh water supply mains, to the toilet flushing and irrigation water storage tanks; and
- All precaution measures will be clearly stated in the O&M Manual of the STP, toilet flushing and irrigation systems.

Management Measures

- Warning plate with sign and letter "NOT FOR POTABLE USE" would be shown on the toilet flushing and landscape irrigation storage tanks, and tagged on all accessible water taps supplying reclaimed water if any within the WSW developments;
- All water taps of reclaimed water at communal areas if any should be locked to avoid misuse of reclaimed water;
- Proper signage, promotion and training workshops will be provided periodically to all management and operation staff of the WSW Development, as well as future land owners on the proper use of reclaimed water and potable water;
- All precaution measures will be clearly stated in the management manual of the WSW Development; and
- Operators of landscape irrigation will be required to wear protective gears to minimise direct contact with reclaimed water whilst carrying out irrigation works.

With the implementation of the aforementioned measures, potential health impacts are not anticipated.

Other Projects with Reuse of Reclaimed Water for Non-Potable Use

Table 2.2 below is a list of projects that have adopted the reuse of reclaimed water in Hong Kong.

Table 2.2: Summary of Hong Kong Project Utilizing Reclaimed Water for Non-Potable Use

Project	Non-Potable Use	Reference
Reuse of Treated Sewage Effluent from Redeveloped Lo Wu Correctional Institution	• Toilet flushing	DIR – 174/2008
Liantang / Heung Yuen Wai Boundary Control Point and Associated Works	• Irrigation	AEIAR – 161/2011
Water Reclamation Facilities for Stonecutters Island, Sham Tseng and Siu Ho Wan Sewage Treatment Works	• Toilet flushing • Make-up water • Ground and facility washing	DIR – 183/2009
Reuse of Treated Effluent from Ngong Ping Sewage Treatment Plant for Toilet Flushing	• Toilet flushing	DIR – 080/2003
Outlying Islands Sewerage Stage 2 – Upgrading of Tai O Sewage Collection, Treatment and Disposal Facilities	• Toilet flushing • Process cleansing	AEIAR – 209/2017
North East New Territories New Development Areas	• Toilet flushing • Irrigation • District cooling system	AEIAR – 175/2013
Water Reclamation Facilities in Shatin Sewage Treatment Works	• Polymer preparation • Irrigation	DIR – 177/2009
Phase III Redevelopment of the Hong Kong Federation of Youth Groups Jockey Club Sai Kung Outdoor Training Camp	• Irrigation • Flushing	AEIAR – 157/2010
Demonstration Scheme on Reclaimed Water Uses in the North District	• Household toilet flushing • Unrestricted irrigation and water features (e.g., decorative streams and fountains)	DIR – 125/2005
Water Reclamation Facilities in Pumping Station and Preliminary Treatment works of Drainage Services Department	• Ground and facility washing • Toilet flushing • Landscape irrigation	DIR – 181 /2009
Water Reclamation Facilities for Yuen Long, Sai Kung and Stanley Sewage Treatment Works	• Make-up water for deodorizer • Ground and facility washing • Toilet flushing • Landscape irrigation	DIR 182/2009
Tseung Kwan O Area 86 Property Development – Rainwater and Greywater Recycling	• Landscape irrigation • Street cleaning • Water features	DIR – 137/2006
Water Reclamation Facility at Tai Po Sewage Treatment Works	• Ground and facility washing • Toilet flushing	DIR 214 / 2011

Project	Non-Potable Use	Reference
Reuse of Treated Wastewater for Cooling Tower make up in Planned Food Factory at No. 3 Dai Shun Street Tai Po Industrial Estate	• Cooling tower make-up water	DIR – 232/2013

2.4 Need of the Project

As stated in **Section 1.1**, it is understood that a number of sewage projects have been proposed to upgrade the existing system in North West New Territories. As such, it was anticipated that domestic effluent from the WSW development can be discharged via the public sewer during the preparation of the EIA study for the WSW Development. However, according to latest available information, the implementation programme of the government sewerage system is currently uncertain.

Therefore, a temporary measure to handle the sewage generated from the WSW Development before the availability of public sewerage connection is necessary.

In accordance with the prevailing water quality control policy, there should be no net increase in pollution load to Deep Bay. The use of existing discharge from Wo Shang Wai Village for co-treatment in order to offset the additional pollutant load had been considered but was found insufficient to meet the “no net increase” requirement. As such, it is proposed to reuse all reclaimed water for flushing and landscape irrigation within the WSW Development, in order to meet the “no net increase” requirement.

2.4.1 Environmental Benefits of the Project

The major environmental benefit of the Project will be the reduction of wastewater discharge to receiving waterbodies thereby reducing pollution load to the environment. Particularly, the WSW Development is located where direction of water flow would eventually discharge to the Shenzhen River in the Deep Bay Water Control Zone. The Deep Bay is an important habitat recognised as wetland of international importance. Reducing wastewater discharge to the Deep Bay area will protect the important habitat and wildlife of the Deep Bay region, which is also the underlying principle of the “no net increase in pollution load to Deep Bay” under the prevailing water quality control policy.

Currently, 70-80% of Hong Kong’s freshwater needs are met by importation from Mainland China (i.e., Dongjiang, Guangdong). The reuse of reclaimed water for landscape irrigation and toilet flushing will reduce the overall freshwater demand during operation of the WSW Development.

Furthermore, it is the Hong Kong Government’s long term objective to increase water sources (including grey water reuse) and promote water conservation, with the aim to become more water sufficient locally and strengthen local water security. The Project, although relatively small scale, is in line with the Total Water Management initiatives and contributing positively to the Government’s long term aim towards sustainable development.

2.5 Consideration of “Without Project” Alternative

In the absence of the proposed STP, discharge of sewage generated from the WSW Development will be impossible. As mentioned in **Section 2.4**, the requirement of no net increase in pollution load to Deep Bay could not be met even if discharge from the Wo Shang Wai Village is collected for co-treatment. As such, without the proposed interim on-site STP and effluent reuse, occupation of the WSW Development will have to be put on hold indefinitely until public sewerage system is available for connection.

2.6 Consideration of Alternative Siting and Layout

The interim STP and effluent reuse facility are proposed to specifically handle sewage generated from the WSW Development. In order to minimise construction footprint and potential environmental impacts on nearby sensitive uses, the interim STP is proposed to be located within the WSW Development.

Potential Locations within WSW Development

Potential locations for the Project within the WSW Development were primarily identified with the aim of minimising disruption to the development's master layout plan (MLP). A few potential locations were identified as below and illustrated in **Figure 2.1a**:

Option 1 – Open space south-west of the WSW Development

Option 2 – Next to WSW site entrance

Option 3 – Near or integrate with the WSW clubhouses

Option 4 – E&M building of WSW Development across the clubhouses next to the development's boundary fencing

Option 1 is considered to cause the least disruption to the development as no houses or supporting facilities were planned in this area. However, this location is situated in between WSW housing blocks and is anticipated to cause disturbances to nearby residents. Furthermore, area of the site is not sufficient to house the entire STP and effluent reuse facility. In addition, should a structure is constructed to accommodate the STP and associated ventilation facilities, the structure will obstruct the visual and ventilation corridor of the WSW Development, which was an operational phase mitigation measure for landscape and visual impact and was committed by the WSW Development. Therefore, Option 1 is considered not feasible.

An alternative option (**Option 2**) that would not affect the MLP is to locate the Project near WSW site entrance. However, the ventilation building of the Express Rail Link (XRL) is located adjacent to the WSW site boundary, which already causes fixed noise impact to nearby sensitive receivers. Considering the Project will also generate fixed noise impact, albeit minimal, locating the Project near the entrance is expected to further increase the potential fixed noise impact to nearby sensitive receivers. Furthermore, this location is situated relatively further away from all the residential units of WSW and open space. As reclaimed water has to be fully reused for toilet flushing and irrigation throughout the entire WSW development, locating the STP at the site entrance will require additional effort in conveyance to collect sewage and distribute reclaimed water. Besides, conveyance by gravity may not be feasible and would require mechanical means (e.g., pumps), which would be more energy intensive. To avoid additional noise impacts and energy inefficiency in STP operation, and collection and distribution process, Option 2 was not selected.

The potential of locating the Project near or integration with the WSW clubhouses was also examined (**Option 3**). This option does not only cause minimal disruption to the MLP, but is also located relatively farther away from sensitive receivers, compared to the above options. Based on latest information available, the E&M facilities supporting the operation of the clubhouses will be accommodated within the clubhouse. Limited space is available for the incorporation of the Project near or within the clubhouses without the need for expanding the premise. According to the approved WSW EIA (AEIAR – 120/2008), the maximum height of buildings within the WSW Development area will be four storeys, to minimise impacts to flight paths of birds. Hence, it is considered to be more appropriate to maintain the form and height of the clubhouse as designed, which will also be compatible with the general character of the area.

The corner near the roundabout of the WSW Development in the east was proposed as an E&M building under the WSW development. This site is considered to be located relatively further from sensitive receivers in comparison to above options (**Option 4**). This area is also sufficient to house the entire STP and effluent reuse facility. Although this option may be closer to existing residents at Royal Palms when compared to Option 3, the perimeter walls of the WSW development is expected to block the STP structure, and minimise potential noise and visual impact. After careful examination of the affected facilities originally to be housed in the E&M building, it was concluded that relocation of the concerned facilities to the large E&M building near the WSW site entrance was feasible. As such, this is selected as the preferred location considering it will cause the least disruption to the MLP and minimal potential environmental impacts.

Minimal Disturbance to Nearby Existing and Planned Residents

The operation of the Project is expected to cause potential odour, noise and visual impact. As such, minimisation and avoidance of these potential impacts has been considered in deriving the preferred siting and layout of the Project.

Upon confirmation of the site location, due consideration has been given on the layout / setting of the STP and effluent reuse facility. The initial design was to construct an one storey structure at the selected site, with direct connection to the internal driveway leading to the WSW site entrance. However, there are several disadvantages in this:

- The one storey structure will be of medium size, leading to potential greater visual impacts
- Although the transfer, treatment and storage of sewage, sludge and reclaimed water is expected to be confined within the structure, there is yet higher potential for odour impact to nearby sensitive receivers
- Potential noise impact from the operation of STP and tankers transporting sludge offsite

In view of the above, it was decided to place major effluent reuse facilities underground to avoid the aforementioned potential impacts as far as possible. Locating the facilities underground will allow direct connection with the basement carpark of the WSW development. The greatest benefit of this option is the confinement of potential odour impacts from the process of sewage and handling / transportation of sludge. The tankers will be able to transfer all sludge in the basement to minimise the nuisance to the residents.

The STP will be equipped with high-efficiency deodorizer with forced ventilation. Sludge will be directly pumped to the tanker parked at basement / ground floor from the sludge tank or the dewatered sludge will be packed in sealed package / container for off-site disposal. Hence, potential odour nuisance to the carpark is expected to be negligible. Besides, carpark users are not expected to stay within the area for long, potential odour nuisance will be minimal and short-term if any. With the recommended measures to contain potential odour impacts from the STP as detailed in **Section 3.6.2**, no adverse odour impact to the basement carpark is expected. Furthermore, the aboveground structure will also be of smaller size and thereby minimising potential visual impact.

After due consideration of the above factors, the STP is proposed to be located near the roundabout beside the future clubhouse, as shown in **Option 4** of **Figure 2.1b**. The aforementioned options and their respective environmental benefits and dis-benefits are summarised in **Table 2.3** below.

Table 2.3: Summary of Alternative Siting and Layout of the Project

Options	Environmental Benefits	Environmental Dis-benefits
Option 1 *Open space south-west of the WSW Development*	• Minimal disturbance to the MLP.	• Close proximity to sensitive receivers situated in between WSW housing blocks and is anticipated to cause disturbances to nearby residents. • Obstruction of committed visual and ventilation corridor under the WSW Development.
Option 2 *Next to WSW site entrance*	• Integration with original E&M buildings and minimise visual impacts. • Located further away from majority of the sensitive receivers, minimising air and noise impacts.	• Located far away from sewage collection and reclaimed water distribution, which will require additional pumping facilities and associated infrastructure. Thus, not energy efficient. • Cumulative noise impacts with XRL's ventilation building.
Option 3 *Near or integrate with WSW clubhouses*	• Avoid potential additional visual impact from a new superstructure. • Relatively farther away from sensitive receivers.	• Potential need for expansion of clubhouse footprint to accommodate the STP, potentially affecting the form and height of the clubhouse, which has been designed to be compatible with the character of the area.
Option 4 *E&M building of WSW Development across the clubhouses next to the boundary fencing*	• Some distance from sensitive receivers, but located centrally enough for effective sewage collection and reclaimed water distribution.	• Additional superstructure with potential visual impacts.
Preferred Option: *Option 4*		

2.7 Consideration of Alternative Construction Method

As the Project falls within the WSW Development, which has already completed site clearance and is in the process of site formation as part of the development's construction, these works will not be required in this Project.

Other major construction elements will broadly include basement excavation, foundation works, superstructure construction and laying of associated piping network.

The main excavation works required for the Project is the formation of the basement level, at approximately -4.9mPD. There are 2 general approach for excavation, namely bottom up (i.e., open-cut) or top-down. The former approach is the conventional method for excavation and provides easy access for PME and the handling/delivery of materials. However, the bottom up approach requires large construction footprint and the surface can only be restored after completion. Top-down excavation is another common method requiring less construction space and allows other activities to be carried out on the surface simultaneously. Considering the scale of works involved under this Project is relatively small, and both approach utilises similar powered mechanical equipment (PME), the potential environmental impacts associated with either approach would be similar. Furthermore, construction of the Project will be located within the existing construction site of the WSW Development, as such, the potential environmental impact associated with the works footprint for these two approaches is not anticipated to differ greatly.

Regardless of the method to be adopted, all excavated inert materials will be reused on-site as far as practicable or within the WSW Development site.

Foundation and Superstructure

The extent of building structures construction will be minimum. Considering the structure will only consists of basement level and 1-storey above ground, shallow foundations such as strip or pad footings may be adopted. Other common methods for foundations (e.g., large diameter bored piles, pre-bored socket h-piles and driven steel h-piles) are generally for multi-storey buildings requiring large loading capacity and is not considered to be suitable for the Project. Besides, these construction methods generally require larger working areas.

The construction methods for shallow foundation are well established and there are limited alternative options. Minimisation of potential environmental impacts will largely be achieved via application of specific mitigation measures as identified in **Section 3** to **8** where applicable.

The superstructure may be constructed by (a) conventional in-situ reinforced concrete; (b) precast concrete; or (c) steelwork construction, largely in the form of prefabricated steelwork elements. The above construction options will not present significant differences in terms of environmental impacts to nearby sensitive receivers. Specific construction methods will be subject to future detailed design. Nevertheless, the superstructure is expected to be of small scale, and the conventional reinforced concrete is likely to be adopted. Should a different form be adopted, it will not present a significant change with regards to environmental impacts.

Percussive piling is not anticipated. However, should percussive piling is eventually required, a Construction Noise Permit will be applied for in accordance with statutory requirements. Non-percussive piling method (e.g. earth auger, mini-pile) is relatively quiet than the percussive piling method as no shocks or vibrations are induced. Given the construction disturbance, non-percussive piling would be adopted.

The piping network for connecting to the effluent reuse facilities will be laid in conjunction with other utilities of WSW Development.

2.8 Programme and Sequence of Works

Construction of the Project is targeted to commence in Q3 2018 and complete by 2021 in time for occupation of the WSW Development. The sequence of works will generally follow the order described above, which is

common for general building projects, that is excavation, foundation and superstructure works. As the Project is constructed in parallel with the WSW development site to serve the residents in the future, works will be carried out to match the latest WSW development construction programme. The piping network will be constructed together with the network of the WSW development.

The Project will be decommissioned once the planned public sewer on Castle Peak Road is available. However, it is to be noted that the structure of the STP and its associated infrastructure will only cease operation and will not be demolished.

2.9 Concurrent Projects

The following major projects under planning and/or construction are likely to interface with the Project:

- Proposed Comprehensive Development at Wo Shang Wai, Yuen Long
- Hong Kong Section of Guangzhou – Shenzhen – Hong Kong Express Rail Link
- The planned Ngau Tam Mei public trunk sewer
- Construction of Cycle Tracks and the associated Supporting Facilities from Sha Po Tsuen to Shek Sheung River

Proposed Comprehensive Development at Wo Shang Wai, Yuen Long

The Proposed Comprehensive Development at Wo Shang Wai is to develop approximately 20.7ha of land in Wo Shang Wai into a residential community in harmony with a wetland restoration area. The proposed STP and effluent reuse facility is to serve this residential community prior to the availability of public sewerage system. The EIA study for this project (AEIAR-120/2008) was approved on 31 July 2008 and construction commenced in 2009. The wetland restoration area has completed construction in 2010 and the residential units are expected to complete for occupation by 2021.

Hong Kong Section of Guangzhou – Shenzhen – Hong Kong Express Rail Link

The Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL) is a railway service to connect Hong Kong, Shenzhen and Guangzhou via a high speed network from the boundary at Huanggang to West Kowloon Terminus (WKT). It is comprised of an approximately 26km long dedicated underground railway with 8 ventilation buildings, a stabling sidings plus emergency rescue station at Shek Kong. The EIA study for this project (AEIAR-143/2009) was approved on 28 September 2009 and construction commenced in January 2010. One of the eight ventilation buildings is located near the WSW site. According to the latest XRL Newsletter (September 2015), construction is targeted for completion by Q3 2018. Based on the environmental monitoring and audit (EM&A) report for this project and observation from site visits, construction of the Mai Po Ventilation Building has been completed. Therefore, cumulative impacts will be assessed where appropriate.

Ngau Tam Mei Public Trunk Sewer

The planned Ngau Tam Mei public trunk sewer is to provide the trunk sewerage consisting of gravity sewers, rising mains and pumping stations to Ngau Tam Mei / San Tin for the collection and conveyance of sewage generated from Fairview Park and nearby low rise development. The alignment of the proposed trunk sewer falls within the assessment area of the Project, and may have potential cumulative impact. However, based on latest available information, the proposed trunk sewer is currently under planning and design stage and the implementation programme is uncertain. Given the construction programme is unconfirmed and insufficient information is available at this stage, this project cannot be considered as a concurrent project and cumulative impacts will not be assessed.

Construction of Cycle Tracks and the associated Supporting Facilities from Sha Po Tsuen to Shek Sheung River

According to the approved EIA for the project (AEIAR-133/2009), this project is for construction of a new cycle track (with footpath) linking up local cycle track networks in Yuen Long and Sheung Shui. The

proposed cycle track will accommodate two-way traffic with minimum width of 3.5m. The associated supporting facilities include five resting stations, one information kiosk and one small seating area which all the facilities will not fall into the assessment area of the Project (i.e. within 500m of the Project boundary). Based on the latest information in EM&A report for the cycle tracks EP (EP-501/2015), the construction work within the assessment area of the Project (i.e. Portion D – Construction of pedestrian ramp) is anticipated to commence in mid-2016 and commission is tentatively in mid-2019. Given the construction works are expected to be small scale, no significant environmental impacts are anticipated during operation phase and the proposed alignment is far away (i.e. more than 300m) from the STP, with the implementation of recommended mitigation measures in the approved EIA report, cumulative impacts will be insignificant and detailed assessment is not required.

3 Air Quality Impact

3.1 Introduction

This section presents the assessment of potential air quality impacts associated with the construction and operation phases of the Project. Dust generated from construction activities is the major source of air pollution during the construction phase, whereas odour from the sewage treatment plant and sludge generated are the primary concerns during the operation phase.

Representative Air Sensitive Receivers (ASRs) within a study area 500 m from the site boundary have been identified and assessed in accordance with Annex 4 and 12 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) as well as the requirements stipulated in Clause 3.4.3 and Appendix B of the EIA Study Brief (ESB-289/2015). Suitable mitigation measures, where necessary, are recommended to protect the nearby ASRs and to ensure that the legislative criteria and guidelines can be satisfied.

3.2 Environmental Legislation, Standards and Guidelines

The following legislation and regulations provide the standards and guidelines for the evaluation of air quality impacts and the type of works that are subject to air pollution control:

- Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) (Environmental Impact Assessment Ordinance (EIAO) (Cap. 499.S16), EIAO-TM, Annexes 4 and 12;
- Air Pollution Control Ordinance (APCO) (Cap. 311) and the Air Quality Objectives (AQO);
- Air Pollution Control (Construction Dust) Regulation; and
- Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation.

3.2.1 Technical Memorandum on Environmental Impact Assessment Process

The criteria and guidelines for evaluating air quality impacts are laid out in Annex 4 and Annex 12 of the EIAO-TM, respectively. Annex 4 stipulates the criteria for evaluating air quality impacts, which include meeting the AQO and other standards established under the APCO, as well as meeting the hourly Total Suspended Particulate (TSP) criterion of 500μg/m^3 and the 5-second average odour concentration of 5 odour units (ou/m^3). Annex 12 provides the guidelines for conducting air quality assessments under the EIA process, including determination of ASRs, assessment methodology and impact prediction and assessment.

3.2.2 Air Pollution Control Ordinance

The principal legislation for the management of air quality is the APCO. It specifies AQO which stipulate the statutory limits of air pollutants and the maximum allowable numbers of exceedances over specific periods. The AQO are listed in **Table 3.1**.

Table 3.1: Air Quality Objectives

Pollutant	Averaging time	Concentration (μg/m^3)	Number of exceedances allowed
Sulphur Dioxide (SO_2)	10-minute	500	3
	24-hour	125	3
Respirable suspended particulates (RSP or PM_{10})	24-hour	100	9
	Annual	50	N/A
Fine suspended particulates (FSP or $PM_{2.5}$)	24-hour	75	9
	Annual	35	N/A

Pollutant	Averaging time	Concentration (μg/m^3)	Number of exceedances allowed
Nitrogen dioxide (NO_2)	1-hour	200	18
	Annual	40	N/A
Carbon monoxide (CO)	1-hour	30,000	0
	8-hour	10,00	0
Ozone (O_3)	8-hour	160	9
Lead (Pb)	Annual	0.5	N/A
Total Suspended Particulates (TSP) (1)	1 hour	500	0
Odour (1)	5-second	5 odour units (ou)	0

Note: (1) Criteria under the EIAO-TM, not an AQO
N/A Not Applicable

3.2.3 Air Pollution Control (Construction Dust) Regulation

The Air Pollution Control (Construction Dust) Regulation enacted under the APCO defines notifiable and regulatory work activities that are subject to construction dust control, as listed below:

Notifiable Work

1. Site formation
2. Reclamation
3. Demolition of a building
4. Work carried out in any part of a tunnel that is within 100 m of any exit to the open air
5. Construction of the foundation of a building
6. Construction of the superstructure of a building
7. Road construction work

Regulatory Works

1. Renovation carried out on the outer surface of the external wall or the upper surface of the roof of a building
2. Road opening or resurfacing work
3. Slope stabilisation work
4. Any work involving any of the following activities:
   a. Stockpiling of dusty materials
   b. Loading, unloading or transfer of dusty materials
   c. Transfer of dusty materials using a belt conveyor system
   d. Use of vehicles
   e. Pneumatic or power-driven drilling, cutting and polishing
   f. Debris handling
   g. Excavation or earth moving
   h. Concrete production
   i. Site clearance
   j. Blasting

Notifiable works require advance notice of activities to be given to the Environmental Protection Department (EPD). The Regulation also requires the works contractor to ensure that both notifiable works and regulatory works are conducted in accordance with the Schedule of the Regulation, which provides dust control and suppression measures.

The Project scope includes construction of superstructures; and is therefore notifiable. The Project also includes: excavation and backfilling and is therefore regulatory.

3.2.4 Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation

The Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation controls emission of dust from non-road vehicles and regulated machines to be used in construction sites. The regulated machines must comply with the emission standards of Stage IIIA of the European Union (EU) or the equivalent, while non-road vehicles must comply with the prevailing emission standards for newly registered road vehicles, which is Euro V. Upon confirmation of their compliance with emission requirement, EPD will issue them with an approval label.

According to the regulation, mobile machine and equipment (regulated machines) means any mobile machine or transportable industrial equipment that is powered by an internal combustion engine with a rated engine power output that is greater than 19 kW but not greater than 560 kW. Non-road Mobile Machinery (NRMM) is intended to be used in a private road that is within an area wholly or mainly used for the carrying on of construction work/industry. The regulated machines include crawler cranes, excavators, etc., while non-road vehicles include private cars goods vehicles, etc. Therefore, this regulation is applicable to the regulated machines and NRMM to be deployed for construction activities of the Project.

3.3 Study Area

3.3.1 Local Environment and Study Area Description

The proposed effluent reuse facility will be entirely underground and located at the basement level within the proposed sewage treatment plant (STP), inside the Comprehensive Development at Wo Shang Wai, Yuen Long (WSW Development). The WSW Development is designated as “OU(CDWRA)”, which stands for “Other Specified Uses (Comprehensive Development to include Wetland Restoration Area)” under the approved Mai Po & Fairview Park Outline Zoning Plan (S/YL-MP/6). It is bound by Castle Peak Road – Mai Po and San Tin Highway to the east, fish ponds to the north, Wo Shang Wai Village to the south-west, and residential developments such as Royal Palms and Palms Spring to the south. The location of the Project is shown in **Figure 2.1**.

3.3.2 Background Air Quality

Existing air quality in the 500m Study Area is mainly affected by the traffic flow along major roads near the Project Area such as Castle Peak Road and San Tin Highway to the east of the site. In accordance with the wind data obtained from the nearest wind monitoring station at Lau Fau Shan, the prevailing wind direction was easterly (070 degrees) in year 2016[1].

With respect to background air quality, the closest EPD general air quality monitoring station located in Yuen Long is referenced. It is noted however that the Yuen Long monitoring station is situated in an urban area surrounded by existing road networks whereas the Project is located in a rural area. Given the differing nature of both locations, the background air quality at the general air quality monitoring station is presented as a conservative indication. **Table 3.2** shows the recent five years (2012-2016) monitoring data recorded at the Yuen Long Monitoring Station, which is used as reference to represent the historical background air quality in the Project area. In addition, as part of the on-going EM&A programme for the proposed WSW Development, hourly TSP levels have been recorded at four monitoring locations since 12 May 2010. The four monitoring locations representing the existing sensitive receivers close to the WSW Development are as shown in **Figure 3.1**. The hourly TSP concentrations measured at these four monitoring locations, which can

[1] Hong Kong Observatory, “Summary of Meteorological and Tidal Observations in Hong Kong 2016”, published in August 2017, http://www.hko.gov.hk/publica/smo/smo2016.pdf

represent the cumulative TSP impacts due to the construction activities of the proposed WSW Development and other concurrent projects in the vicinity during the monitoring period, are also presented in **Table 3.2**.

Table 3.2: Historical Air Quality at the Project Area

Pollutant	Averaging Period	Concentration (µg/m^3)					Corresponding AQO (µg/m^3)
		2012	2013	2014	2015	2016	
Sulphur Dioxide (SO_2)	10 minute - 4th highest (1)	NM	NM	92	51	58	500
	24 hour - 4th highest (1)	29	33	27	17	17	125
Respirable suspended particulates (RSP or PM_{10})	24 hour - 10th highest (1)	100	**142**	**124**	**102**	86	100
	Annual (1)	44	**56**	50	44	37	50
Fine suspended particulates (FSP or $PM_{2.5}$)	24 hour - 10th highest(1)	65	**106**	**86**	**78**	63	75
	Annual(1)	29	**37**	35	30	23	35
Nitrogen dioxide (NO_2)	1 hour - 19th highest(1)	147	183	165	162	149	200
	Annual(1)	**49**	**54**	**52**	**45**	**46**	40
Carbon monoxide (CO)	1 hour - 1st highest(1)	2,200	2,690	2,560	2,460	2,080	30,000
	8 hour - 1st highest(1)	1,945	1,950	2,319	2,143	1,474	10,000
Ozone (O_3)	8 hour - 10th highest(1)	NM	NM	**177**	**161**	143	160
Lead (Pb)	Annual (1)	NM	NM	0.035	0.029	*	0.5
Total Suspended Particulates (TSP)	1 hour - range	62-272	65-284	51-280	32-211	30-288(2)	500(3)

Notes:
(1) Data extracted from EPD'S Air Quality in Hong Kong Reports for Annual Air Quality Monitoring Result (2012-2016) for Yuen Long Monitoring Station
(2) Hourly TSP levels obtained from the EM&A data recorded for the WSW Development from Jan 2016 to Feb 2018
(3) EIAO-TM criterion, not an AQO
NM Not Measured
*: No data is available in 2016 Statistical Summary.
Monitoring results that exceeded prevailing AQO criteria are shown in bold characters.

Table 3.2 shows that the historical background concentrations for hourly NO_2 and daily SO_2 complied with their respective AQO in all the past 5 years and the hourly TSP levels recorded at the proposed WSW Development are well below the EIAO-TM criterion throughout the monitoring period. The historical daily background levels for RSP and FSP as well as the annual background NO_2 levels, however, exceeded their corresponding AQO in most or all of the 5 past years. For the historical annual RSP and FSP levels, they exceeded their corresponding AQO in 2013.

The predicted future background air pollutant concentrations at the Project area can be extracted from the relevant grids of the PATH-2016 model (for year 2020), as summarised in **Table 3.3**.

Table 3.3: Future Background air quality from PATH-2016 for year 2020

Pollutant	Averaging Period	Average Concentration (µg/m^3) at relevant PATH-2016 grids		Corresponding AQO (µg/m^3)
		(28,51)	(28,52)	
Respirable Suspended Particulate (RSP or PM_{10})	Daily - 10th highest	81.0	83.0	100
	Annual	34.1	35.3	50
Fine Suspended Particulate (FSP or $PM_{2.5}$)	Daily - 10th highest (1)	60.7	62.2	75
	Annual (2)	24.2	25.1	35
Nitrogen Dioxide (NO_2)	Hourly – 19th highest	88.9	91.9	200
	Annual	15.6	17.1	40

(1) The daily FSP levels are conservatively estimated by multiplying daily RSP levels, predicted by PATH-2016, by a factor of 0.75, according to EPD'S Guidelines on the Estimation of $PM_{2.5}$ for Air Quality Assessment in Hong Kong.

(2) The annual FSP levels are conservatively estimated by multiplying annual RSP levels, predicted by PATH-2016, by a factor of 0.71, according to EPD'S Guidelines on the Estimation of $PM_{2.5}$ for Air Quality Assessment in Hong Kong.

It can be seen from **Table 3.2** and **Table 3.3** that while the historical background daily/annual RSP and FSP levels exceeded their respective corresponding AQO in some of the past 5 years, the future background levels for RSP and FSP are below their corresponding AQOs in 2020. The improvement in future ambient air quality can be attributed to the government's commitment to implementing the various planned emission reduction measures, as published on EPD website[2]. It is also noted that an improvement would be expected since the historical background levels are obtained from EPD's new town Yuen Long monitoring station, whereas the future background levels extracted from PATH-2016 are for over the rural Project area.

3.3.3 Key Pollutants of Concern

As presented in **Section 3.2**, under the APCO, AQO are stipulated for seven major air pollutants, namely, sulphur dioxide (SO_2), respirable suspended particulates (RSP), fine suspended particulates (FSP), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3) and lead (Pb) and the EIAO-TM specifies criteria for two parameters, namely total suspended particulates (TSP) and odour. During the construction phase the Project site will have dust emitting activities and potential odour impact from the excavation of sediment. Potential odour may also result from the proposed STP for reclaimed water reuse during the operation phase. Each of the nine pollutants of concern have been reviewed for their relevance to the Project as follows:

Sulphur Dioxide (SO_2)

According to the "2015 Hong Kong Emission Inventory Report" published by EPD in April 2017, 59% of total SO_2 emission in Hong Kong in 2015 is attributed to navigation whereas only below 1% of the total emission is due to road transport. The introduction of ultra-low sulphur diesel for vehicle fleet in 2000 has helped in reducing the SO_2 emission from road transport in Hong Kong. No significant sources of sulphur dioxide emitted from the Project, therefore it is not considered as key air pollutant for air quality impact assessment for this Project, though it is one of the criteria pollutants under the AQO.

Respirable Suspended Particulates (RSP)

According to the "2015 Hong Kong Emission Inventory Report" published by EPD in April 2017, navigation and non-combustion sectors were the top two sources of RSP emissions, accounting for 34% and 17% of total RSP emissions in 2015, respectively. In addition, as can be calculated from **Table 3.2**, the latest 5-year annual average RSP concentration at Yuen Long Station is about 46.2 $\mu g/m^3$, which is 92% of the corresponding AQO. As the Project is expected to produce construction dust, RSP has been identified as a key air pollutant of concern during the construction phase of this Project. It is also noted that RSP is one of the criteria pollutants under the AQO.

Fine Suspended Particulates (FSP)

According to the "2015 Hong Kong Emission Inventory Report" published by EPD in April 2017, major sources of FSP include non-combustion such as construction activities. FSP is a finer component of RSP. As the Project is expected to produce dust during the construction phase, FSP has been identified as a key air pollutant of concern during the construction phase of this Project.

Nitrogen Dioxide (NO_2)

According to the "2015 Hong Kong Emission Inventory Report" published by EPD in April 2017, navigation, public electricity generation and road transport are the top three major sources of nitrogen oxides (NOx) generated in Hong Kong, constituting respectively about 37%, 28% and 18% of the total NOx emission in 2015. NOx is transformed to NO_2 in the presence of O_3 under sunlight. As there are no significant sources of nitrogen dioxide emitted from the Project, nitrogen dioxide is not identified as a key air pollutant for air quality impact assessment for this Project, though it is one of the criteria pollutants under the AQO.

[2] http://www.epd.gov.hk/epd/english/environmentinhk/air/prob_solutions/strategies_apc.html

Carbon Monoxide (CO)

According to the "2015 Hong Kong Emission Inventory Report" published by EPD in April 2017, road transport and navigation are the top two major sources of CO emissions in Hong Kong, contributing to respectively about 51% and 23% of the total CO emission in 2015. However, based on the "Air Quality in Hong Kong 2016" published by EPD, the highest 1-hour average (3,130 µg/m^3) was recorded in Causeway Bay roadside station and the highest 8-hour average (2,339 µg/m^3) was recorded at Tsuen Wan general station, and both were well below the respective AQO limits. Given that the ambient CO levels are well below the relevant AQO with large margins, CO is not identified as a key air pollutant for air quality impact assessment for this Project.

Ozone (O_3)

Ozone is a major constituent of photochemical smog. It is not a pollutant directly emitted from man-made sources but formed by photochemical reactions of primary pollutants such as NOx and volatile organic compounds (VOCs) under sunlight. As it takes several hours for these photochemical reactions to take place, ozone recorded in one place could be attributed to VOC and NOx emissions from places afar. Hence, ozone is a regional air pollution problem. In other words, unlike air pollutants such as NOx and RSP, ozone is not a pollutant directly attributable to emissions from nearby road traffic. As a result, ozone is not identified as a key air pollutant for air quality impact assessment for this Project, though it is one of the criteria pollutants under the AQO.

Lead (Pb)

Since leaded petrol was banned in Hong Kong on 1 April 1999, it is no longer considered as a primary source in Hong Kong. According to the "Air Quality in Hong Kong 2016" published by EPD, the ambient lead concentrations continued to linger at very low levels during 2016 as in previous years, and the overall annual averages, ranging from 14 ng/m^3 (at Central/Western) to 20 ng/m^3 (at Yuen Long and Tuen Mun), were well below the AQO limit of 500 ng/m^3. Therefore, it is not considered as a key air pollutant for the operation phase air quality impact assessment.

Total Suspended Particulates (TSP)

As the project is expected to produce construction dust, TSP has been identified as a key pollutant of concern for assessment, together with RSP and FSP.

Odour

As the excavation works of the Project are expected to encounter sediment, odour may potentially be generated during the construction of the Project. During the operation phase, air quality impacts would be attributed to potential odour emission from the proposed STP. Therefore, odour has been identified as a key parameter of concern during both the construction and operation phases of this Project.

Identified Key Air Pollutants

Based on the above review results, the following key air pollutants of concerns are identified for the purpose of air quality impact assessment of the Project:

1. For construction phase – TSP, RSP, FSP and Odour; and
2. For operation phase – Odour.

3.3.4 Air Sensitive Receivers

Representative Air Sensitive Receivers (ASRs) within 500m of the site boundary have been identified through site inspections and a review of land use plans, according to the criteria set out in the EIAO-TM. ASRs and their horizontal distances from the Project site are summarized in **Table 3.4**. Locations of the existing and planned ASRs are shown in **Figure 3.1**.

Table 3.4: Location of Representative Air Sensitive Receivers

ID	Description	Usage	Construction Phase	Operation Phase	Horizontal Distance from the Project site boundary (m)	Horizontal Distance from the Proposed STP Vent
ASR1	Royal Palms	Rs(E)	✓	✓	approx. 23m	approx. 46m
ASR2A	Palm Springs	Rs(E)	✓	✓	approx. 59m	approx. 556m
ASR2B_1	Palm Springs	Rs(E)	✓	✓	approx. 10m	approx. 291m
ASR2B_2	Palm Springs	Rs(E)	✓	✓	approx. 10m	approx. 305m
ASR3	Wo Shang Wai	Rs(E)	✓	✓	approx. 50m	approx. 395m
ASR4	Village House of Mai Po San Tsuen	Rs(E)	✓	✓	approx. 118m	approx. 329m
ASR4A	Village House of Mai Po San Tsuen	Rs(E)	✓	✓	approx. 54m	approx. 290m
P1	Proposed WSW Development - Residential block	Rs(P)	×	✓	Not applicable	approx. 26m
P2	Proposed WSW Development - Clubhouse associated facilities	Rc(P)	×	✓	Not applicable	approx. 31m
P3	Proposed WSW Development - Clubhouse associated facilities	Rc(P)	×	✓	Not applicable	approx. 45m
P4	Proposed WSW Development - Residential block	Rs(P)	×	✓	Not applicable	approx. 58m

Legend: ✓ - included in the assessment; ×- not included in the assessment
Rs(E) – Existing Residential
Rs(P) – Planned Residential
Rc(P) – Planned Recreational

3.3.5 Cumulative Impacts

The proposed construction programme for the Project is scheduled to commence in Q3 2018, for completion and operation by 2021. Upon availability of public sewerage network, the Project will be decommissioned, which will take approximately 4 months. The concurrent projects that may have cumulative effects during the various phase of the Project include:

Table 3.5: Summary of Concurrent Projects

Concurrent Project	Anticipated Works Period	Possible Cumulative Impact
Comprehensive Development at Wo Shang Wai, Yuen Long (WSW Development)	Q2 2010 – Q1 2021	Yes – dust emissions from the construction of the project
Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL)	Q1 2010 – Q3 2018*	No
Planned Ngau Tam Mei public trunk sewer at Castle Peak Road (Yuen Long and Kam Tin Sewerage and Sewage Disposal)	Under planning & design	Yes – dust emissions and potential odour emissions from the construction of the project

Note:
* Only the works area of Mai Po Ventilation Building (MPVB) proposed under the XRL Project is located within 500m of the Project site boundary and would hence have potential concurrent impact. Based on on-site observation, the construction of the MPVB structure has been completed in 2014. It is therefore anticipated that no cumulative dust impact would arise from the construction of the Project.

3.4 Air Quality Impact Assessment Methodology

3.4.1 Construction Phase

Activities anticipated during the construction phase that could potentially give rise to fugitive dust emissions include earth moving, transfer of dusty material and construction of the superstructure of the STP building, etc. Other potential sources of air quality impacts may include exhaust emissions from construction vehicles and potential odour generated from the excavation of sediment.

Clause 3 (ii) of Appendix B of the EIA Study Brief (ESB-289/2015) for the proposed Project states that a quantitative assessment shall be carried out to evaluate the construction dust impact at the identified ASRs if it is anticipated that the Project will give rise to significant construction dust impact likely to exceed recommended limits in the EIAO-TM at the ASRs within 500 m from the Project boundary despite the incorporation of dust control measures. Fugitive dust impacts are anticipated to be short-term and could be controlled with the mitigation measures presented in **Section 3.6.1**. As reviewed in **Section 3.3.2**, the environmental monitoring and audit (EM&A) data recorded for the WSW Development at the Project site shows no exceedances of the hourly TSP criterion. Therefore, a qualitative assessment of the dust impact is carried out.

3.4.2 Operation Phase

During operation phase, it is anticipated that the ASRs would be subject to potential odour impacts due to the following proposed and existing odour emission sources within the 500m Study Area are:

- the proposed STP;
- sludge generated at the proposed STP;
- existing STP serving Royal Palms residential development;
- existing STP serving Palm Springs residential development; and
- potential odour emissions from the construction of the planned Ngau Tam Mei public trunk sewer at Castle Peak Road.

Clause 4 (ii) of Appendix B of the EIA Study Brief (ESB-289/2015) for the proposed Project states that a quantitative assessment shall be carried out to evaluate the operation phase air quality impacts at the identified ASRs if it is anticipated that the Project will give rise to significant air quality impacts likely to exceed recommended limits in the EIAO-TM at the ASRs despite the incorporation of proposed control/ mitigation measures. As the proposed STP will be fully enclosed and is not of a large scale, the potential odour impact is expected to be minor. In addition, it is anticipated that the operation phase air quality impacts could be controlled with the mitigation measures presented in **Section 3.6.2**. Therefore, a qualitative assessment of the operation phase air quality impacts is carried out.

3.5 Evaluation and Assessment of Air Quality Impacts

3.5.1 Construction Phase

Fugitive dust emissions

The proposed STP is a 1-storey high building structure with the proposed effluent reuse facility located in the basement of the building, and the footprint of the building is about 225 m^2. Given the small scale and localized nature of the building construction works together with implementation of the mitigation measures as recommended in **Section 3.6.1**, the potential construction phase dust emission is anticipated to be short-term and not significant. While the associated works of the Project which will mainly involve laying of piping for the effluent reuse facility will spread over the entire WSW Development site, the required earthworks will be minor with insignificant dust emissions.

The extent of the STP building construction works for the proposed Project represent only a small part of the proposed WSW Development. The construction programme for the Project is expected to overlap with the

construction of the proposed WSW Development in Q3 2018 to 2021. The cumulative impact however is expected to be limited given the small scale and localized nature of the STP building construction works.

Based on the information provided by the Drainage Services Department (DSD) and EPD, a gravity trunk sewer will be provided along Castle Peak Road between Ngau Tam Mei and San Tin under PWP Item 235DS. This has been assessed in a separate EIA report for "Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 2" (EIA Application No. EIA-094/2004). The tentative construction period mentioned in the EIA was from 2009 to 2012, however, the latest status of the implementation programme of the public trunk sewer has yet to be confirmed, and the construction has not yet commenced. While it is uncertain at this stage whether construction of the public trunk sewer would overlap with that of the proposed Project, this concurrent project is far away (over 200m) from the Project Area and proper mitigation measures have been proposed in the EIA study. As such, the cumulative impact that can be caused by this concurrent project is anticipated to be insignificant.

Another concurrent project identified within the 500m Study Area is the construction of the Mai Po Ventilation Building (MPVB) and the associated railway section of the XRL with part of the works area encroached in the WSW development. However, based on on-site observations, the construction of the MPVB structure appears to have been largely completed in 2014 and therefore no cumulative dust impact arising from the construction of the Project is anticipated since then.

An EM&A programme is currently being undertaken for the proposed WSW Development to monitor the dust impacts associated with its construction to ensure no adverse impacts on the adjacent ASRs and to verify the effectiveness of the dust control measures. The historical EM&A findings since its commencement are summarised in **Table 3.2**. The measured hourly TSP concentrations ranged from 30 to 456 μg/m^3 during the monitoring period from May 2010 to February 2018, which are all below the EIAO-TM criterion of 500 μg/m^3. Since March 2011, the hourly TSP levels were in a lower range of 30 to 288 μg/m^3, which are well below the EIAO-TM criterion. A number of these readings were taken whilst site formation works were being conducted and other concurrent projects such as the construction of the MPVB were still underway, hence representing the short-term cumulative construction dust levels at the nearby ASRs due to the proposed WSW Development and other concurrent projects. Hence, it is anticipated that with proper implementation of the recommended control measures as detailed in **Section 3.6.1** the TSP, RSP and FSP levels at all the identified ASRs would be in compliance with the relevant criteria during the construction phase of the Project.

Construction vehicle and machine emissions

Given the small scale of construction works for the Project and with the enforcement of the Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation, the regulated machines and non-road vehicles must comply with the relevant emission standards. Therefore, the particulates, SO_2 and NO_2 emissions from these machines and vehicles should be limited and will not be significant. It is anticipated that emissions from these machines are small and would not result in exceedances of the relevant AQOs at the identified ASRs.

Potential odour impact from excavation of sediment

As indicated in the Waste Management Implications section, **Chapter 6**, approximately 800m^3 of sediment will be excavated from the Project site during the construction phase. As described above, the proposed STP is a 1-storey high building structure with the proposed effluent reuse facility located in the basement of the building, and the footprint of the building is about 225 m^2. Given the small scale and localized nature of the building construction works, potential odour nuisance to the surrounding environment would be avoided by following control measures as recommended in **Section 3.6.1.3**. Hence, with proper measures, potential odour impact is considered to be short-term and controllable.

3.5.2 Operation Phase

Odour emission from proposed interim on-site sewage treatment plant

The proposed STP will serve the WSW Development until the commissioning of the public gravity trunk sewer that is planned along Castle Peak Road. It will adopt Membrane Bioreactor (MBR) technology with UV disinfection system and the effluent generated from the STP will be fully reused at the WSW Development for toilet flushing and irrigation of landscaped areas. Upon commissioning of the public trunk sewer, the sewage from the proposed development will be connected to the public sewerage system as a long-term measure. The STP will then be decommissioned but not demolished.

The proposed housing development for the WSW Development is anticipated to be occupied by 2021. It will consist of a 400-unit proposed development, with a design population intake of 1,245 persons, for which all the sewage generated is expected to be treated and re-used on-site. The design average dry weather flow (ADWF) of the proposed STP will be 482m^3/day as presented in **Section 5.5.2.1**.

The proposed STP and associated effluent reuse facility will be housed indoors with full enclosure and maintained at negative pressure. The STP will be designed with an inlet chamber and wet well which will be located underground and enclosed by airtight cover. A high-efficiency deodorizer (with at least 99.5% odour removal efficiency) with a forced ventilation system will also be installed at the STP building to remove odour before discharge into open air. In addition, discharge point of the proposed STP will be directed away from nearby ASRs. The dewatered sludge of the STP will be loaded onto a truck at underground level for off-site disposal. Details of the odour containment and control measures for the STP are presented in Section 3.6.2.

The potential odour impacts due to the proposed STP has been reviewed by making reference to the approved EIA report of Expansion of Sha Tau Kok Sewage Treatment Works (STKSTW) (EIA Register No.: AEIAR – 207/2017). The sewage treatment technology and the sludge handling approach of the proposed STP for WSW Development is similar to that of the STKSTW in terms of odour generation activities. According to the approved EIA report for STKSTW, the odour control measures of the proposed STKSTW are similar to those of the proposed STP for WSW Development, as exemplified below:

- Enclosure of the major process equipment inside building structure, which is equipped with ventilation system to ensure adequate air exchange within the structure (in other words, maintaining negative pressure inside the structure);
- MBR system equipped with deodorizer (at least 99.5% odour removal efficiency) for treating odorous emissions;
- Regular maintenance of the deodorizer to ensure the odour removal efficiency is maintained at/above the design requirement; and
- Locating the exhausts of deodorization facilities away from the nearby ASRs.

The design ADWF of the STKSTW is 5,000m^3/day, which is more than 10 times of the design ADWF of the proposed STP (i.e. 482m^3/day). It is therefore considered as a conservative approach to review the potential odour impacts due to the proposed STP by making reference to the odour impact assessment findings of the approved EIA report for STKSTW.

According to Table 3-3 of the approved EIA report for STKSTW, the shortest separation distance between the nearest ASR (i.e. A8) and site boundary of the proposed STKSTW is 20m. The predicted 5-second odour concentrations at the ASR A8 would be in the range of 0.03OU to 0.13OU at the heights of 1.5m to 10.5m above ground (Table 3.7 of the approved EIA report for STKSTW refers), which are well below the odour criterion of 5OU. As presented in Table 3.4 above, the shortest horizontal distance between the nearest ASR (i.e. P1) and the proposed ventilation exhaust of the STP is approximately 26m, and the approximate height of ASR P1 is 8m above ground. Given that the STKSTW is of similar design to the proposed STP but the design ADWF of STKSTW is over 10 times of that of the proposed STP; and that the nearest ASR A8 assessed in the approved EIA for STKSTW is of similar distance and height to those of the nearest ASR P1 in this EIA, the potential odour level at the nearest ASR P1 due to the proposed STP would be

conservatively comparable to those predicted at the ASR A8 due to the STKSTW, i.e., well below the odour criterion of 5OU. In other words, with the scale of the proposed STP and with the appropriate odour containment and control measures in place to confine and reduce the potential odour emissions at sources, it is anticipated that adverse odour impact due to the proposed STP is not expected.

Cumulative odour impact from existing and planned odour emission sources

There are two existing private STPs serving Royal Palms and Palm Springs residential developments, which are respectively about 200m and 250m from the Project Area. According to the approved EIA for the proposed WSW Development (EIA Register No.: AEIAR-120/2008), site walks conducted near these two STPs detected no sewage odour. Moreover, based on the information provided by EPD no odour complaints related to the two existing private STPs were received by EPD in the last 5 years (2012 to 2016). As reviewed in the previous paragraphs, there would not be significant odour impact due to the proposed STP on the nearby ASRs. As a result, the odour impacts caused by the two existing STPs are minor, and thus unacceptable cumulative odour impact is not anticipated.

The implementation programme for the planned Ngau Tam Mei public trunk sewer at Castle Peak Road is uncertain since it is currently under the planning and design stage. However, it is assumed that the public trunk sewer will be designed in accordance with the relevant standards and guidelines published by DSD. With appropriate sewage septicity management and ventilation/ odour control, no adverse odour nuisance from the new sewerage system is expected and therefore unacceptable cumulative odour impact is not anticipated.

3.5.3 Decommissioning Phase

Upon implementation of the public trunk sewer, the proposed STP will be decommissioned, but the structures will be retained in-situ and will not be demolished. Hence no adverse air quality impacts on the surrounding ASRs are anticipated during the decommissioning phase of the Project.

3.6 Mitigation Measures

3.6.1 Construction Phase

3.6.1.1 General Practices for Dust Control

It is recommended that the following dust mitigation measures are implemented to maintain dust emissions at acceptable levels during the construction phase:

- Any dusty activities should be regularly sprayed with water to maintain damp conditions of the works area.
- Any dusty materials should be covered with tarpaulin or similar material during transportation.
- Any dusty materials stockpiles should be either (i) covered entirely by impervious sheeting; or (ii) sprayed with water.

3.6.1.2 Best Practices for Dust Control

It is recommended that the relevant best practices for dust control as stipulated in the Air Pollution Control (Construction Dust) Regulation should also be adopted to further reduce the construction dust impacts of the Project. These best practices include:

Good Site Management

- Good site management is important to help reduce potential air quality impact down to an acceptable level. As a general guide, the Contractor should maintain high standard of housekeeping to prevent emission of fugitive dust. Loading, unloading, handling and storage of raw materials, wastes or by-products should be carried out in a manner so as to minimise the release of visible dust emissions. Any piles of materials accumulated on or around the work areas should be cleaned up regularly. Cleaning,

repair and maintenance of all plant facilities within the work areas should be carried out in a manner minimising generation of fugitive dust emissions. The material should be handled properly to prevent fugitive dust emission before cleaning.

Loading, Unloading or Transfer of Dusty Materials

- All dusty materials should be sprayed with water immediately prior to any loading or transfer operation so as to keep the dusty material wet.

Debris Handling

- Any debris should be covered entirely by impervious sheeting or stored in a debris collection area sheltered on the top and the three sides.
- Before debris is dumped into a chute, water should be sprayed so that it remains wet when it is dumped.

Transportation of Dusty Materials

- Vehicle used for transporting dusty materials/spoils should be covered with tarpaulin or similar material. The cover should extend over the edges of the sides and tailboards.

Wheel washing

- Vehicle wheel washing facilities should be provided at each project site exit. Immediately before leaving the project site, every vehicle should be washed to remove any dusty materials from its body and wheels.

Use of vehicles

- Immediately before leaving the Project site, every vehicle should be washed to remove any dusty materials from its body and wheels.
- Where a vehicle leaving the Project site is carrying a load of dusty materials, the load should be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle.

Site hoarding

- Where a site boundary adjoins a road, street, service lane or other area accessible to the public, hoarding of not less than 2.4m high from ground level should be provided along the entire length of that portion of the site boundary except for a site entrance or exit.

3.6.1.3 Odour control measures

During excavation works, the following mitigation measures are recommended in order to contain potential odour from excavated sediment:

- all malodorous excavated material should be placed as far as possible from any ASRs;
- the stockpiled malodorous materials should be removed from site as soon as possible; and
- the stockpiled malodorous materials should be covered entirely by plastic tarpaulin sheets.

3.6.2 Operation Phase

For the potential odour impact due to the proposed STP, it is recommended to implement the following measures to contain and mitigate the potential odour impact:

- The STP will be totally enclosed.
- Negative pressure ventilation will be provided within the enclosure to avoid any fugitive odorous emission from the STP.
- Further odour containment will be achieved by covering or confining the sewage channels, sewage tanks, and equipment with potential odour emission.
- Proper mixing will be provided at the equalization and sludge holding tanks to prevent sewage septicity.
- Chemical or biological deodorization facilities with at least 99.5% odour removal efficiency will be provided to treat potential odorous emissions from the STP including sewage channels / tanks, filter press and screening facilities so as to minimize any potential odour impact to the nearby ASRs.

- The deodorization facilities should be regularly maintained so as to ensure at least 99.5% odour removal efficiency.
- The deodorization facilities should be designed such that the discharge point is directed away from nearby ASRs.

3.7 Residual Impacts

3.7.1 Construction Phase

With proper implementation of the recommended mitigation measures, no adverse residual air quality impacts are anticipated for the Project during the construction phase.

3.7.2 Operation Phase

During the operation phase, the potential cumulative odour impacts at all ASRs due to the proposed STP and the two existing STPs serving Royal Palms and Palm Springs are anticipated to be not significant. Hence, no adverse residual air quality impacts are anticipated for the Project during the operation phase.

3.8 Environmental Monitoring and Audit

3.8.1 Construction Phase

With implementation of the recommended mitigation measures, no significant dust impact is expected and regular dust monitoring is therefore not considered necessary during the construction phase of the Project.

3.8.2 Operation Phase

The proposed effluent reuse facility will be entirely underground, enclosed within the STP building and equipped with a high efficiency deodorizer. With proper operation of the STP and proposed effluent reuse facility, no additional mitigation measures are required and hence odour monitoring and audit is considered not necessary during the operation phase.

3.9 Conclusion

3.9.1 Construction phase

Given the small scale and localized nature of the STP building construction works together with implementation of the recommended mitigation measures, no adverse air quality impacts on the surrounding ASRs are anticipated during the construction phase of the Project.

3.9.2 Operation Phase

With proper operation of the proposed STP and effluent reuse facility, as well as the recommended odour containment and control measures in place to confine and reduce the potential odour emissions at sources, adverse odour impacts on the surrounding ASRs are not anticipated.

4 Noise Impact

4.1 Introduction

This section presents the assessment of potential noise impacts associated with the construction and operation phases of the Project, which has been conducted in accordance with the criteria and guidelines as stated in Annex 5 and Annex 13 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) as well as the requirements given in Clause 3.4.4 and Appendix C of the EIA Study Brief (ESB-289/2015).

4.2 Environmental Legislation, Standards and Guidelines

4.2.1 Construction Phase

4.2.1.1 Construction Noise

Control over the generation of construction noise from Designated Projects (DPs) under Environmental Impact Assessment Ordinance (EIAO) in Hong Kong is governed by the EIAO and the Noise Control Ordinance (NCO). The NCO is to provide statutory controls for carrying out construction work using Powered Mechanical Equipment (PME) and prescribed construction works during the restricted hours. The noise standards for daytime construction activities of DPs are in accordance with Table 1B, Annex 5 of Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM). The Technical Memoranda (TMs) applicable to the control of noise from construction activities of the proposed construction works of the Project are:

- TM on Environmental Impact Assessment Process (EIAO-TM)
- TM on Noise from Construction Work other than Percussive Piling (GW-TM)

These TMs prescribe the maximum permitted noise levels for the use of PME and certain construction activities and processes, according to the type of equipment or activity, the perceived noise climate of the area and the working hours of equipment operation and usage.

The works area of this project will fall outside the Designated Areas. Therefore, the TM on Noise from Construction Work in Designated Areas is not applicable to the Project.

According to the proposed construction methodology, percussive piling is not required for the Project. Therefore, the TM on Noise from Percussive Piling is not applicable to the Project.

4.2.1.2 General Construction Activities during Non-Restricted Hours

Noise impacts arising from general construction activities other than percussive piling during the daytime period (0700 – 1900 hours of any day not being a Sunday or general holiday) would be assessed against the noise standards tabulated in **Table 4.1** below.

Table 4.1: Noise Standards for Daytime Construction Activities

Noise Sensitive Use	0700 to 1900 hours on any day not being a Sunday or general holiday, $L_{eq(30\ mins)}$, dB(A)
All domestic premises including temporary housing accommodation	75
Hotels and hostels	
Education institutions including kindergartens, nurseries and all others	70

Noise Sensitive Use	0700 to 1900 hours on any day not being a Sunday or general holiday, $L_{eq(30\ mins)}$, dB(A)
where unaided voice communication is required	65 during examinations

Source: EIAO-TM, Annex 5, Table 1B – Noise Standards for Daytime Construction Activities
Notes:
(i) The above noise standards apply to uses which rely on openable windows for ventilation.
(ii) The above standards shall be viewed as the maximum permissible noise levels assessed at 1m from the external facade.

4.2.1.3 General Construction Activities during Restricted Hours

Noise impacts arising from general construction activities (excluding percussive pilling) conducted during the restricted hours (1900 to 0700 hours on any day and anytime on Sunday or general holiday) and percussive pilling during anytime are governed by the NCO.

For carrying out of any general construction activities involving the use of any PME within restricted hours, a Construction Noise Permit (CNP) is required from the Noise Control Authority under the NCO. The noise criteria and the assessment procedures for the issuing a CNP are specified in the GW-TM under the NCO.

Regardless of any description or assessment made in this section, in assessing a filed application for a CNP, the Noise Control Authority will be guided by the relevant TMs. The Noise Control Authority will consider all the factors affecting their decision taking contemporary situations/ conditions into account. Nothing in this Report shall pre-empt the Noise Control Authority in making their decisions, and there is no guarantee that a CNP will be issued. If a CNP is to be issued, the Noise Control Authority may include any conditions they consider appropriate and such conditions are to be followed while the works covered by the CNP are being carried out. Failing to do so may lead to cancellation of the permit and prosecution action under the NCO.

According to the construction programme, the proposed construction works would be carried out during non-restricted hours, i.e., 0700-1900 hours on any day not being a Sunday or general holiday. In case of any construction activities during restricted hours, it is the Contractor's responsibility to ensure compliance with the NCO and the relevant TMs. The Contractor will be required to submit CNP application to the Noise Control Authority and abide by any conditions stated in the CNP, should any be issued.

4.2.2 Operation Phase

4.2.2.1 Fixed Noise Sources

For fixed noise sources impact assessment, the Acceptable Noise Levels (ANLs) for the Noise Sensitive Receivers (NSRs) are determined with consideration of the Area Sensitivity Rating (ASR) which is defined in the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM) issued under the NCO.

The ASR depends on the type of area and the degree of impact that Influencing Factors (IFs) have on the NSRs as illustrated in **Table 4.2** below. Industrial area, major road or the area within the boundary of Hong Kong International Airport shall be considered to be an IF. Regardless of the ASR adopted in the fixed noise sources impact assessment, the Noise Control Authority will assess the fixed noise sources and/ or take enforcement action, if necessary, based on the NCO, the relevant TMs and the contemporary conditions/ situations.

Table 4.2: Area Sensitivity Rating

Type of Area Containing NSR	Degree to which NSR is affected by IF		
	Not Affected[(c)]	Indirectly Affected[(d)]	Directly Affected[(e)]
(i) Rural area, including country parks[(a)] or village type developments	A	B	B
(ii) Low density residential area consisting of low-rise or isolated high-rise developments	A	B	C
(iii) Urban area[(b)]	B	C	C

Type of Area Containing NSR	Degree to which NSR is affected by IF		
(iv) Area other than those above	B	B	C

Source: IND-TM, Table 1 – Area Sensitivity Rating
Definitions:
(a) "Country park" means an area that is designated as a country park pursuant to section 14 of the Country Parks Ordinance.
(b) "Urban area" means an area of high density, diverse development including a mixture of such elements as industrial activities, major trade or commercial activities and residential premises.
(c) "Not Affected" means that the NSR is at such a location that noise generated by the IF is not noticeable at the NSR.
(d) "Indirectly Affected" means that the NSR is at such a location that noise generated by the IF, whilst noticeable at the NSR, is not a dominant feature of the noise climate of the NSR.
(e) "Directly Affected" means that the NSR is at such a location that noise generated by the IF is readily noticeable at the NSR and is a dominant feature of the noise climate of the NSR.

Fixed noise is controlled under the NCO and shall comply with the ANLs laid down in the Table 2 of the IND-TM. For a given ASR, the ANL in dB(A) is given in **Table 4.3** below.

Table 4.3: Acceptable Noise Level for Fixed Noise Sources

Time Period	Area Sensitivity Rating		
	A	B	C
Day-time (0700 to 1900 hours)	60	65	70
Evening (1900 to 2300 hours)			
Night-time (2300 to 0700 hours)	50	55	60

Source: IND-TM, Table 2 - Acceptable Noise Levels
Note: (i) The above standards apply to uses which rely on opened windows for ventilation.
(ii) The above standards should be viewed as the maximum permissible noise levels assessed at 1m from the external facade.

As stipulated in Annex 5 of the EIAO-TM, the noise standards for planning fixed noise source are (a) 5 dB(A) below the appropriate ANL as stipulated in the IND-TM, or (b) the prevailing background noise levels (for quiet area with level 5 dB(A) below the ANL).

Background noise measurements were carried out in Wo Shang Wai (WSW) for the Project "Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link" (XRL) EIA (EIA Report Register No. AEIAR-143/2009). Given that the background noise levels measured in the approved XRL EIA Report were carried out before the commencement of the Project "Proposed Comprehensive Development at Wo Shang Wai, Yuen Long" (the WSW Development) and XRL construction works, the background noise levels measured for the XRL project, which is lower than the prevailing background noise level, have been adopted in this EIA study as a conservative approach.

The subject site is located in rural area with village type developments. According to **Table 4.2**, the ASR of the NSR shall be classified as "B" for the assessment point directly or indirectly affected by nearby major roads namely San Tin Highway, Castle Peak Road and San Tam Road, which are considered as IFs according to the IND-TM. The ASR of the NSR shall be classified as "A" for the assessment point not affected by the identified IFs.

According to the approved XRL EIA Report, background noise measurements were conducted at 2 locations in Wo Shang Wai (see **Figure 4.2**). Measurement location M2 located within the WSW development site which is less affected by the identified IFs, has a noise environment similar to that of the representative NSRs under this EIA study. Hence, the measurement results at M2 in the approved XRL EIA have been adopted for determining the operation noise assessment criteria for the planned fixed noise criteria in this EIA study, as illustrated in **Table 4.4** below.

Table 4.4: Noise Criteria for the Planned Fixed Noise Sources

Measurement Location in XRL EIA	Time Period	Measured Noise Level, $L_{eq(30mins)}$, dB(A)	Area Sensitivity Rating	ANL-5, dB(A)	Operation Noise Assessment Criteria $L_{eq(30mins)}$ dB(A)
M1 (Wo Shang Wai)	Day-time and Evening (1400-1800)	68	B	60	60
	Night-time (2300-0200)	62		50	50
M2 (Wo Shang Wai)	Day-time and Evening (1400-1800)	51	A	55	**51**
	Night-time (2300-0200)	49		45	**45**

Source: EIA of Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link, Table 5.8 – Background Noise Measurement Results
Bold figure denotes noise criteria adopted in this EIA Study.

4.3 Assessment Area

The Project site is located within the WSW development site in Yuen Long District. The Assessment Area for the noise impact assessment should generally include areas within 300 m from the boundary of the Project and the works of the Project as shown in **Figure 4.1**.

4.4 Description of the Noise Environment

The proposed interim Sewage Treatment Plant (STP) is located within the existing WSW development site surrounded by the area with residential uses. The background noise environment is dominated by the traffic on nearby San Tin Highway, Castle Peak Road and San Tam Road. Noise impact from nearby construction works at the WSW development site and the XRL site was observed during site visit on 3 and 17 May 2016.

4.5 Noise Sensitive Receivers

NSRs have been identified in accordance with Annex 13 of the EIAO-TM within the 300m assessment area. The existing, planned and committed noise sensitive developments and relevant uses on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department and any land use and development applications approved by the Town Planning Board were also reviewed in the vicinity of the Project.

For the purpose of noise impact assessment, the first layer of NSRs located close to boundary of the Project have been selected as assessment points/ identified representative NSRs within the assessment area.

Locations of all representative NSRs during construction and operation phases are shown in **Figure 4.1** and **Figure 4.2**, respectively, and summarised in **Table 4.5**. The photos of the existing NSRs are showed in **Figure 4.3**. All construction work for the Project will be completed before occupation of the WSW Development with residential uses. As such, no NSRs within the Wo Shang Wai development site are considered during the construction phase.

Table 4.5: Representative Noise Sensitive Receivers for Construction and Operation Phases

NSR ID	Description	Existing/ Planned	Use	No. of Storeys	Construction Phase	Operation Phase
NSR 1	House No. 7, Cherry Path, Palm Springs	Existing	Residential	3	Yes	Yes
NSR 2	House No. 1, Narcissus Path, Palm Springs	Existing	Residential	3	Yes	Yes
NSR 3	House No. 61, Narcissus Path, Palm Springs	Existing	Residential	3	Yes	Yes
NSR 4	St. Lorraine English Kindergarten	Existing	Educational Institute	1	Yes	Yes

NSR ID	Description	Existing/ Planned	Use	No. of Storeys	Construction Phase	Operation Phase
NSR 5	House No. 1, Ventura Avenue, Royal Palms	Existing	Residential	3	Yes	Yes
NSR 6	House No. 1, Marin Avenue, Royal Palms	Existing	Residential	3	Yes	Yes
NSR 7	House No. 202, Mai Po San Tsuen	Existing	Residential	3	Yes	Yes
NSR 8	House in Wo Shang Wai Development Site	Planned	Residential	2	No	Yes
NSR 9	House in Wo Shang Wai Development Site	Planned	Residential	2	No	Yes
NSR 10	House in Wo Shang Wai Development Site	Planned	Residential	2	No	Yes

4.6 Identification of Noise Sources

4.6.1 Construction Phase

Potential noise impact during construction phase will be mainly from the uses of PME. As mentioned in **Section 2.7**, major construction activities will broadly include basement excavation, foundation works, superstructure construction and laying of associated piping network. The piping network for connecting to the effluent reuse facilities will be laid in conjunction with other utilities of the WSW Development. PME likely to be used in this Project include excavators, cranes, lorries, and concrete pumps, etc. The major construction works are localized in the small footprint of the proposed interim STP building (i.e. 225 m^2).

Underground construction work is required for the basement level of proposed interim STP, which is expected to involve small-scale construction activities only. Use of drill and blast method for these works is not expected. Therefore, no potential ground-borne noise impact to the existing NSRs is anticipated.

Potential noise sources during construction phase include construction noise from the WSW development site. Given that the construction of XRL is expected to be completed in Q3 2018 (as mentioned in **Section 2.9**), no cumulative construction noise impact associated with XRL is anticipated.

4.6.2 Operation Phase

Potential noise sources during operation phase include the operation of the proposed interim STP itself, the planned Electrical and Mechanical (E&M) building under the WSW Development, the existing Mai Po Ventilation Building (MPVB) and the existing STP at the nearby residential development Royal Palms, as shown in **Figure 4.2**.

4.6.2.1 Proposed Interim STP

The proposed interim STP will be situated closed to the planned residential buildings in WSW development site, and is expected to operate 24 hours a day. There will be one louver opening on the western façade of the proposed interim STP. During the operation phase, noise will be generated from fixed plants including screens, blowers, pumps and fans, etc. which are enclosed in the proposed interim STP building structure. Potential noise impact to the nearby NSRs (i.e. residential uses of the WSW Development) from the operation of the STP is anticipated.

Also associated with the operation of the proposed interim STP is the transportation of sludge by designated sewage tankers for off-site disposal. The collection and transportation of sludge is expected to involve two vehicles per day only during non-peak traffic hours of day-time and evening periods. The sludge collection and loading activities will be carried out underground at basement level and well shielded from the nearby NSRs. Thus, no significant potential noise impact from the delivery of sludge is expected.

4.6.2.2 E&M Building of the WSW Development

The E&M buildings at the eastern part of the WSW development site will be in small scale. Plants of the E&M building will be entirely enclosed and confined. Therefore, noise impact from the E&M building is considered insignificant and will not be considered in this assessment.

4.6.2.3 Mai Po Ventilation Building (MPVB)

The MPVB is located within the XRL site near the east boundary of the WSW development site, and is expected to operate 24 hours a day. The ventilation openings at four sides of the MPVB are expected to cause noise impacts.

4.6.2.4 Existing STP at Royal Palms

An existing STP at Royal Palms is located at the south-east of the Project site, and is expected to operate 24 hours a day. The distance between the proposed interim STP to the existing STP is about 200m and there is line-of-sight from the residential uses of the WSW development to the noise sources. Potential cumulative noise impact from the operation of the existing STP is also expected.

4.6.3 Decommissioning Phase

The proposed interim STP will be decommissioned when the WSW Development is connected to the committed public sewer. The STP will only cease operation and the structure of the STP and its associated infrastructure will not be demolished. No PME would be used for the decommissioning work. As such, no noise impact is anticipated during decommissioning phase.

4.7 Assessment Methodology

4.7.1 Construction Noise

According to the requirement of Clause 2.1 of the Appendix C of the Study Brief (ESB-289/2015), the construction noise impact assessment should be conducted in accordance with methodology in paragraph 5.3 and 5.4 of Annex 13 of the EIAO-TM. The construction noise impact assessment is carried out based on standard acoustic principles and practices, following the methodology given in the Section 2 of the GW-TM.

Potential construction noise sources include the uses of plants and equipment for the construction of the proposed interim STP and associated piping network. Construction activities are expected to be carried out during non-restricted hours. The potential construction noise impacts shall be assessed against the noise standards stipulated in Table 1B, Annex 5 of the EIAO-TM.

As mentioned in **Section 4.6.1**, potential ground-borne noise impact is not anticipated hence no ground-borne noise impact assessment is carried out in this EIA Study.

4.7.2 Operational Noise

4.7.2.1 Fixed Noise Sources

The major fixed noise sources identified during the operation phase include the proposed interim STP itself, the existing STP at Royal Palms and Mai Po Ventilation Building (MPVB).

According to Clause 3.3.1 in the Appendix C of the EIA Study Brief (ESB-289/2015), various operation modes including worst operation mode and other operation modes of the fixed noise source should be quantitatively assessed. However, in absence of detailed information and noise specification for the proposed interim STP, the maximum allowable noise emission levels at the opening for future detailed design of the plant have been predicted based on backward calculation of separation distance between the noise source and the nearest NSRs. The worst operation mode with 100% utilisation rate of equipment is assumed in the prediction. As such, the operation of the STP is expected to comply with all relevant noise criteria regardless of the operation mode.

The maximum allowable sound power levels (Max SWLs) of the identified fixed noise sources were determined by adopting standard acoustics principles:

SPL = Max SWL – DC + FC – BC

where

SPL: Sound Pressure Level in dB(A)
Max SWL: Maximum Allowable Sound Power Level in dB(A)
DC: Distance Attenuation in dB(A) = 20 log D + 8 (where D is the distance in m)
FC: Façade Correction in dB(A) = +3 dB(A)
BC: Barrier Correction in dB(A)

If those fixed plant directly adjacent to the NSR building but with no direct line-of-sight to the noise source / opening, a 5 dB(A) attenuation will be applied. If the fixed plant is not directly adjacent to the NSR and with no direct line-of-sight to the noise source / opening which is located on the other side of the NSR building or completely blocked by substantial barrier including building(s) or topographical feature(s), a 10 dB(A) attenuation will be applied.

For the existing STP at the entrance of Royal Palms, reference has been made to the noise level measured in the approved WSW Development EIA (EIA Report Register No. AEIAR- 120/2008). The plant operates 24 hours a day and the operational noise is assumed to be steady throughout the day based on the assumption in the approved WSW EIA Report and on-site verification on 3 and 17 May 2016. The sound power level from the approved WSW EIA Report (i.e. 73dB(A)) is adopted for the assessment.

For the MPVB, the maximum SWLs of the ventilation openings in accordance with the MPVB design provided by MTRC have been adopted for assessment. Correspondence from MTRC is shown in **Appendix 4.1**.

Corrections of tonality, intermittency or impulsiveness have not been considered in proposed fixed noise source as there are no detailed information and noise specification for these planned noise sources. However, if the noise exhibits any of these characteristics during the operation of the plant, the maximum allowable SWLs should be reduced in accordance with the recommendation given in Section 3.3 of the IND-TM.

4.8 Evaluation and Assessment of Noise Impact

4.8.1 Construction Phase

4.8.1.1 Construction Noise

In approved WSW VEP (VEP-538/2017), there is an E&M building at the same location of the proposed interim STP in this project as shown in Figure 6 of the approved EP-311/2008/E. The scope of the approved WSW VEP does not include the proposed interim STP as the WSW Development relies on the public sewerage network. In contrast, the scope of this project as indicated in **Section 1.1**, a 1-storey high building structure with basement is proposed to house an interim STP on-site as a temporary measure to handle the sewage generated from the development before the availability of public sewerage connection. The E&M building (as mentioned of the preferred option in **Section 2.6**) is found to be suitable to house the proposed interim STP and the associated effluent reuse facilities in the basement of the building. The Project Engineer has confirmed that the works in the construction of the 1-storey high building structure for the proposed interim STP will be the same as the E&M building as indicated in approved master layout plan of the approved WSW VEP.

The footprint of the STP building is about 225 m^2. Only few number of PME will be operated simultaneously during the construction period. The extent of the STP building construction works for the Project will be minimum and shallow foundations will be adopted. No noisy operations are expected for the STP building construction works due to the small footprint of STP building.

Based on observation made during site visits on 3 and 17 May 2016, 9m and 10m high continuous noise barriers were erected around the perimeter of the WSW development site in accordance with requirement of the approved WSW Development EIA (AEIAR-120/2008). The construction site of STP is located within these barriers and will also benefit from the existing measure where noise sources of construction equipment will be blocked at all identified representative NSRs. The photos of the existing noise barriers are shown in **Figure 4.4**.

Given that the locations of the identified representative NSRs are of same conditions to that in the approved WSW EIA Report, the continuous vertical noise barriers which would be in place during the whole construction period of the proposed interim STP are considered to be sufficient to alleviate the potential construction noise impact from the proposed Project.

The construction programme for the Project is expected to overlap with the construction of the WSW Development from Q3 2018 to 2021. Quantitative construction noise impact assessment of the WSW Development for worst-case scenario with all construction activities including the construction of building structure for the proposed STP has already been conducted in the Environmental Review Report (ERR) for the WSW VEP and excerpted in **Appendix 4.2**. The plant inventory including the type and quantity of equipment and utilisation rate in the assessment was confirmed with the Project Engineer and remain valid subsequent to the design development for constructing the proposed interim STP.

The predicted cumulative construction noise levels at the representative NSRs with the implemented temporary noise barriers as shown in **Figure 4.4**, has been assessed and summarised in **Table 4.6** below.

Table 4.6: Maximum Predicted Cumulative Construction Noise Levels at Representative NSRs

NSR ID	Description	Maximum Predicted Construction Noise Level, $L_{eq(30mins)}$, dB(A)	Daytime Construction Noise Criteria*, $L_{eq(30mins)}$, dB(A)
NSR 1	House No. 7, Cherry Path, Palm Springs	70	75
NSR 2	House No. 1, Narcissus Path, Palm Springs	71	75
NSR 3	House No. 61, Narcissus Path, Palm Springs	70	75
NSR 4	St. Lorraine English Kindergarten	65	70 (65 for examination period)
NSR 5	House No. 1, Ventura Avenue, Royal Palms	74	75
NSR 6	House No. 1, Marin Avenue, Royal Palms	70	75
NSR 7	House No. 202, Mai Po San Tsuen	68	75

Source (*): EIAO-TM, Annex 5, Table 1B - Noise Standards for Daytime Construction Activities.

The noise assessment in the ERR for the WSW VEP (VEP-538/2017) has assessed the worst-case scenario with all construction activities at the WSW development site including the construction of building structure for the STP and demonstrated all the predicted noise levels at representative NSRs are complied with the relevant EIAO-TM construction noise criteria with implementation of the temporary continuous noise barriers. The construction works that were not covered in the noise assessment of the ERR for the WSW VEP include installation works of the equalization tank, compartments and equipment of the STP only which will all be conducted inside the enclosed building structure. Therefore, the construction noise for the installation works is expected to be insignificant and the construction noise impact assessment in the ERR for the WSW VEP and no adverse cumulative noise impacts are anticipated.

All construction activities are anticipated to be within the existing WSW Development construction site. To further reduce the construction noise impact, the sequence of works of the Project would be scheduled to prevent overlapping with other construction activities of the WSW Development by breaking the construction works into different phases / groups as far as practicable.

Considering the above and with the implementation of measures detailed in **Section 4.9.1** as well as the existing continuous noise barriers implemented for the construction phase of the WSW Development, adverse construction noise impact is not anticipated.

4.8.2 Operation Phase

4.8.2.1 Fixed Noise Sources

Based on the preliminary design information, the proposed interim STP will have one ventilation opening of on the western façade of the building structure as shown in **Figure 4.2**. Adopting the methodology stated in **Section 4.7.2**, the maximum allowable SWLs of the only ventilation opening identified at the western façade during different time periods have been predicted and are summarised in **Table 4.7** below. Detailed calculation is shown in **Appendix 4.3**.

Table 4.7: Maximum Allowable SWL and Predicted Fixed Plant Noise Levels

NSR ID	Day-time and evening (0700-2300 hours)			Night-time (2300-0700 hours)		
	Maximum Allowable SWL	Predicted Noise Level, $L_{eq(30mins)}$, dB(A)	Noise Criterion $L_{eq(30mins)}$, dB(A)	Maximum Allowable SWL	Predicted Noise Level, $L_{eq(30mins)}$, dB(A)	Noise Criterion $L_{eq(30mins)}$, dB(A)
NSR 8	92	47	51	86	41	45
NSR 9	92	43	51	86	37	45
NSR 10	92	51	51	86	45	45

With the consideration of both day-time and evening criterion (i.e. 51 dB(A)) and night-time criterion (i.e. 45 dB(A)), the maximum allowable SWLs for the proposed interim STP calculated is 92 dB(A) for day-time and evening and 86 dB(A) for night-time. Appropriate noise reduction design at source will be considered (such as acoustic louver blade or ventilation silencers, etc.) during the detailed design stage to ensure the required maximum allowable SWLs is achieved. As stated in **Section 4.11.2** and the Environmental and Monitoring Manual, noise commissioning test prior to the operation of the Project is required to ensure the noise associated with the fixed plant operation would comply with the noise standards stipulated in the EIAO-TM and the NCO.

With the adoption of the maximum allowable SWLs for the proposed interim STP, the predicted noise level at all identified representative NSRs is expected to comply with the relevant noise criteria. Therefore, no adverse fixed noise sources impacts on nearby NSRs are anticipated.

4.9 Mitigation Measures

4.9.1 Construction Phase

As discussed in **Section 4.8.1**, all construction activities are anticipated to be within the existing WSW Development construction site. With the continuous noise barriers implemented under the approved WSW Development EIA Report (AEIAR-120/2008) and VEP (VEP-538/2017) as shown in **Figure 4.4**, no adverse construction noise impact is anticipated.

Nevertheless, the following noise control measures are recommended to reduce potential noise impact from construction activities:

- Good Site Practice;
- Selection of quieter plant;
- Use of enclosure / acoustic shed;
- Use of Insulating Fabric; and
- Schedule of the use of PME

4.9.1.1 Good Site Practice

Good site practice and noise management can significantly reduce the impact of site activities on nearby NSRs. The measures should be followed as far as practicable during construction:

- Only well-maintained plant should be operated on-site and plant should be serviced regularly;
- Machines and plants that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- Mobile plant, if any, should be sited as far from NSRs as possible;
- Plant known to emit noise strongly in one direction should, wherever possible, be orientated to direct noise away from NSRs;
- Material stockpiles and other structures should be effectively utilized, wherever practicable, in screening noise from on-site construction activities;
- Silencers or mufflers on construction equipment should be utilized and should be properly maintained during construction works; and
- Routine maintenance of plant and equipment should be carried out.

4.9.1.2 Selection of Quieter Plant

Quiet plant is defined as Quality Powered Mechanical Equipment (QPME) whose actual SWL is less than the value specified in GW-TM for the same piece of equipment. This is one of the most effective measures and is increasingly practicable because of the availability of quiet equipment.

The Contractor may be able to obtain particular models of plant that are quieter than the standards given in the GW-TM. The SWLs for specific quiet plant can be taken from EPD's QPME Inventory.

4.9.1.3 Use of Enclosure / Acoustic Shed

The use of noise enclosure or acoustic shed is to cover stationary PME such as air compressor and generator. With the adoption of the noise enclosure or acoustic shed, the PME could be completely screened and the noise emission at source can be effectively reduced.

4.9.1.4 Use of Noise Insulating Fabric

Noise insulating fabric should be adopted for certain PME where applicable. With the adoption of the fabric, noise emission from the opening or gaps of the joints of the PME can be effectively reduced.

4.9.1.5 Schedule of the Use of PME

The construction activities should be scheduled, where practicable, to prevent the use of multiple PMEs simultaneously.

4.9.2 Operation Phase

4.9.2.1 Fixed Noise Sources

With the proposed interim STP designed to meet the maximum allowable sound power levels as stated in **Section 4.8.2**, no exceedance of relevant noise criteria is anticipated, and hence no mitigation measure is required. Noise commissioning test should be carried out prior to the operation of the proposed STP to ensure the compliance of the noise levels from the operation of the STP with the stipulated noise criteria.

4.10 Residual Impacts

4.10.1 Construction Phase

With the continuous vertical noise barriers along the perimeter of the WSW development site and the noise barriers would be in place when works for the proposed interim STP is carried out, the predicted construction noise levels at the representative NSRs will comply with the relevant noise criteria. No residual noise impact during construction phase is expected.

4.10.2 Operation Phase

With the adoption of maximum allowable sound power levels as described in **Section 4.8.2**, all predicted noise levels at identified NSRs will comply with the relevant noise criteria. No residual noise impact during operation phase is anticipated.

4.11 Environmental Monitoring and Audit

4.11.1 Construction Phase

The extent of the STP construction works represent only a small part of the proposed WSW Development. As regular noise monitoring of the on-going EM&A programme for the proposed WSW Development would be carried out during the whole construction period of the Project, no noise monitoring is proposed under this project during the construction phase of the proposed STP.

4.11.2 Operation Phase

Prior to the operation of the proposed STP, a noise commissioning test should be conducted by the Contractor to check for the compliance of the noise levels from the operation of the fixed plant with the stipulated noise criteria. The testing results should be checked and signed by the Contractor, the Engineer's Representative and the Environmental Team and verified by Independent Environmental Checker respectively.

4.12 Conclusion

4.12.1 Construction Phase

Construction works are expected to be of small scale and localized. Potential cumulative construction noise impacts from the construction of the proposed Project and the WSW Development have been identified and assessed. Under the consideration of the prevailing site condition with vertical noise barriers during the whole construction period of the proposed interim STP, no adverse construction noise impact is anticipated.

4.12.2 Operation Phase

Potential cumulative fixed noise impacts from the operation of the proposed Project and the existing noise sources have been identified and assessed. The maximum allowable sound power levels for the operation of the proposed interim STP have been determined as 92 dB(A) for day-time and evening periods and 86 dB(A) for night-time period.

With the adoption of the maximum allowable sound power levels for the proposed STP, no exceedances in relevant noise criteria is expected. No adverse fixed noise impact during operation phase is anticipated.

A noise commissioning test should be conducted prior to the operation of the proposed STP and implemented as specified in the standalone Environmental Monitoring and Audit Manual.

4.12.3 Decommissioning Phase

The interim STP will be decommissioned when the WSW Development is connected to the committed public sewer. The STP will only cease operation and the structure of the STP and its associated infrastructure will not be demolished. Therefore, no noise impact is anticipated during decommissioning phase.

5 Water Quality Impact

5.1 Introduction

This section identifies and assesses potential water quality impacts associated with the construction and operation phases of the Project.

5.2 Environmental Legislation, Standards and Guidelines

There are several regulatory controls and guidance documents relevant to water quality impacts applicable to the Project, including:

- Environmental Impact Assessment Ordinance (Cap. 499)
- Water Pollution Control Ordinance (Cap. 358)
- Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters
- "No Net Increase in Pollution Load" Requirement in Deep Bay
- Practice Note for Professional Persons on Construction Site Drainage
- Guidelines for the Design of Small Sewage Treatment Plant.

5.2.1 Environmental Impact Assessment Ordinance

Annexes 6 and 14 of the *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM), issued under Section 16 of the Environmental Impact Assessment Ordinance (EIAO), outline the criteria and guidelines for assessing water quality impacts.

5.2.2 Water Pollution Control Ordinance

The Water Pollution Control Ordinance (WPCO), and its subsidiary legislation, provides the main statutory framework for the protection and control of water quality in Hong Kong. Water quality is controlled through a set of Water Quality Objectives (WQOs) defined for each of the ten demarcated Water Control Zones (WCZs) in Hong Kong. The WQOs determine the water quality that should be achieved and maintained to support beneficial uses such as marine waters, inland waters, bathing beach subzones, secondary contact recreation subzones and fish culture subzones.

In accordance with Section 3.4.5.2 of the EIA Study Brief (ESB-289/2015), consideration has been given to the requirements of the Deep Bay WCZ. The respective WQOs for this WCZ are presented in **Table 5.1**.

Table 5.1: Water Quality Objectives for Deep Bay WCZ

Water Quality Parameters	Objectives	Deep Bay WCZ Subzone
Offensive Odour, Tints	Not to be present	Whole zone
Colour	Not to exceed 30 Hazen units	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	Not to exceed 50 Hazen units	Yuen Long & Kam Tin (Lower) Subzone and other inland waters
Visible foam, oil scum, litter	Not to be present	Whole zone

Water Quality Parameters	Objectives	Deep Bay WCZ Subzone
Escherichia coli (E. coli)	Not to exceed 610 per 100mL, calculated as the geometric mean of the all samples taken in one calendar year	Secondary Contact Recreation Subzone and Maricultural Subzone
	Should be zero per 100mL, calculated as the running median of the most recent 5 consecutive samples taken at intervals between 7 and 21 days	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	Not to exceed 1,000 per 100mL, calculated as the running median of the most recent 5 consecutive samples taken at intervals between 7 and 21 days	Yuen Long & Kam Tin (Lower) Subzone and other inland waters
	Not to exceed 180 per 100mL, calculated as the geometric mean of all samples collected from March to October inclusive in one calendar year. Samples should be taken at least 3 times in a calendar month at intervals of between 3 and 14 days	Yung Long Bathing Beach Subzone
Dissolved Oxygen (DO)	Not less than 4.0mg/L^{-1}	Yuen Long & Kam Tin (Upper and Lower) Subzones, Beas Subzone, Indus Subzone, Ganges Subzone, Water Gathering Ground Subzones and other inland waters of the Zone
- depth-averaged	Not less than 4.0mg/L^{-1} for 90% of samples	Outer Marine Subzone except Mariculture Subzone
- within 2m of the seabed	Not less than 2.0mg/L^{-1} for 90% of samples	Outer Marine Subzone except Mariculture Subzone
- 1m below the surface	Not less than 4.0mg/L^{-1} for 90%of the sampling occasions during the year	Inner Marine Subzone except Mariculture Subzone
	Not less than 5.0mg/L^{-1} for 90%of the sampling occasions during the year	Mariculture Subzone
pH	To be in the range of 6.5 - 8.5, change due to waste discharge not to exceed 0.2	Marine waters excepting Yung Long Bathing Beach Subzone
	Not to exceed the range of 6.5 – 8.5 due to waste discharge	Yuen Long & Kam Tin (Upper and Lower) Subzones, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	To be in the range of 6.0 - 9.0	Other inland waters
	To be in the range of 6.0 – 9.0 for 95% of samples. Waste discharge shall not cause the natural pH range to be extended by more than 0.5 units	Yung Long Bathing Beach Subzone
Salinity	Change due to waste discharge not to exceed 10% of ambient	Whole zone
Temperature	Change due to waste discharge not to exceed 2°C	Whole zone
Suspended solids	Waste discharge not to raise the natural ambient level by 30% nor cause the accumulation of suspended solids which may adversely affect aquatic communities	Marine waters
	Annual median not to exceed 20mg/L^{-1} due to waste discharges	Yuen Long & Kam Tin (Upper and Lower) Subzones, Beas Subzone, Ganges Subzone, Indus Subzone, Water Gathering Ground Subzones and other inland waters
Unionized Ammonia (Ammoniacal nitrogen)	Annual mean not to exceed 0.021mg/L^{-1} as unionised form	Whole zone
Nutrients	Nutrients shall not be present in quantities sufficient to cause excessive or nuisance growth of algae or other aquatic plants	Inner and Outer Marine Subzone
	Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.7mg/L^{-1}, expressed as an annual mean.	Inner Marine Subzone
	Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.5mg/L^{-1}, expressed as annual water column average (arithmetic mean of at least 2 measurements 1m below	Outer Marine Subzone

Water Quality Parameters	Objectives	Deep Bay WCZ Subzone
	surface and 1m above seabed).	
5-Day Biochemical Oxygen Demand (BOD_5)	Not to exceed 3mg/L^{-1}	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	Not to exceed 5mg/L^{-1}	Yuen Long & Kam Tin (Lower) Subzone and other inland waters
Chemical Oxygen Demand (COD)	Not to exceed 15mg/L^{-1}	Yuen Long & Kam Tin (Upper) Subzone, Beas Subzone, Indus Subzone, Ganges Subzone and Water Gathering Ground Subzones
	Not to exceed 30mg/L^{-1}	Yuen Long & Kam Tin (Lower) Subzone and other inland waters
Toxic substances	Should not attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms.	Whole zone
	Waste Discharge should not cause a risk to any beneficial use of the aquatic environment.	Whole zone
Phenol	Not to be present to produce a specific odour, or in concentration greater than 0.05mg/L^{-1} as C_6H_5OH	Yung Long Bathing Beach Subzone
Turbidity	Not to reduce light transmission substantially from normal level due to waste discharges	Yung Long Bathing Beach Subzone

Source: Statement of Water Quality Objectives (Deep Bay Water Control Zone). Water Pollution Control Ordinance (Cap. 358R), 1997.

Table 5.2: Key Water Quality Objectives for inland waters in Yuen Long & Kam Tin (Lower) Subzone of Deep Bay Water Control Zones

Min. DO (mg/L)	pH range	Max. BOD_5 (mg/L)	Max. COD (mg/L)	Max. Annual Median SS (mg/L)	Max. *E. coli* (CFU/100ml)
≥ 4	≥ 6.5 and ≤ 8.5	≤ 5	≤ 30	≤ 20	≤ 1,000

Source: Statement of Water Quality Objectives (Deep Bay Water Control Zone).

5.2.3 Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters

Effluent discharges are controlled under the WPCO. The *Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* (TM-DSS) sets limits for effluent discharges under Cap. 358AK. Specific limits are set for different WCZs, effluent flow rates and discharges to surface waters, coastal waters and sewers.

The proposed development is located adjacent to Group C (pond fish culture) Inland Waters. The standards for effluents discharged into Group C inland waters are provided in **Table 5.3**. The key inland water WQOs associated with the WCZs are provided in **Table 5.2**.

Table 5.3: Standards for effluents discharged into Group C inland waters (All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated)

Determinand	Flow rate (m^3/day)			
	⩽100	> 100 and ⩽ 500	> 500 and ⩽ 1000	> 1000 and ⩽ 2000
pH (pH units)	6-9	6-9	6-9	6-9
Temperature (°C)	30	30	30	30
Colour (lovibond units) (25mm cell length)	1	1	1	1
Suspended solids	20	10	10	5
BOD	20	15	10	5
COD	80	60	40	20
Oil & Grease	1	1	1	1
Boron	10	5	4	2

Determinand	Flow rate (m^3/day)			
	⩽100	> 100 and ⩽ 500	> 500 and ⩽ 1000	> 1000 and ⩽ 2000
Barium	1	1	1	0.5
Iron	0.5	0.4	0.3	0.2
Mercury	0.001	0.001	0.001	0.001
Cadmium	0.001	0.001	0.001	0.001
Silver	0.1	0.1	0.1	0.1
Copper	0.1	0.1	0.05	0.05
Selenium	0.1	0.1	0.05	0.05
Lead	0.2	0.2	0.2	0.1
Nickel	0.2	0.2	0.2	0.1
Other toxic metals individually	0.5	0.4	0.3	0.2
Total toxic metals	0.5	0.4	0.3	0.2
Cyanide	0.05	0.05	0.05	0.01
Phenols	0.1	0.1	0.1	0.1
Sulphide	0.2	0.2	0.2	0.1
Fluoride	10	7	5	4
Sulphate	800	600	400	200
Chloride	1000	1000	1000	1000
Total phosphorus	10	10	8	8
Ammonia nitrogen	2	2	2	1
Nitrate + nitrite nitrogen	30	30	20	20
Surfactants (total)	2	2	2	1
E. coli (count/100ml)	1000	1000	1000	1000

Source: Table abstract from Technical Memorandum on Effluent Standards (EPD, 1991).

5.2.4 Town Planning Board Guidelines No. 12C

Effluent treatment is required prior to discharge into the water courses in the Deep Bay Area, in order to meet the criteria of “no net gain” in pollution load as specified in the Town Planning Board Guidelines No. 12C. The underlying principle is to protect the important habitats and wildlife of the Deep Bay region.

5.2.5 Practice Note for Professional Persons on Construction Site Drainage

Environmental Protection Department (EPD) issued a practice note for professional persons on the handling and disposal of construction site discharges. The Practice Note for Professional Persons on *Construction Site Drainage* (ProPECC Note PN 1/94) provides good practice guidelines to manage the various types of discharge from a construction site. Practices outlined in ProPECC Note PN 1/94 should be followed as far as possible during construction to minimize the potential water quality impacts from construction site drainage.

5.3 Assessment Area, Water Sensitive Receivers and Background Conditions

5.3.1 Assessment Area and Water Sensitive Receivers

In accordance with Section 3.4.5 of the EIA Study Brief, the study area for the water quality impact assessment comprises the area 500m from the Project boundary, the Deep Bay WCZ and sensitive receivers in the vicinity of the Project site.

The Project site is located within the Comprehensive Development at Wo Shang Wai (EP-31/2008/D) (WSW Development). The Project Area lies within two Drainage Basins (Basin 9 the North District & Basin 10 the Yuen Long Basin) under different Drainage Master Plan Studies (DMP). The direction of water flow in the water ditches and drainage channels are basically from south to north discharging to the Shenzhen River in the Deep Bay WCZ.

Aside from the Wetland Restoration Area (WRA) within the planned WSW Development, there are fishponds and other ponds located primarily to the north and west of the Project site, as well as some water ditches and drainage channels, which are potential water sensitive receivers (WSRs). These are presented in **Figure 5.1**.

5.3.2 Background Water Quality Conditions

The existing water pollution sources may include runoff and wastewater from adjacent aquaculture (fish pond) activities at the northern boundary of the planned WSW Development and the disposal of domestic sewage (septic tank systems) from the adjacent unsewered developments. Effluent from fish pond activities may contain high nutrient (e.g. ammonia nitrogen) loading, while domestic sewage contains high suspended solids and *E. coli* levels.

5.3.2.1 River Water Quality

The EPD River Water Quality Report summarizes the results collected from monthly river water quality monitoring at 82 stations in 35 inland watercourses. A total of 48 parameters have been measured including physical and aggregate properties, flow, aggregate organics, nutrients, inorganic constituents, faecal bacteria, metals and pigments. The health of the rivers is rated by a Water Quality Index (WQI) based on the dissolved oxygen, 5-day Biochemical Oxygen Demand (BOD_5) and ammonia-nitrogen concentration. The river water quality at the Deep Bay WCZ has been used as reference for the baseline river water quality for this Study.

The routine river water quality monitoring data collected by EPD between 2011 and 2015 has been reviewed for the nearest monitoring location to Wo Shang Wai at Fairview Park Nullah. This nullah is a short concrete channel within the Fairview Park residential development, which shares the same drainage basin as the southern part of the Project Area (see **Table 5.4** for the summary of findings).

Table 5.4: Summary of River Water Quality at Nearby Fairview Park Nullah in the Deep Bay Water Control Zones between 2011 and 2015 (Source: River Water Quality in Hong Kong in 2011 – 2015 (EPD))

Parameters	EPD River Monitoring WQO	2011	2012	2013	2014	2015
pH	6.0 – 9.0	7.8 (7.1 – 8.9)	7.5 (7.3 – 8.5)	7.6 (7.2 – 8.3)	8.0 (7.1 – 8.8)	7.5 (7.2 – 8.8)
BOD_5 (mg/L)	≤ 5 (Max)	**11** (4 – **20**)	5 (3 – **14**)	**6** (2 – **18**)	**8** (3 – **23**)	**6** (4 – **20**)
COD (mg/L)	≤ 30 (Max)	30 (13 – **46**)	22 (12 – **54**)	26 (14 – **50**)	26 (10 – **39**)	20 (13 – **45**)
SS (mg/L)	≤ 20 (Annual Median)	**29** (6 – **49**)	**26** (11 – **56**)	15 (6 – **41**)	**22** (4 – **590**)	**30** (7 – **47**)
DO (mg/L)	≥ 4 (Min)	9.2 (**3.9**– 17.2)	5.5 (**3.8** – 11.7)	5.7 (**2.9** – 10.1)	6.5 (4.8 – 10.5)	6.3 (5.4 – 14.1)
E. coli (cfu/100mL)	≤ 1000 (Max)	**18,000 (4,200 – 97,000)**	**16,000 (2,800 – 330,000)**	**55,000 (3,500 – 2,500,000)**	**28,000 (1,900 – 210,000)**	**29,000 (8,500 – 200,000)**
Ammonia-nitrogen (mg/L)	--	4.55 (0.74 – 5.60)	4.15 (2.30 – 6.60)	3.95 (0.71 – 5.50)	0.94 (0.45 – 6.90)	2.55 (0.33 – 3.20)
Nitrate-nitrogen (mg/L)	--	0.56 (0.10 – 1.00)	0.96 (0.35 – 1.30)	0.82 (<0.01 – 1.20)	0.39 (0.11 – 1.10)	0.82 (0.36 – 1.80)
Aluminium (µg/L)	(a) Waste discharges shall not cause the toxins in water to attain such levels as to produce significant toxic carcinogenic, mutagenic or teratogenic effects in humans, fish or	170 (60– 400)	240 (110 – 470)	185 (110 – 390)	180 (98 – 3,147)	250 (153 – 405)
Cadmium (µg/L)		<0.1	<0.1	<0.1	<0.1 (<0.1 –	<0.1 (<0.1 – 1.3

Parameters	EPD River Monitoring WQO	2011	2012	2013	2014	2015
	any other aquatic organisms, with due regard to biologically cumulative effects in food chains and to toxicant interactions with each other. (b) Waste discharges shall not cause a risk to any beneficial uses of the aquatic environment.	(<0.1 – <0.1)	(<0.1 – <0.1)	(<0.1 – 1.0)	0.9)	)
Chromium (µg/L)		<1 (<1 – 2)	1 (<1 – 3)	<1 (<1 – 2)	1 (<1 – 7)	2 (<1 – 3)
Copper (µg/L)		3 (2 – 5)	3 (2 – 7)	3 (1 – 5)	5 (2 – 73)	4 (3 – 5)
Lead (µg/L)		2 (<1 – 4)	2 (1 – 7)	2 (1 – 4)	3 (<1 – 86)	2 (1 – 3)
Zinc (µg/L)		35 (20 – 170)	30 (10 – 120)	50 (20 – 138)	35 (17 – 436)	37 (23 – 50)

*Note: 1. WQO follows for river monitoring stations in the Northwestern New Territories (EPD, 2015)
2. Data presented are in annual medians of monthly samples, except those for *E. coli* which are in annual geometric means.
3. Figures in brackets are annual ranges.
4. Figures in bold show non-compliance to WQO.

It is observed that Fairview Park Nullah achieved 62% compliance with river WQOs in 2015 when compared to 58% compliance in 2014 (EPD, 2015). The recorded maximum levels of chemical oxygen demand, minimum levels of dissolved oxygen, annual median of biochemical oxygen demand and the annual median suspended solids typically exceed the river WQOs, while high ammonia nitrogen and *E. coli* counts further indicate poor water quality in the Fairview Park Nullah. This is considered to be a clear indication of the negative impact of the discharge from existing unsewered villages and the remaining livestock farms to the river water quality.

5.3.2.2 Other Inland Water Quality

Baseline water quality monitoring and construction phase impact water quality monitoring has been undertaken under the EM&A programme for the approved EIA study for the planned WSW Development Project. The sampling locations include the drainage channel which flows to the Mai Po Ramsar Site (MP1 and MP2); the fishpond at the north of the planned WSW Development (MP3); and the drainage channel along fishponds area (MP4, MP5 to MP6). **Figure 5.1** shows the baseline water quality sampling locations. The water quality at monitoring stations MP3 to MP6 are summarised in **Table 5.5** and **Table 5.6**.

Table 5.5: Summary of Baseline Water Quality Monitoring Results of the Planned WSW Development (2009)

Parameter	WQO under WPCO	MP1	MP2	MP3	MP4	MP5	MP6
pH	6.5 – 8.5	7.3	7.4	8.2	7.3	7.3	7.4
		(7.1 – 7.5)	(7.3 – 7.7)	(7.7 – 8.6)	(7.1 – 7.6)	(7.1 – 7.5)	(7.2 – 7.5)
BOD_5 (mg/L)	≤ 5	3	2.8	**10.8**	4.2	5	4.3
		(<2 – **5.5**)	(<2 – 5.0)	(5.0 – **16.5**)	(<2 – **8.5**)	(<2 – **10.5**	(<2 – **9.5**)
SS (mg/L)	≤ 20 (Annual Median)	**104**	**60**	**50**	**37**	**48**	**54**
		(13 – **316**)	(18 – **219**)	(**35** – **66**)	(**24** – **54**)	(**28** – **70**)	(**24** – **76**)
DO (mg/L)	≥ 4	**2.71**	4.57	8.92	5.69	5.52	6.2
		(**1.15** – 4.65)	(**0.85** – 7.10)	(6.60 – 11.90)	(**3.80** – 10.05)	(**3.80** – 8.60)	(4.50 – 9.10)
Turbidity (NTU)	--	79	46	53	42	56	65
		(10 – 178)	(17 – 171)	(39 – 68)	(23 – 65)	(26 – 84)	(33 – 96)

Source: Proposed Comprehensive Development at Wo Shang Wai, Yuen Long, Baseline Monitoring Report, 2010.
Notes: 1. WQO follows for Yuen Long & Kam Tin (Lower) Subzone, Statement of Water Quality Objectives (Deep Bay Water Control Zone), WPCO (Cap. 358);
2. Values in brackets are sample ranges, where applicable. Values in **bold** type are exceedances of the WQOs.

Table 5.6: Summary of Impact Water Quality Monitoring Results of the Planned WSW Development (2015)

Parameters	WQO under WPCO	MP3	MP4	MP5	MP6
pH	6.5 – 8.5	7.5	7.4	7.4	7.4
		(7.3 - 7.7)	(7.2 - 7.7)	(7.2 - 7.6)	(7.2 - 7.6)
BOD_5 (mg/L)	⩽ 5	**8.1**	4.4	**6.5**	**6.1**
		(2.0 - **33.0**)	(2.0 - **26.0**)	(2.0 - **32.5**)	(2.0 - **39.0**)
SS (mg/L)	⩽ 20 (Annual Median)	**30**	20	**26**	**26**
		(6 - **86**)	(2 - **116**)	(2 - **69**)	(4 - **90**)
DO (mg/L)	⩾ 4	7.6	7.4	7.5	7.2
		(6.5 - 9.5)	(6.3 - 9.1)	(6.4 - 8.7)	(6.0 - 8.7)
Turbidity (NTU)	--	34	21	29	27
		(5 - 77)	(1 - 51)	(8 - 59)	(7 - 59)

Source: Proposed Comprehensive Development at Wo Shang Wai, Yuen Long, Project Website http://www.woshangwai-ema.com/eng/EM&A_D_WQ.htm (accessed in April 2016)

Notes: 1. WQO follows for Yuen Long & Kam Tin (Lower) Subzone, Statement of Water Quality Objectives (Deep Bay Water Control Zone), WPCO (Cap. 358);
2. Values in brackets are sample ranges, where applicable. Values in **bold** type are exceedances of the WQOs.
3. Monitoring at stations MP1 and MP2 were concluded in 2012 hence do not form part of this summary.

Compared to the results of Year 2009, monitoring data in 2015 shows an improvement in the average and minimum DO levels except at MP3 whereby the average DO level is lower in 2015 compared to the baseline. However, the annual range in 2015 is largely the same as baseline range. There has been a marked improvement in both Turbidity and SS at all stations, and pH has stayed largely the same as baseline range except at MP3 which shows a notable decrease. Conversely, BOD has improved on average at MP3 but has increased in all the other stations compared to baseline.

5.4 Assessment Methodology

The water quality impact assessment has been carried out in accordance with Appendix D of the EIA Study Brief and the guidelines specified in Annex 6 and 14 of the EIAO-TM.

Potential water pollution sources that may be generated by the Project during construction, operation and decommissioning phase have been identified. The potential impacts to nearby water sensitive receivers have been evaluated, and where necessary, appropriate mitigation measures have been recommended to reduce any identified adverse impacts on water quality.

5.5 Identification and Evaluation of Water Quality Impacts

5.5.1 Construction Phase

The main construction elements of the Project broadly include site formation, excavation and foundation works, general building and structure works, and installation of sewerage pipes. Potential sources of construction-related water quality impacts include:

- Construction site runoff
- Accidental spillage of chemicals
- Sewage from construction workforce
- General construction activities

5.5.1.1 Construction Site Runoff

Activities within a construction site can generate surface runoff which may contain high levels of suspended solids and contaminants. Such surface runoff can pollute watercourses and lead to deteriorations in water quality if left uncontrolled.

The key sources of pollution to surface water runoff from the construction site include:

- Runoff from exposed earth surfaces within the construction site, particularly during inclement weather
- Erosion of uncovered stockpiles
- Release of bentonite slurries, concrete washing and wastewater from other grouting activities
- Dewatering associated with excavation and/or piling activities
- Wastewater from dust suppression spraying and wheel wash facilities

Uncontrolled discharges from a construction site have the potential to adversely impact nearby stormwater drains, but can be managed through good site practices and provision of appropriate site drainage management facilities. The good site practices outlined in ProPECC Note PN1/94 will be implemented to control site runoff and drainage during construction phase. Precautionary measures relating to rainstorms as stated in Appendix A2 of ProPECC Note PN1/94 will also implemented to avoid water pollution due to site runoff during inclement weather.

5.5.1.2 Accidental Spillage of Chemicals

Chemicals stored on-site during construction phase such as petroleum, oil and grease, lubricants and solvents may be accidentally spilt or leaked at the construction site. If left unattended, such spilt / leaked chemicals may enter the site drainage system and adversely impact stormwater drains outside the site. To avoid and minimise such potential impacts, appropriate site storage and bunding of chemicals should be implemented as part of good site practice, and measures should be taken to clean up any spilt / leaked chemicals immediately.

5.5.1.3 Sewage from Construction Workforce

Domestic sewage will be generated by the construction workforce during construction phase. Release of untreated sewage into the surrounding environment can adversely impact the aquatic environment by causing pollution / eutrophication of nearby water courses, odour nuisance and subsequent deterioration in aquatic biodiversity. On-site portable toilets should be provided, maintained and regularly transported off-site for proper disposal to avoid sewage discharge into the surrounding environment.

5.5.1.4 General Construction Activities

Inadequate or improper storage of construction materials and waste has the potential to impact water quality through release of construction debris (such as packaging and construction materials) and general refuse (waste food containers, paper, bottles and cans) into the construction site drainage system. Implementation of good site management practices and provision of adequate waste receptacles will be adopted to mitigate the potential impacts of general construction activities on water quality.

5.5.2 Operation Phase

5.5.2.1 Onsite Sewage Treatment Plant (STP)

Sewage generated by the WSW Development is proposed to be handled by an onsite STP until the Government trunk sewer is available. The onsite STP will adopt Membrane Bioreactor (MBR) technology and the effluent from the STP will be fully reused at the WSW Development for toilet flushing and irrigation of landscaped areas. Once the Government trunk sewer is available, the onsite STP will be decommissioned but will not be demolished. The basis and assumptions in relation to the STP design and sewerage network, reclaimed water demanded, as well as reclaimed water storage tank have been presented in the Sewerage Impact Assessment Report (SIA) in **Appendix 2.1**.

The design population for the onsite STP is 1,245 persons based on development with 400 residential units. The calculated average dry weather flow (ADWF) and peak flow would be 482 m^3/d and 32 l/s respectively.

The proposed onsite sewerage network and design parameters are presented in the SIA attached in **Appendix 2.1**, and the key information is reproduced in **Figure 5.2** and **Appendix 5.1**.

The on-site sewage treatment facility will be designed generally in accordance with EPD's "Guidelines for the Design of Small Sewage Treatment Plant". Considering the high sensitivity of the development site, the onsite STP is proposed to be designed with capacity to handle a peak flow of three times of ADWF (i.e. 1,446 m^3/d). Any surplus flow would be equalised in an equalisation tank with 4 hours retention time at such flows (i.e. minimum 241 m^3).

The estimated total quantity of sludge generated in the proposed STP is 13 m^3/day. The sludge generated from the on-site STP will be properly collected and stored on-site. The collected sludge will be transported to the designated landfill site by designated sewage tankers for disposal. Details of the sludge management are presented in **Chapter 6**.

5.5.2.2 Potential Operation Phase Water Quality Impacts

During operation phase, the key potential water quality impacts are associated with operation of the onsite STP for treatment of the sewage effluent generated by the WSW Development, and subsequent use of the reclaimed water. The key sources of pollution during operation phase include:

- Reclaimed water use onsite
- Discharge of reclaimed water to Deep Bay WCZ
- Emergency discharge of untreated sewage effluent from the onsite STP

5.5.2.3 Reclaimed Water Use Onsite

Reclaimed water from the onsite STP is proposed to be fully used onsite as flushing and irrigation water. The water demands for toilet flushing and landscape irrigation have been estimated in the SIA in **Appendix 2.1** based on the Layout Plan of Landscape Area of the WSW project. The relevant information is reproduced in **Appendix 5.2**.

The estimated toilet flushing and landscape irrigation water demand is 78 m^3/d and 509 m^3/d respectively. The reclaimed water from the onsite STP (482 m^3/d) can thus be fully utilised within the site, and there would be no offsite discharge of reclaimed water under normal operation.

To enable the reclaimed water to be safely used, the onsite STP will be designed to meet stringent treatment standards. The treatment standards adopted are based on the reuse water quality standards recommended in the "Water Supplies Department Inter-departmental Working Group on the Implementation of Reclaimed Water Supply in Sheung Shui and Fanling" for non-potable uses. The Water Supplies Department's reclaimed water standards as summarized in **Table 5.7** will be adopted by this Project.

Table 5.7: WSD Reuse Water Quality Standard for Non-Potable Uses

Water Quality Parameter	Unit	WSD Criteria (Irrigation & Non-Potable Uses)
pH	-	6-9
Turbidity	NTU	$\leqslant$ 5
Total Suspended Solids	mg/l	$\leqslant$ 5
BOD_5	mg/l	$\leqslant$ 10
E. coli	cfu/100ml	Non-detectable
Total Residual Chlorine	mg/l	$\geqslant$ 1 (out of treatment system) $\geqslant$ 0.2 (at point of use)
Dissolved Oxygen (DO)	mg/l	$\geqslant$ 2
Colour	Hazen Unit	$\leqslant$ 20
Threshold Odour Number (TON)	TON	$\leqslant$ 100

Water Quality Parameter	Unit	WSD Criteria (Irrigation & Non-Potable Uses)
Ammonia nitrogen	mg/l	⩽ 1
Synthetic detergents	mg/l	⩽ 5

Note: The water quality standards for all parameters shall be applied at the point of use, unless otherwise specified

The MBR process proposed for the onsite STP is proven technology that has been applied in other projects in Hong Kong, and this process coupled with the proposed post-process ultraviolet disinfection and chlorine dosing (for *E. coli* removal) is capable of treating effluents to the water quality standards specified in **Table 5.7**. In addition, preventive measures for avoiding cross-contamination and mis-use of the reclaimed water will be put in place.

With sewage effluent treated to the WSD reclaimed water standards specified in **Table 5.7** and implementation of water pollution preventive measures, no adverse water quality impacts are anticipated from use of reclaimed water in the Project site.

5.5.2.4 Discharge of Reclaimed Water to Deep Bay WCZ

In cases of potential adverse weather conditions (e.g. successive heavy rainy days), or maintenance of landscape areas, the supply of reclaimed water may temporarily exceed demand. This may result in either direct (surplus discharge) or indirect / non-point (as excessive irrigation water) overflow of reclaimed water into the stormwater drainage system and eventually into Deep Bay.

To avoid this, an onsite reclaimed water storage tank (which does not form part of the storage volume for regular operation of the onsite STP) is proposed which would temporarily store any excessive reclaimed water. The reclaimed water would be progressively consumed in the following periods or used in case of shortage of irrigation water. Any further excessive reclaimed water will be tanked away to public Sewage Treatment Works to prevent overflow of reclaimed water.

The sizing of the buffer tank has taken into account extreme weather condition so as to minimise the likelihood and frequency of excess reclaimed water requiring tanking away. It is considered that no irrigation would be required when the soil is saturated at the landscaping area, thus irrigation would normally stop when daily rainfall depth reaches 15 mm (which is equivalent to the average daily irrigation rate of 10 l/m^2/d assuming a runoff coefficient of 0.35). Past rainfall records from a nearby weather station (Au Tau Automatic Weather Station from 2004 to 2013) show that successive rainfall events with daily rainfall depth over 15 mm mostly occurred over 2 or 3 successive days, accounting for over 90% of the total number of adverse weather events.

Based on the above, a minimum capacity of 1,180 m^3 reclaimed water storage tank, which equates to three days of net reclaimed water available for irrigation (i.e. ADWF of 482 m^3 minus 78 m^3 for flushing demand and 13 m^3 for sludge disposal) is proposed to temporarily store the excessive reclaimed water.

With provision of the buffer tank to cater for most of the successive extreme rainfall events, the likelihood and frequency of excess reclaimed water requiring tanking away can be minimized.

5.5.2.5 Emergency Discharge of Untreated Sewage Effluent from the Onsite STP

During emergency situations, such as loss of power supply at the onsite STP, or mechanical faults / equipment failures, untreated sewage effluent may overflow and cause potential impacts at downstream WSRs. With the ‘no net increase of pollution load’ requirement as stipulated in the Town Planning Board Guideline, any discharge of sewage leading to a net increase in pollution load is not environmentally acceptable. To minimise the risk of untreated sewage effluent discharge due to emergency events, a number of contingencies will be provided at the onsite STP, such as equalisation tank, dual or standby power supply, standby sewage treatment units, flow sensors and alarm systems. As a last resort and in case operation of the onsite STP cannot be resumed after all these contingency measures have been exhausted, any surplus raw sewage will be tanked away to the public STW. The estimated worst case quantity of 20 m^3/hr of raw

sewage (based on the design average dry weather flow of 482 m^3/day) can be readily tanked away by 3-4 tankers per hour (with capacity of 5-6 m^3 per tanker). With these contingency measures in place, the risk of untreated sewage effluent discharge to Deep Bay WCZ due to emergency events is considered to be negligible.

5.5.3 Decommissioning Phase

The onsite STP is proposed as an interim measure to handle the sewage effluents generated by the WSW Development, until the Government trunk sewer is implemented. Once all the sewerage is connected to the permanent Government sewer, the onsite STP would be decommissioned. It is currently proposed that decommissioning would involve only isolation of the sewerage connections to the onsite STP and retirement of the treatment units after the connection to the Government sewer has been established, while the STP building and other structural components would be retained in place.

Arrangements would be made between the Estate Manager and Drainage Services Department (DSD) for activation, transfer and/or testing and commissioning of the relevant sewerage connections to the Government sewer where applicable, and the onsite STP would not be decommissioned until the sewerage connection to the Government sewer has satisfactorily completed these arrangements. Any wastewaters generated from the decommissioning process (e.g. cleaning out of the treatment and storage units) and any residual untreated sewage or reclaimed water would be pumped out and tanked away to the public STW for offsite treatment and disposal.

With these proposed arrangements, no adverse water quality impacts are expected during decommissioning phase.

5.6 Mitigation of Adverse Water Quality Impacts

5.6.1 Construction Phase

5.6.1.1 Construction Site Runoff

Construction site runoff and wastewater shall be collected and diverted to the temporary drainage system installed by the Contractor for treatment (to remove sediment) prior to discharge to the existing stormwater system. The Contractor shall obtain a discharge licence from EPD under the WPCO for all discharges from the site and shall ensure such discharges meet the requirements of the TM-DSS.

Good site practices outlined in ProPECC Note PN1/94 should also be adopted to minimise runoff from construction works areas. The following measures are recommended, but are not exhaustive, and other relevant measures listed in ProPECC Note PN1/94 should be implemented as necessary to minimise the impacts of construction on downstream water quality:

- Temporary site drainage facilities shall be designed and implemented by the Contractor prior to commencement of construction to convey surface runoff to storm drains. The design of the silt/ sand removal traps and sediment basins shall follow the design in ProPECC Note PN1/94;
- Perimeter cut-off drains shall be installed in advance of any excavation and site formation works to convey site runoff from the works areas to the silt removal facilities;
- Runoff into the excavation areas during rainstorm events shall be minimised as far as practicable. Any wastewater pumped out of the excavation areas shall be treated to remove suspended solids prior to discharge;
- Maintenance and inspection of the drainage system and sediment removal facilities should be carried out regularly to remove any sediment and blockages, especially when rainstorms are forecast;
- Final surface levels should be compacted and final surface protections installed to prevent erosion by rainstorms;
- Open stockpiles of material should be covered on site with waterproof layers such as tarpaulin.

- The wheels of all vehicles and plant should be cleaned before leaving the works areas. The washwater should be treated to remove any suspended sediment;
- Surface water from concrete batching areas and the rest of the site should be separated as far as possible. Wastewater from any concrete batching plant (if required) shall be treated to the required standards including pH adjustment and settlement of suspended sediments before discharging to stormwater drains; and
- Manholes (including those constructed as part of the Project) should be adequately covered and temporarily sealed at all times.

Precautionary measures relating to inclement weather outlined in Appendix A2 of ProPECC Note PN1/94 should also be adopted to prevent water pollution due to site runoff. The following measures are recommended, but are not exhaustive, and other relevant measures listed in Appendix A2 of ProPECC Note PN1/94 should be implemented as necessary to minimise the impacts of construction on downstream water quality:

- Silt removal facilities, channels and manholes should be maintained and deposited silt and grit should be removed regularly;
- Temporarily exposed slope surfaces should be covered;
- Temporary access road should be protected by crushed stone or gravel;
- Intercepting channels should be provided to prevent storm runoff from washing across exposed soil surfaces; and
- Trenches should be dug and backfilled in short sections. Measures should be taken to minimize the ingress of rainwater into trenches.

5.6.1.2 Accidental Spillage of Chemicals

The Waste Disposal Ordinance (Cap. 354) and its subsidiary regulations in particular the Waste Disposal (Chemical Waste) (General) Regulation should be observed and complied with for control of chemical wastes. The Contractor should register as a chemical waste producer if chemicals are to be generated from site. Off-site disposal of chemical waste should only be carried out in accordance with the requirements of the WDO.

In addition, the following measures shall be observed:

- The labelling and storage of chemicals should be in accordance with the “Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes” and maintained at all times by the Contractor;
- Oils and fuels should only be stored in designated areas which have appropriate pollution prevention control facilities such as oil and grease traps and petrol interceptors;
- The maintenance of vehicles should only be undertaken in areas of the site served by these pollution prevention measures; and
- All fuel tanks and storage areas should be locked and located on sealed areas of the site, within bunded areas with a capacity equal to 110% of the storage capacity of the largest container. The bund should be drained of surface water after each rainfall event.

5.6.1.3 Sewage from Construction Workforce

Portable toilets shall be provided throughout construction phase and shall be regularly maintained, collected and disposed by a licensed waste collector.

5.6.1.4 General Construction Activities

Mitigation measures to be adopted for general construction activities including the following:

- Construction waste, debris and refuse generated onsite should be stored in designated areas and properly contained.
- Waste materials should be regularly removed offsite.
- Stockpiles of construction materials such as cement and excavated material should be covered when not in use.

With the adoption of these good site practices, no adverse water quality impacts are anticipated.

5.6.2 Operation Phase

5.6.2.1 Reclaimed Water Use Onsite

For use of reclaimed water, the following measures shall apply:

- The onsite STP shall comprise MBR technology with post-process disinfection via ultraviolet (UV) treatment and chlorine dosing; and
- Sewage effluent shall be treated to meet the Water Supplies Department's reclaimed water standards as summarized in **Table 5.7**. Samples of reclaimed water shall be taken regularly and tested by a HOKLAS or other internationally accredited laboratory to ensure the effluent quality meets the required reuse standard.

In addition, preventive measures for cross-contamination and mis-use of reclaimed water shall include the following:

Engineering Measures

- Water to be supplied for potable use, toilet flushing and irrigation should be stored in three different tanks in different colours and clearly labelled;
- All pipes and fittings used for the reclaimed water supply and associated distribution system should be purple in colour (exact colour code to be reviewed) for distinguishing them from the pipes and fittings used for the fresh water supply and its distribution systems;
- Regular checking/inspections of the reclaimed water supply and associated distribution systems should be carried out to identify any possible cross connection to the fresh water supply and distribution system. Non-toxic dye may be adopted in the checking/inspections;
- Non-return valves should be installed on both the inlet pipes feed from reclaimed water storage tank and WSD's supply mains, to the toilet flushing and irrigation waters storage tanks; and
- All precaution measures should be clearly stated in the O&M manual of the STP, toilet flushing and irrigation systems.

Management Measures

- Warning plate with sign and letter "NOT FOR POTABLE USE 不能飲用" would be shown on the toilet flushing and irrigation water storage tanks, and tagged on all accessible water taps supplying reclaimed water if any within the developments, notifying the staff, visitors and the public at large that reclaimed water is being used and is not suitable for drinking;
- All water taps of reclaimed water at communal areas, if any should be locked in order to avoid mis-use of reclaimed water for other non-planned use;
- Proper signage, promotion and training workshops will be provided periodically to all management and operation staffs of the Development, as well as future land owners on the proper use of reclaimed water and potable water; and
- All precaution measures should be clearly stated in the management manual of the Development.

5.6.2.2 Discharge of Reclaimed Water to Deep Bay WCZ

For prevention of discharge / overflow of reclaimed water, the following measures shall be incorporated as part of the onsite STP:

- Provision of a minimum capacity of 1,180 m^3 reclaimed water storage tank to store excessive reclaimed water in case of emergency (e.g. extreme adverse weather) or maintenance of landscape area;
- Reclaimed water storage tank will be partitioned into several compartment to allow partial shut-down of the tank for maintenance;
- The operation of the project will maintain the reclaimed water demands for toilet flushing and landscape irrigation as detailed in the SIA in **Appendix 2.1** to ensure the reclaimed water can be totally used. A minimum of 50,850m^2 landscape areas within the development will be maintained (as committed in the Town Planning Board application for this development) using reclaimed water for irrigation; and
- Level sensors connected with alarm signalizing system will be installed to keep monitoring on storage volume of reclaimed water to avoid overflow of reclaimed water. The warning signal will be automatically generated and sent to the Estate Manager when the flow in the tank reaches a pre-set level so as to allow the Estate Manager sufficient time (e.g. 1 day) to arrange and mobilize tanker service to tank away the excessive reclaimed water with 1-day reclaimed water storage capacity reserved as contingency.

As a last resort and when irrigation is stopped due to continuous adverse weather or prolonged suspension of irrigation or flushing water supply systems for maintenance / repairing, any further excessive reclaimed water shall be tanked away to the public STW for offsite treatment and disposal.

For prevention of excessive irrigation leading to surface runoff, the following measures shall be adopted:

- A pre-set semi-automatic control irrigation system with underground drip pipes would be installed in the private garden and managed by the Deed of Mutual Covenant manager to ensure that reclaimed water would be used properly for irrigation.
- Installation of flow meters to monitor the irrigation water demand, with daily cut-off limits applied to prevent excessive irrigation using the reclaimed water.

All the recommended measures for collection, treatment and disposal to ensure no net increase in Pollution to Deep Bay shall be incorporated in the Project contract document.

5.6.2.3 Emergency Discharge of Untreated Sewage Effluent from the Onsite STP

For prevention of emergency discharge / overflow / surface runoff of untreated sewage effluent, the following measures shall be incorporated as part of the onsite STP:

- Regular test, maintenance and replacement of membranes or equipment will be carried out according to the recommendations from manufacturers to lower the chances of facilities breakdown;
- Provision of equalization tank to store three times of ADWF for a period of 4 hours (i.e. minimum 241 m^3);
- Provision of emergency storage tank to store the overflow of raw sewage with a capacity of approximate 130 m^3 based on the latest information (actual size to be confirmed in the detailed design stage).
- Dual or standby power supply;
- Standby unit for major equipment to allow for partial shut down for maintenance; and
- Installation of flow measurement and level sensors connected with alarm signalizing system to keep monitoring on inflow rate to avoid sewage overflow.

In case operation of the STP cannot be resumed after all the above mitigation measures have been exhausted, raw sewage shall be tanked away to the public STW for offsite treatment and disposal.

Details of these and other specific contingency measures shall be documented in a contingency plan to be prepared by the operator of the STP. The contingency plan shall cover situations when the reclaimed water cannot meet the proposed criteria as well as situations when the STP is out of service, and shall be implemented throughout operation of the onsite STP.

5.6.3 Decommissioning Phase

The onsite STP shall not be decommissioned until the sewerage connection to the Government sewer has been fully established and implemented. Any residual wastewaters generated from cleaning out and decommissioning of the treatment and storage units and any residual reclaimed water would be pumped out and tanked away to the public STW for offsite treatment and disposal. The water pollution preventive measures as detailed in **Section 5.6.1** are also applicable and shall be implemented for decommissioning activities.

5.7 Evaluation of Cumulative and Residual Impact

Proposed Comprehensive Development at Wo Shang Wai, Yuen Long

The Project will be constructed and operated concurrently with the WSW Development. Both projects have in place mitigation measures to prevent polluted discharges to the surrounding environment during construction phase, and during operation phase, this Project will form and be managed and maintained as part of the WSW Development.

With implementation of the recommended design and mitigation measures, no adverse cumulative or residual impacts are expected during construction, operation and decommissioning of the Project.

Hong Kong Section of Guangzhou – Shenzhen – Hong Kong Express Rail Link

The construction site for the Mai Po Ventilation Building is adjacent to the Project site to the northeast. The construction of the Ventilation Building is largely completed with few further construction activities expected. This project has in place mitigation measures to prevent polluted discharges to the surrounding environment. Therefore, no adverse cumulative or residual impacts are expected.

5.8 Environmental Monitoring and Audit

During construction phase, regular site audits shall be conducted to check implementation of the recommended mitigation measures.

During operation phase, the management, maintenance and operation of the onsite STP shall follow the O&M Manual for the onsite STP and the Management Manual of the Development, which shall cover the mitigation measures specified in this EIA report. An EM&A program will be implemented according to the EM&A manual. A water quality monitoring programme is proposed to monitor compliance with the reclaimed water use criteria.

5.9 Conclusion

This Section has identified the potential water quality impacts associated with construction, operation and decommissioning of the onsite STP. For construction phase, potential water quality impacts (mainly land-based) including construction site runoff, accidental spillage of chemicals, sewage from the construction workforce and general construction activities can be readily mitigated with implementation of environmental best practices for construction site management as well as water pollution preventive and mitigation measures. For operation phase, the interim sewage treatment plant will employ Membrane Bioreactor technology to treat the sewage generated from the WSW development and the effluent will be further polished by disinfection to meet the WSD water reuse standards. With treatment to the required WSD reuse standards and the full use of the reclaimed water at the WSW Development, alongside preventive and contingency measures for avoidance and minimisation of treated or untreated effluent discharge to Deep Bay, the Project would comply with the ‘no net increase in pollution load’ requirement. In addition, preventive

measures for cross-contamination and mis-use of reclaimed water will be implemented through engineering and management measures. Decommissioning of the onsite STP would not occur until all sewage from the WSW Development is fully diverted to the permanent Government sewers. With implementation of these recommended measures, no adverse water quality impacts would arise due to the Project.

6 Waste Management Implications

6.1 Introduction

This section identifies the potential waste arising from the construction and operation activities of the Project and evaluates the potential environmental impacts that may result from waste generated. Mitigation measures on waste handling, transportation and disposal, are recommended with reference to applicable waste legislation and management guidelines to minimise potential waste management impacts.

6.2 Environmental Legislation, Standards and Guidelines

6.2.1 Environmental Impact Assessment Ordinance

The criteria and guidelines for assessing waste management implications are outlined respectively in Annexes 7 and 15 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).

The following legislation relates to the handling, treatment and disposal of wastes in Hong Kong and has been used in assessing potential impacts:

- Waste Disposal Ordinance (Cap. 354)
- Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C)
- Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N)
- Dumping at Sea Ordinance (Cap. 466)
- Public Health and Municipal Services Ordinance (Cap. 132) - Public Cleansing and Prevention of Nuisances Regulation
- Land (Miscellaneous Provisions) Ordinance (Cap. 28)

6.2.2 Waste Disposal Ordinance

The Waste Disposal Ordinance (WDO) is the principal piece of legislation for management and control of waste disposal in Hong Kong. The WDO prohibits the unauthorised disposal of wastes. Construction waste is defined as any substance, matter or thing that is generated from construction work and abandoned, whether or not it has been processed or stockpiled before being abandoned, but does not include any sludge, screenings or matter removed in or generated from any desludging, desilting or dredging works. Under the WDO, waste can be disposed of only at designated waste disposal facilities.

6.2.3 Waste Disposal (Chemical Waste) (General) Regulation

Under the WDO, the Chemical Waste (General) Regulation provides regulations for chemical waste control, and administers the possession, storage, collection, transport and disposal of chemical wastes.

According to the Waste Disposal (Chemical Waste) (General) Regulation, all producers of chemical waste must register with Environmental Protection Department (EPD) and treat their wastes, either utilising on-site plant licensed by EPD, or arranging for a licensed collector to transport the wastes to a licensed facility. The Regulation also prescribes the storage facilities to be provided on site, including labelling and

warning signs, and requires the preparation of written procedures and training to deal with emergencies such as spillages, leakages or accidents arising from the storage of chemical wastes.

The EPD has also issued a 'guideline' document, the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992), which details how the Contractor should comply with the regulations on chemical wastes.

6.2.4 Waste Disposal (Charges for Disposal of Construction Waste) Regulation

Under the Waste Disposal (Charges for Disposal of Construction Waste) Regulation, enacted in January 2006, construction waste delivered to a landfill for disposal must not contain more than 50% by weight of inert material. Construction waste delivered to a sorting facility for disposal must contain more than 50% by weight of inert material, and construction waste delivered to a public fill reception facility for disposal must consist entirely of inert material.

6.2.5 Dumping at Sea Ordinance

In accordance with the Dumping at Sea Ordinance (DASO), application for dumping permits from EPD is required for marine disposal of dredged materials.

The Practice Notes for Authorised Persons, Registered Structural Engineers and Registered Geotechnical Engineers ADV-21 (PNAP ADV-21) – *Management Framework for Disposal of Dredged/ Excavated Sediment*, set out the procedures for seeking approval to dredge/ excavate sediment and the management framework for marine disposal of such sediment. Applications for approval of dredging proposal and allocation of marine disposal shall be made to the Secretary of Marine Fill Committee (MFC). The aforementioned documents outline the requirements to be followed for assessing and classifying the sediment and explain the marine disposal arrangement for the classified material.

6.2.6 Public Cleansing and Prevention of Nuisances Regulation

The Public Cleansing and Prevention of Nuisances Regulation provides control on illegal tipping of wastes on unauthorised (unlicensed) sites.

6.2.7 Land (Miscellaneous Provisions) Ordinance

The Land (Miscellaneous Provisions) Ordinance requires that dumping licenses be obtained by individuals or companies who deliver public fill to public filling areas. The CEDD issues the licences under delegated powers from the Director of Lands. The current policy related to dumping of construction and demolition (C&D) materials is documented in the Works Branch Technical Circular No. 2/93 – Public Dumps. C&D materials that are wholly inert, namely public fill, should not be disposed of to landfill, but taken to fill banks or public filling areas.

Individual licences and windscreen stickers are issued for each vehicle involved. Under the licence conditions, public fill reception facilities will only accept soil, sand, rubble, brick, tile, rock, boulder, concrete, asphalt, masonry or used bentonite. In addition, in accordance with paragraph 12 of the Development Bureau (DEVB) *Technical Circular (Works) TC(W) No.6/2010*, Public Fill Committee (PFC) will advise on the acceptance criteria. The material will, however, be free from marine mud, household refuse, plastic, metal, industrial and chemical wastes, animal and vegetable matter and any other materials considered unsuitable by the public fill reception facility supervisor.

6.3 Assessment Methodology

The criteria for assessing waste management implications are outlined in Annex 7 of the EIAO-TM. The methods for assessing potential waste management impacts during construction and operation phases of the Project follow those presented in Annex 15 of the EIAO-TM and include the following:

6.3.1 Analysis of Activities and Waste Generation

- Identify the quantity, quality and timing of waste arising as a result of the construction and operation activities of the Project;
- Adopt appropriate design, general layout, construction methods and programme to minimise the generation of inert C&D materials and maximise the use of inert C&D materials for other construction works.

6.3.2 Development of Proposals for Waste Management

- Prior to considering the disposal options for various types of wastes, opportunities for reducing waste generation, on-site or off-site re-use and recycling should be fully evaluated.
- Estimate the types and quantities of the wastes required to be disposed of.
- Identify the disposal methods / options for each type of waste.
- Identify the transportation routings and the frequency of the trucks / vessels involved.
- Assess the potential impacts from the management of solid waste with respect to potential hazards, air and odour emissions, noise, wastewater discharges, ecology and public transport.

6.3.3 Excavation and Dumping of Sediment

- Identify and estimate excavated sediment transportation and disposal activities and requirements.
- Identify potential dumping ground to be involved.
- Identify and evaluate the best practicable methods to minimise excavation and dumping requirements.

6.4 Identification, Prediction and Evaluation of Environmental Impact

6.4.1 Potential Land Contamination

The approved Environmental Impact Assessment (EIA) Report for the “Proposed Comprehensive Development at Wo Shang Wai, Yuen Long” (here after “approved EIA Report”) identified contaminated land at eight sampling locations within the proposed development area, containing a low-level exceedance of lead and or zinc (Dutch B levels) according to the Dutch Guidelines. An updated Contaminated Assessment Plan (CAP) based on the risk-based remediation goals (RBRGs) introduced by EPD for land contamination assessment since August 2007 to replace Dutch B levels was submitted to EPD in late 2009 for the adoption of criteria used for the Contamination Assessment Report (CAR) and Remediation Action Plan (RAP).

When the laboratory analytical results were compared with the relevant RBRGs, the nature of the contamination for the Comprehensive Development at Wo Shang Wai, Yuen Long (here after “WSW Development”) was narrowed down to only lead for heavy metals and none for hydrocarbons. Heavy metals concentration which have exceeded the respective RBRGs for “Rural Residential” criteria are found in boreholes BH-LC9 and BH-LC14 only at 1.25mbgl and 1.50mbgl respectively. It is noted that both BH-LC9 and BH-LC14 are located outside Project area of the on-site Sewage Treatment Plant (STP). The CAR and RAP were approved by EPD on 26 April 2010 and remediation has since been completed according to the procedures recommended in the approved RAP. The analytical results of soil samples had shown no exceedance of the respective RBRG “Rural Residential” criteria thus demonstrating successful completion of the remedial objectives. The remediation report (RR) was submitted to EPD on 27 January 2012 and it was approved by EPD on 12 March 2012. The treated soil was reused on site by backfilling as recommended in the RAP. The approved RR is presented in **Appendix 6.1**. No land contaminating activities have been carried out within the STP Project area after remediation works and the site photos of the STP Project area from 2013 to 2017 are presented in

Appendix 6.2. The current land use of the STP project area is a vegetated land with temporary office building. Therefore, assessment of land contamination is considered not necessary.

6.4.2 Construction Phase

The activities to be carried out for construction of the Project would generate a variety of wastes that can be divided into different key categories based on their composition and ultimate method of disposal. The identified waste types include:

- Construction and demolition (C&D) materials;
- Excavated sediment;
- Chemical waste; and
- General refuse.

Each type of the above waste arising is described below, together with an evaluation of the potential environmental impacts associated with the waste generation, handling, storage, transport and disposal.

6.4.2.1 Construction and Demolition (C&D) Materials

Key Sources of C&D Materials

It is anticipated that the majority of C&D materials will be generated from the following key construction activities:

- Excavation works;
- Foundation works; and
- STP construction works.

It is estimated that the total amount of C&D materials to be generated would be mainly inert topsoil and approximately 14,000 m^3. The amount of non-inert C&D materials generated during the construction phase of the Project is anticipated to be very minor as most site clearance and site formation works have been completed.

The inert materials should be segregated from the C&D materials on-site for reuse as far as practicable. In order to minimise the impact resulting from collection and transportation of C&D materials for off-site disposal, the inert C&D materials will be reused on-site as fill materials as far as practicable.

In case on-site reuse of all inert C&D materials is not applicable, the surplus inert C&D materials generated could be reused by the WSW Development or other concurrent projects in Hong Kong. During the detailed design stage, further alternative disposal arrangement (e.g. other potential projects that could receive inert C&D materials from the Project) will be continuously explored and identified. If no potential projects could receive the surplus inert C&D materials, the remaining inert C&D materials could be disposed of at the Government's Public Fill Reception Facilities (PFRFs) for beneficial use by any other projects in Hong Kong. Liaison with the CEDD Public Fill Committee (PFC) on the management of inert C&D materials will be required before the commencement of construction work. No construction work is allowed to proceed until all issues on management of C&D materials have been resolved and all relevant arrangements have been endorsed by the relevant authorities including PFC and EPD.

The Contractor should separate the non-inert C&D materials from the inert C&D materials on-site. Any recyclable materials (e.g., metal) should be segregated from the non-inert C&D materials for collection by reputable licensed recyclers. Only the remaining minor non-recyclable portion will be disposed of at designated landfill sites by dump trucks via Castle Peak Road – Mai Po using a reputable licensed waste collector. Therefore, the number of dump trucks required for delivery of the non-inert C&D materials would be minimal, which would not impose significant traffic loading on Castle Peak Road – Mai Po.

With careful planning for reuse of C&D materials on-site and proper implementation of good construction site practice and mitigation measures recommended, potential dust, noise and water quality impacts associated with on-site handling of C&D materials are not anticipated.

6.4.2.2 Excavated sediment

It is anticipated that approximately 800 m^3 of sediment to be excavated from the Project. In the approved EIA Report, the sediment sampling work for WSW Development Project which covers the area of on-site STP was carried out in 2006. According to PNAP ADV-21, re-testing of sediment is required if the time lapse of sediment sampling and commencement of construction works is more than 3 years. Therefore, a Sediment Sampling and Testing Plan (SSTP) for WSW Development Project was submitted and approved by EPD on 23 October 2015. The approval letter of the SSTP is presented in **Appendix 6.3**. Site investigation (SI) works was carried out at the whole WSW Development Area from 10 December 2015 to 29 February 2016 to determine the properties of the excavated sediment. The location of relevant sampling point (BH04b) which covers the on-site STP is extracted and shown in **Figure 6.1**.

From the chemical testing results, all the sediment samples collected at BH04b exceeds the lower chemical exceedance level (LCEL) and/or the upper chemical exceedance level (UCEL) for arsenic, therefore belonging to either Category M or H. In accordance with the Geochemical Atlas of Hong Kong[1], high natural background levels of arsenic were recorded in the northern New Territories including the Project area. The details of the chemical testing results are presented in **Appendix 6.4**. Biological testing was further conducted on Category M sediment samples and the testing results showed that all the sediment samples collected at BH04b passed the biological tests. The details of the biological testing results are presented in **Appendix 6.5**. A Sediment Quality Report (SQR) was submitted and approved by EPD on 5 October 2016. The approval letter of the SQR is presented in **Appendix 6.6**.

The identified categories and the estimated quantities of sediment to be excavated from the Project is summarised in **Table 6.1**.

Table 6.1: Estimation of Sediment Quantities for Each Category

Sediment Category	Estimated Sediment Quantity (m^3)
M	480
H	320
Total	**800**

All the sediment will be treated and reused as backfilling material in the WSW Development. After exploring different possibilities of carrying out remediation on-site and reuse of treated sediment, it is proposed to mix sand/soil and cement with all the sediment generated from this Project to provide the treated sediment as construction material, which will be used as profiling and backfilling within the WSW Development. A minimum cement content of 5% is proposed for all categories (M and H) of contaminated sediment subject to corresponding tests.

The criteria for reuse of treated sediment are proposed with reference to the Universal Treatment Standards (UTS) and Unconfined Compressive Strength (UCS) Standard as shown in **Table 6.2**.

Table 6.2: Criteria for Reuse of Treated Sediment

Standard	Parameters	Criteria
Universal Treatment Standards (1)	Arsenic	Toxicity Characteristics Leaching Procedure (TCLP) limit: 5 mg/L

[1] Sewell, R.J.. Geochemical Atlas of Hong Kong. Civil Engineering Department Geotechnical Engineering Office, 1999.

Standard	Parameters	Criteria
Unconfined Compressive Strength Standard	Unconfined Compressive Strength	Not less than 1 MPa

Note: 1. Universal Treatment Standard – US 40 CFR 268.48

The methodology for mixing the sediment with sand/soil and cement involves drying the excavated sediment and mixing with sand/soil in batches using an excavator and/or backhoe. A cement and water mixture will then be added for the solidification process. The treated sediment will be placed at a temporary storage area covered by tarpaulin sheets, while samples are taken for laboratory testing. The testing frequency shall be one sample per 200 m^3 for the first 10,000 m^3 of treated sediment.

6.4.2.3 Chemical Waste

Chemical wastes arising during the construction phase may pose environmental, health and safety hazards if not stored and disposed of in an appropriate manner as stipulated in the Waste Disposal (Chemical Waste) (General) Regulations. The potential hazards include:

- Toxic effects to workers;
- Adverse impacts on water quality from spills; and
- Fire hazards.

The maintenance and servicing of construction plants and equipment may generate some chemical wastes such as used solvents, contaminated rags and waste lubricating oil. It is difficult to quantify the amount of chemical waste that will arise from the construction activities since it will be dependent on the Contractor's on-site maintenance requirements. However, it is anticipated that the quantity of chemical waste, such as waste lubricating oil and solvents produced from plant maintenance, will be small and estimated to be less than a few litres per month. The amount of chemical waste to be generated will be quantified in the Waste Management Plan (WMP) to be prepared by the Contractor for the site.

Materials classified as chemical wastes will require special handling and storage arrangements before removal for off-site disposal at the approved Chemical Waste Treatment Facility (CWTF) or recycling by licensed facilities. Mitigation and control requirements for chemical wastes are detailed in **Section 6.5.1.5**. Provided that the handling, storage and disposal of chemical wastes are in accordance with these requirements, adverse environmental impacts are not expected.

6.4.2.4 General Refuse

The construction workforce will generate refuse comprising food scraps, waste paper and empty containers etc. The daily general refuse arising from the construction workforce can be estimated based on a generation rate of 0.65 kg per worker per day. It is estimated that about 30 construction workers would be employed during the construction phase. Therefore, approximately 20 kg/day of general refuse will be generated.

Such refuse will be properly managed so that intentional or accidental release to the surrounding environment will be avoided. Such refuse will be delivered to licensed landfill sites or refuse transfer stations. Disposal of refuse at sites other than approved waste transfer or disposal facilities will be prohibited. Effective collection of site wastes will be required to prevent waste materials being blown around by wind, flushed or leached into the drainage system, or creating an odour nuisance or pest/ vermin problem. Waste storage areas will be well maintained and cleaned regularly.

Corresponding to this maximum daily volume, up to around 1 vehicle-trip per day would be needed for delivery of the general refuse by dump trucks (each with a loading capacity of about 6 m^3) to the designated landfill sites via Castle Peak Road – Mai Po. Given this small daily number of vehicle-trips, the extra traffic loading on the public roads would be negligible.

With the implementation of good waste management practices at the site, adverse environmental impacts are not expected to arise from the storage, handling and transportation of workforce wastes.

6.4.2.5 Summary

Table 6.3 presents a summary of all key types of waste arising during the construction phase of the Project.

Table 6.3: Summary of Waste Arising during Construction Phase

Waste Type	Key Sources of Waste Generation	Timing of Waste Generation	Estimated Quantity of Waste Generation	Waste Reuse or Disposal
Inert C&D Materials	Excavation works; foundation works; STP construction works	Q3 2018 – 2021	About 14,000 m^3	The inert C&D materials generated would be reused on-site as fill materials as far as practicable. In case on-site reuse of all inert C&D materials is not applicable, the surplus inert C&D materials generated could be reused by WSW Development or other concurrent projects in Hong Kong.
Non-inert C&D materials	Excavation works; foundation works; STP construction works*	Q3 2018 – 2021	Anticipated as very minor	Any recyclable materials (e.g., metal) will be segregated from the non-inert C&D materials for collection by reputable licensed recyclers. Only the remaining minor non-recyclable portion will be disposed of at designated landfill sites.
Excavated Sediment	Excavation works	Q3 2018 – 2021	800 m^3	The sediment will be treated and reused as backfilling material in WSW Development
General Refuse	Food scarps, waste paper, empty containers, etc. generated from the site workforce	Q3 2018 – 2021	0.65kg per worker per day, the maximum daily arising of general refuse during the construction period would be approximately 20 kg	Encourage segregation of recyclable materials (e.g., paper, tin-cans, etc.) for collection by outside recyclers. The non-recyclable materials will be disposed of at refuse station or designated landfill sites.
Chemical Waste	Used cleansing fluids, solvents, lubricating oil, waste fuel, etc., from maintenance and servicing of construction plant and equipment	Q3 2018 – 2021	Anticipated as small quantity To be quantified in the site Waste Management Plan to be prepared by the Contractor	The chemical waste will be disposed of at the Chemical Waste Treatment Centre or other licensed recycling facilities.

Remark:
* Most site clearance and site formation works have been completed. Therefore, non-inert C&D materials are not anticipated to be generated from these works.

6.4.3 Operation Phase

The on-site STP will temporarily handle the sewage generated by the WSW Development before the government sewerage network is available. The design capacity of the proposed treatment plant is 1,446 m^3/day, which meets the design population of 1,245 persons based on the 400 residential units development.

The following types of wastes would be generated during operation of the on-site STP:

- Screening and grits;
- Sludge;
- General refuse; and
- Chemical waste.

Each type of the above waste arising is described below, together with an evaluation of the potential environmental impacts associated with the waste generation, handling, storage, transport and disposal.

6.4.3.1 Screening and Grits

Screening and grits would be generated at the inlet works of the proposed STP. The screening and grits will be properly stored in a fully enclosed container before disposal to designated landfill sites. The total quantity of screening and grits generated in the proposed STP is expected to be 0.075 m^3/day. Considering the small amount of screening and grits generated, the number of containers required for disposal of screening and grits would be minimal. The transportation and disposal of the screening will be handled by a reputable licensed waste collector. No adverse environmental impact is anticipated given proper handling and disposal of the screening and grits generated.

6.4.3.2 Sludge

The major solid waste types produced from the proposed STP would be the sludge associated with the sewage treatment process. The total quantity of sludge generated in the proposed STP is expected to be 13 m^3/day. It is estimated that around 2 tankers per day would be required to transport the sludge for disposal via Castle Peak Road – Mai Po.

Sludge generated from the proposed sewage treatment plant will be mechanically dewatered, which will then be delivered to the designated landfill sites for final disposal. Another alternative to on-site dewatering of sludge, sludge could be transferred to government's sewage treatment works for off-site treatment. Once the arrangement of disposal of sludge is finalised during the detailed design stage of the Project, agreement will be sought from relevant authorities.

The sludge will be properly stored in a fully enclosed container before delivery for disposal or off-site treatment in order to minimise odour emission and potential health risks to the workforce due to pests and other disease vectors. The transportation and disposal of the sludge will be handled by a reputable licensed waste collector. No adverse environmental impact is expected given proper handling and disposal during the operational phase of the Project.

6.4.3.3 General Refuse

General refuse (such as food scraps, waste paper, empty containers and packaging, etc.) from operation of the Project will mainly be generated from staff working within the Project. Such refuse will be properly managed by suitable waste collectors so that intentional or accidental release to the surrounding environment will not occur. The amounts of general refuse generation during the operation phase have been preliminarily estimated during the design stage of the Project, and are summarized in **Table 6.4**.

Table 6.4: Estimation of General Refuse Generation during Operation Phase

Number of Staff	Waste Classification [1]	Per capita disposal rate [2]	Estimated Waste Generation
10	Commercial waste	0.35 kg/ person/ day*	3.5 kg/day

Source: (1) Appendix 1: Classification of Solid Waste and Monitoring Methodology, in *Monitoring of Solid Waste in Hong Kong – Waste Statistic for 2014*
(2) Plate 2.1 and Plate 2.7, *Monitoring of Solid Waste in Hong Kong – Waste Statistic for 2014*

Note: *Calculated from percentage of commercial waste over total municipal solid waste, based on municipal solid waste disposal rate

Effective collection of general wastes will be implemented to prevent waste materials from creating odour nuisance or pest/ vermin problem. Waste storage areas will be well maintained and cleaned regularly. To reduce waste and improve recycling, it is expected that waste such as waste paper, plastics and aluminium can be segregated for off-site recycling.

6.4.3.4 Chemical Waste

Chemical waste will be generated from various routine maintenance and servicing activities for emergency generators and other electrical and mechanical equipment. Chemical waste such as waste lubricating oil, contaminated rags, waste paint, used solvents and spent chemicals are expected to be generated from these activities. It is difficult to quantify the amount of chemical waste that will arise from those activities at this stage since it will be dependent on the equipment maintenance requirements and the amount of equipment utilised.

Chemical wastes may pose environmental, health and safety hazards if not stored and disposed of in an appropriate manner as stipulated in the *Waste Disposal (Chemical Waste) (General) Regulation*. Chemical wastes will require special handling and storage arrangements in accordance with the relevant regulations before removal for off-site disposal at the approved CWTF or recycling by licensed facilities. Provided that the handling, storage and disposal of chemical wastes will be in accordance with these requirements, adverse environmental impacts will not be expected.

6.4.3.5 Decommissioning Phase

The on-site STP is proposed to temporary handle the sewage generated by the WSW Development before the government sewerage network is available. Once all the sewage is connected to the permanent government sewer, the on-site STP would be decommissioned but will not be demolished. Therefore, it is anticipated that no waste will be generated during decommissioning phase.

6.5 Mitigation of Adverse Environmental Impact

6.5.1 Construction Phase

6.5.1.1 Good Site Practices

Adverse impacts related to waste management such as dust, odour, noise and wastewater discharge will not be expected to arise, provided that good site practices will be strictly followed. Recommendations for good site practices during the construction activities include:

- Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site
- Training of site personnel in proper waste management and chemical handling procedures
- Provision of sufficient waste disposal points and regular collection of waste
- Appropriate measures to minimise windblown litter and dust/odour during transportation of waste by either covering trucks or by transporting wastes in enclosed containers
- Stockpiles of C&D materials should be kept covered by impervious sheets to avoid wind-blown dust.
- All dusty materials including C&D materials should be sprayed with water immediately prior to any loading transfer operation so as to keep the dusty material wet during material handling at the stockpile areas
- Provision of wheel washing facilities before the trucks leaving the works area so as to minimise dust introduction to public roads

- Well planned delivery programme for offsite disposal such that adverse environmental impact from transporting the inert or non-inert C&D materials is not anticipated

6.5.1.2 Waste Reduction Measures

Good management and control can prevent the generation of a significant amount of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include:

- Sort non-inert C&D materials to recover any recyclable portions
- Segregation and storage of different types of waste in different containers or skips or stockpiles to enhance reuse or recycling of materials and their proper disposal
- Encourage collection of recyclable waste such as waste paper and aluminium cans by providing separate labelled bins to enable such waste to be segregated from other general refuse generated by the work force
- Proper site practices to minimise the potential for damage or contamination of inert C&D materials
- Plan the use of construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste

In addition to the above measures, specific mitigation measures are recommended below for the identified waste arising to minimise environmental impacts during handling, transportation and disposal of these wastes.

6.5.1.3 Inert and Non-inert C&D materials

In order to minimise impacts resulting from collection and transportation of inert C&D materials for off-site disposal, the inert C&D materials should be reused on-site as fill material as far as practicable. In addition, inert C&D materials generated from excavation works could be reused as fill materials in local projects that require public fill for reclamation.

The surplus inert C&D materials will be disposed of at the Government's PFRFs for beneficial use by other projects in Hong Kong.

The C&D materials generated from general site clearance should be sorted on site to segregate any inert materials for reuse or disposal of at PFRFs whereas the non-inert materials will be disposed of at the designated landfill site.

In order to monitor the disposal of inert and non-inert C&D materials at respectively PFRFs and the designated landfill site, and to control fly-tipping, it is recommended that the Contractor should follow the DEVB Technical Circular (Works) No. 6/2010 for *Trip Ticket System for Disposal of Construction & Demolition Materials* issued by Development Bureau. In addition, it is also recommended that the Contractor should prepare and implement a Waste Management Plan detailing their various waste arising and waste management practices in accordance with the relevant requirements of the ETWB Technical Circular (Works) No. 19/2005 *Environmental Management on Construction Site*.

6.5.1.4 Excavated Sediment

The following mitigation measures shall be implemented for excavation of sediment:

- The loading, unloading, handling, transfer or storage of treated and untreated sediment should be carried out in such a manner to prevent or minimise dust emissions;
- Temporary stockpiling shall be avoided as far as possible. In case temporary storage is needed, the untreated sediment should be placed at a designated area paved with either concrete or liner and covered properly with tarpaulins;

- Speed control shall be implemented for vehicles carrying untreated sediment within the site to minimise dust emission; and
- All necessary measures should be employed to prevent cross-contamination of untreated sediment with other excavated / fill materials.

General health and safety precautions shall also be employed for all personnel working on site, including:

- No food and drink allowed on site;
- Direct skin contact with excavated sediment should be avoided;
- Provide all necessary Personal Protective Equipment (PPE) to site workers;
- Bulk earth moving equipment shall be used for handling the sediment as much as possible;
- Minimise dust generation; and
- Provision of personal cleaning facilities.

6.5.1.5 Chemical Waste

If chemical wastes are produced at the construction site, the Contractor will be required to register with the EPD as a chemical waste producer and to follow the guidelines stated in the "Code of Practice on the Packaging Labelling and Storage of Chemical Wastes". Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately. Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidising, irritant, toxic, harmful, corrosive, etc. The Contractor should use a licensed collector to transport and dispose of the chemical wastes at the approved Chemical Waste Treatment Centre or other licensed recycling facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

Potential environmental impacts arising from the handling activities (including storage, collection, transportation and disposal of chemical waste) are expected to be minimal with the implementation of appropriate mitigation measures as recommended.

6.5.1.6 General Refuse

General refuse should be stored in enclosed bins or compaction units separated from inert C&D materials. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from inert C&D materials. Preferably an enclosed and covered area should be provided to reduce the occurrence of 'wind blown' light material.

6.5.2 Operation Phase

6.5.2.1 Screening and Grits

The following mitigation measures shall be implemented for handling, collection, transportation and disposal of screening and grits:

- Screens should be cleaned regularly to remove any accumulated organic debris;
- Screening and grit transfer system should be flushed regularly with water to remove organic debris;
- Screening and grits generated should be transferred to closed containers before transportation and disposal at designated landfill sites.

6.5.2.2 Sludge

The following mitigation measures shall be implemented for handling, collection, transportation and disposal of sludge:

- Frequent sludge withdrawal from tanks is necessary to prevent the production of gases;
- Sludge should be transferred to closed containers before transportation and disposal at designated landfill sites or public sewage treatment works by designated sewage tankers;
- Sludge tankers and containers should be flushed with water regularly;
- Sludge tankers should be washed thoroughly before leaving the proposed sewage treatment plant to avoid any odour nuisance during transportation;
- All wastewater, if any, generated from the sludge dewatering process should be diverted to the proposed sewage treatment plant for proper treatment.

6.5.2.3 General Refuse

General refuse should be collected on daily basis and delivered to the refuse collection point accordingly. A reputable waste collector should be employed to remove general refuse regularly to avoid odour nuisance or pest/vermin problem. Sufficient recycling containers are recommended to be provided at suitable locations of the Project to encourage recycling of such waste as aluminium cans, plastics and waste paper.

6.5.2.4 Chemical Waste

If chemical wastes are expected to be produced during the operation phase, the Project Proponent should register with the EPD as a chemical waste producer and follow the guidelines stated in the "Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes". Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately. Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidising, irritant, toxic, harmful, corrosive, etc. Licensed collector should be deployed to transport and dispose of the chemical wastes at the approved Chemical Waste Treatment Centre or other licensed recycling facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

6.6 Evaluation of Residual Impact

With the implementation of the recommended mitigation measures for the handling, transportation and disposal of the identified waste arising, residual impacts are not anticipated during both construction and operation phases of the Project.

6.7 Environmental Monitoring and Audit

It would be the Contractor's responsibility to ensure that all wastes produced during the construction of the Project are handled, stored and disposed of in accordance with good waste management practices and EPD's regulations and requirements. The recommended mitigation measures should form the basis of the WMP to be developed by the Contractor throughout the Project period. The WMP shall be prepared and implemented in accordance with ETWB TC (W) No. 19/2005 Environmental Management on Construction Site.

Throughout the construction phase of the Project, regular site inspections as part of the EM&A procedures should be carried out to determine if wastes are being managed in accordance with the WMP. Different aspects of waste management including waste generation, storage, recycling, treatment, transport and disposal would be included in the programme.

6.8 Conclusion

6.8.1 Construction Phase

The major waste types generated by the construction activities will include C&D materials from excavation works, foundation works, STP construction works; sediment from excavation works; chemical waste from maintenance and servicing of construction plant and equipment and general refuse from the workforce. Provided that all these identified wastes are handled, transported and disposed of in accordance with the relevant legislative and recommended requirements and the recommended good site practices and mitigation measures are properly implemented, no adverse environmental impact is expected during the construction phase.

6.8.2 Operation Phase

During the operation phase, the waste types generated will be screening and grits, sludge from the operation of the on-site STP, general refuse from staff, and chemical waste from regular maintenance activities. Provided that all these wastes are handled, transported and disposed of in accordance with the relevant legislative requirements and the recommended mitigation measures are properly implemented, no adverse environmental impact is expected during the operation phase.

7 Ecological Impact (Terrestrial and Aquatic)

7.1 Introduction

This section addresses the potential ecological impacts that may arise from the construction, operation and decommissioning of proposed interim sewage treatment plant (STP) and effluent reuse facility, and the associated works at Wo Shang Wai (WSW). The potential impacts on the ecological sensitive receivers, habitats and species potentially affected by the proposed works within the Study Area were assessed in accordance with the criteria and guidelines identified in Annexes 8 and 16 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) and Section 3.4.7 of the EIA Study Brief (ESB-289/2015). Suitable mitigation measures were proposed to mitigate the adverse impacts to an environmentally acceptable level.

The proposed project is an integrated part of the Proposed Comprehensive Development at Wo Shang Wai, Yuen Long (WSW development), which is also a Designated Project, for which an EIA study has been conducted and approved under the EIAO (Registration no.: AEIAR-120/2008). By the time of this EIA Study is undertaken, the WSW development is under construction and ecological mitigation measures were implemented as per the Environmental Permit (EP) and Environmental Monitoring and Audit Report (EM&A) requirements. As the proposed STP is an integrated part of the WSW development, the Project site for this EIA is entirely situated within the project site of the WSW development.

Apart from the STP, there will be associated works including pumping facilities and piping network to connect the sewage and treated effluent for reuse as irrigation and toilet flushing for the WSW development From ecological perspective, the associated piping network that to be constructed as part of the WSW development site formation and substructures works, will not have additional ecological impact compared to those have been assessed with mitigation measures in place proposed under the previously approved WSW development EIA.

7.2 Environmental Legislation, Standards and Guidelines

A number of international conventions, local legislation and guidelines provide the framework for protection of species and habitats of ecological importance. Those related to this Project are:

- *Forests and Countryside Ordinance* (Cap. 96), which protects the rare plant species from selling, offering for sale or possession illegally;
- *Forestry Regulations* (Cap. 96 sub. leg.) are subsidiary legislation of the Forests and Countryside Ordinance (Cap. 96). Under these regulations, no person shall without lawful excuse sell, offer for sale or have in his possession or under his custody or control any portion of any of the plants scheduled under the Forestry Regulations.
- *Wild Animals Protection Ordinance* (Cap. 170), which protects wild animals listed under the second schedule from being hunted, possession, sale or export, disturbance of their nest or egg without permission by authorised officer;
- *Protection of Endangered Species of Animals and Plants Ordinance* (Cap. 586), which regulates the import, introduction from the sea, export, re-export, and possession of specimens of a scheduled species, including live, dead, parts or derivatives. The Ordinance applies to all activities involving endangered species which include the parties of traders, tourists and individuals;
- *Environmental Impact Assessment Ordinance (EIAO)* (Cap. 499), which specifies designated projects under Schedule 2 of the Ordinance, unless exempted, must follow the statutory environmental impact assessment (EIA) process and require environmental permits for their construction and operation;

- *EIAO Guidance Notes No. 6/2010, 7/2010, 10/2010 and 11/2010*. These guidance notes provide the observations on Ecological Assessment from the EIAO perspective, providing the general guidelines for conducting an ecological baseline survey for ecological assessment and introducing some methodologies in conducting terrestrial and freshwater ecological baseline surveys;
- *Annexes 8 and 16 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM)*: Annex 8 recommends the criteria for evaluating ecological impacts. Annex 16 sets out the general approach and methodology for assessment of ecological impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential ecological impacts;
- *Town Planning Ordinance* (Cap. 131) which gives designation to country parks, conservation area, green belts, sites of special scientific interest, coastal protection area and other specified uses to promote conservation, protection and education of the valuable environment;
- *Town Planning Board Guideline no. 12C. Town Planning Board Guidelines for application for developments within Deep Bay Area under section 16 of the Town Planning Ordinance* provides the guidance in land use and development for conservation of the Deep Bay wetlands.
- *Hong Kong Planning Standards and Guidelines Chapter 10* (HKPSG) provides the guidelines on landscape and conservation to achieve a balance between the need for development and to minimise disruption of the landscape and natural resources.
- *The IUCN Red List of Threatened Species* is widely recognised as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species. The goal of the IUCN Red List is to provide information and analyses on the status, trends and threats to species in order to inform and catalyse action for biodiversity conservation;
- *The Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES) is an international agreement between Governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival;
- *The Convention on the Conservation of Migratory Species of Wild Animals* (the Bonn Convention) is an intergovernmental treaty concluded under the aegis of the United Nations Environment Programme concerned with the conservation of wildlife and habitats on a global scale. Its aim is to conserve terrestrial, marine and avian migratory species throughout their range;
- *United Nations Convention on Biological Diversity* (CBD) (1992) is an international legally binding treaty. Its aim is to develop national strategies for the conservation and sustainable use of biological diversity; and
- *Wild Animal Protection Law of the Peoples' Republic of China* (PRC) is formulated for the purpose of protecting and saving the species of wildlife which are rare or near extinction, protecting, developing and rationally utilising wildlife resources and maintaining ecological balances.

7.3 Study Area and Methodology

7.3.1 Study Area

According to Section 3.4.7.2 of the EIA Study Brief No. ESB-289/2015, the defined Study Area for the purpose of ecological impact assessment includes area within 500 meters distance from the boundary of the Project and any other areas potentially affected by the Project, which is shown in **Figure 7.1**. The assessment area of aquatic ecology is the same as that for assessment of the water quality impact.

7.3.2 Assessment Methodology

The Project site is situated entirely within the WSW development, which is under construction by the time of this EIA is prepared. A comprehensive ecological monitoring at the fishpond area within the Conservation Area adjacent to the WSW development is ongoing on a monthly basis since the commencement of construction in April 2010. In addition, since the Wetland Restoration Area (WRA) as part of the mitigation measures of the WSW development being established, an ecological monitoring at the WRA are being carried out as part of the EM&A programme. This set of ecological monitoring data collected within the Study Area of this EIA, together with the monthly ecological monitoring at adjacent fishpond for Hong Kong Section of Guangzhou-

Shenzhen-Hong Kong Express Rail Link (XRL), the ecological baseline survey for Environmental Impact Assessment Reports of the Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL EIA) (AECOM, 2009) and the ecological baseline survey for the Comprehensive Development and Wetland Protection Near Yau Mei San Tsuen (YMST EIA) (ENVIRON, 2015) form an up-to-dated and comprehensive set of ecological baseline data. Given the existing site condition of the Project site which currently under site formation as part of the WSW development and with the comprehensive ecological baseline information gathered from relevant literature, it is considered no additional ecological field survey is necessary for the purpose of conducting the ecological impact assessment for this EIA study.

7.3.3 Literature Review

Literature review by desktop study have been conducted to investigate the existing ecological conditions within the Study Area and to identify habitats or species having conservation interest. The available information relevant to this Project including approved EIA reports, Government and private sector reports, published literature, academic study reports and unpublished data requested were covered in the literature review. Some relevant information but not limited to the followings have been reviewed:

- Recent aerial photographs
- Mai Po Inner Deep Bay Ramsar Site Waterbird Monitoring Programme 2015-16. Egretry Counts in Hong Kong with particular reference to Mai Po Inner Deep Bay Ramsar Site. Summer 2016 report by the Hong Kong Bird Watching Society (Anon, 2016)
- EIA, Environmental Review reports and other relevant reports for the projects within the Study Area, including:
  - Proposed Comprehensive Development at Wo Shang Wai, Yuen Long (WSW EIA) (Register No.: AEIAR-120/2008) (MMHK, 2008);
  - Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL EIA) (Register No.: AEIAR-143/2009) (MTRC, 2009); and
  - Comprehensive Development and Wetland Protection Near Yau Mei San Tsuen (Final Report) (YMST EIA) (Register No.: AEIAR-189/2015) (ENVIRON, 2015)
- Environmental Monitoring and Audit reports for projects within the Study Area, including:
  - Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link, January – November 2016 (XRL EM&A) (MTRC, 2016); and
  - Proposed Comprehensive Development at Wo Shang Wai, Yuen Long - Biannual EM&A Report on Ecology (Nov 2012 - Oct 2016) (WSW Biannual EM&A) (MMHK, 2013- 2016)

7.4 Baseline Condition and Ecological Sensitive Receivers

7.4.1 General Description of the Project Site and Study Area

The Project site is located within the residential development portion of the WSW development, which is a Designated Project approved in 2009 under the EIAO. The Project site falls inside the Wetland Buffer Area (WBA) and in proximity to the Wetland Conservation Area (WCA). Owing to the construction activities for the WSW development, the existing habitat of the Project site is currently a developed area under construction, without natural habitat remains. The location of the Project site and the Study Area are shown in **Figure 7.1**.

7.4.2 Recognized Sites of Conservation Interest

7.4.2.1 Wetland Conservation Area (WCA)

The Town Planning Board has designated the wetland areas immediately adjacent to the Ramsar Site as WCA; the planning intention of this is to conserve the ecological value of the fish ponds in the Deep Bay wetland ecosystem (Town Planning Board Guideline No.12C). Development within the WCA will not normally be permitted unless it supports the conservation of the area or provides essential infrastructural development with

overriding public interest. The Project site lies outside the WCA, but part of the fishponds in the north and west of the Study Area fall into the WCA, so impacts to these parts of the WCA are considered in this assessment.

7.4.2.2 Wetland Buffer Area (WBA)

The Wetland Buffer Area (WBA) lies on the landward side of the WCA, with the intention of protecting the ecological integrity of wetland habitats within the WCA (Town Planning Board Guideline No.12C). Developments within the WBA are required to demonstrate that ecological impacts to the WCA (including indirect disturbance impacts) will be minimised and any negative ecological impacts will be fully mitigated through positive measures. Residential developments are permitted in this area, especially for those replace existing open storage and/or incorporate a wetland restoration scheme. A wetland buffer should be included in sites immediately abutting the WCA. The current Project site lies within the WBA.

7.4.2.3 Ramsar Site

The Mai Po Inner Deep Bay Ramsar Site, located 90m from the Project site, forms the core part of the Deep Bay wetland ecosystem. The Ramsar Site was designated as a wetland of international importance under the Ramsar Convention on 4th September 1995 which covers an area of 1,500 ha of gei wai, fishponds and intertidal mudflats. The site includes the Mai Po Marshes and Inner Deep Bay Sites of Special Scientific Interest (SSSIs). It is particularly important to migratory waterbirds supporting internationally important numbers of several species, including several globally-threatened species. Conservation Area (CA)

Under the approved Mai Po & Fairview Park Outline Zoning Plan (OZP) (Statutory Plan No. S/YL-MP/6), the fishponds located immediately adjacent to the existing WRA for the WSW development are within the CA. The planning intention is for conserving the ecologically valuable wetlands and fishponds, which form an integral part of the wetland ecosystem in the Deep Bay Area. Except as otherwise specified by the Town Planning Board, the area is restricted from development and limited to the use as fishponds, plantings, public utilities and maintenance in existed developed structures, with and without further conditions.

7.4.2.4 Egretry

Two egretries are located near the Project site, which are Mai Po Village and Mai Po Lung village egretry (**Figure 7.1**). The Mai Po Village egretry was formerly located in the Mai Po Village SSSI, but has subsequently moved outside of the SSSI to roadside trees to the northwest of the SSSI boundary. The egretry lies presently at approximately 570m from the Project site. In 2016, this was the largest egretry in Hong Kong, with a maximum of 202 nests recorded (Anon 2016). Mai Po Lung Village egretry is approximately 1,135m from the Project site. The egretry held a maximum of 84 nests in 2016 (Anon 2016).

7.4.2.5 Mai Po Village SSSI

The Mai Po Village SSSI contains 5.3ha of secondary woodland derived from fung shui woodland and plantation located to the east of Mai Po Village (**Figure 7.1**). The SSSI lies approximately 420m from the Project site. This site was designated as an SSSI in 1979 on the basis of an egretry containing breeding population of Little Egret, Cattle Egret and Chinese Pond Heron. Egrets no longer breed within the boundaries of the SSSI, although Little Egret and Chinese Pond Heron breed on the roadside trees northwest of the SSSI.

7.4.3 Habitat and Vegetation

There are seven major habitats identified in the Study Area, namely:

- Wetland Restoration Area
- Fishpond
- Abandoned Fishpond
- Water Channel / Ditch
- Marsh / Reedbed
- Secondary Woodland

- Plantation
- Developed / Disturbed Area

The distribution of each habitat type is shown in the habitat map in **Figure 7.1**. The areas of each habitat type within the Project site and Study Area are listed in Table 7.1 and Table 7.2 respectively.

Table 7.1: Habitats Present in the Project Site

Habitat	Proposed Development Area	
	Area (ha)	%
Developed / Disturbed Area	16.00	100%
Total	**16.00**	**100**

Table 7.2: Habitats Present in the Study Area (excluding the Project Site)

Habitat	Study Area	
	Area (ha)	%
Wetland Restoration Area	4.74	2.4%
Fishpond	49.85	25.5%
Abandoned Fishpond	12.14	6.2%
Water Channel / Ditch	4.44	2.3%
Marsh / Reedbed	4.22	2.2%
Secondary Woodland	0.55	0.3%
Plantation	8.11	4.1%
Developed / Disturbed Area	111.39	57.0%
Total	**195.44**	**100.0%**

Representative photographs of each type of habitats are illustrated in **Plates 1** to **7** in **Appendix 7.1**.

7.4.3.1 Habitats within the Project Site

Developed / Disturbed Area

The Project site is currently a construction site with daily construction activities with no natural habitat remains. Other developed / disturbed area found within the Study Area includes village area (Mai Po Village), residential development (Palm Springs, Royal Palms, Scenic Heights and Maple Garden), roads (Castle Peak Road and San Tin Highway), garages and open storage areas. Vegetation is limited within the Project site because it is currently a construction site.

7.4.3.2 Habitat within the Study Area

Wetland Restoration Area (WRA)

The WRA was constructed at the northern portion of the WSW development and immediate south of the existing offsite fishpond habitats, which was proposed under the WSW development EIA as mitigation measure compensate for the loss of seasonal wetland and enhance the ecological connectivity to the adjacent conservation area. The WRA construction was completed on 15th November 2010. The WRA consists of marsh, reeds, ponds, grass, shrubs and tall trees which provide fauna species a diverse habitat. Dominant plant species within the WRA include *Phragmites australis, Ficus hispida, Macaranga tanarius* and *Rhaphiolepis indica.*

Fishpond

Fishponds form the dominant habitat type to the north and west of the Study Area. These form part of the extensive Deep Bay wetland area. The majority of ponds in the north and north-west of the Study Area are currently used for cultivation of a variety of fish species such as Grey Mullet *Mugil cephalus*, *Tilapia*

Oreochromus sp., Grass Carp *Ctenopharyngodon idellus* and Bighead Carp *Aristichthys nobilis*. These ponds are regularly drained during the dry season to harvest fish and to permit management of pond substrate.

Active fishponds have very little emergent vegetation, while bund vegetation is managed to allow access to ponds and is dominated by a small number of widespread species, including *Brachiaria mutica*, *Panicum maximum, Panicum repens, Paspalum paspaloides, Eleusine indica, Cynodon dactylon, Digitaria sanguinalis* and *Bidens alba*.

Abandoned Fishpond

Fishponds in the south-west of the Study Area have not been used for fish cultivation for a number of years. Many of these inactive ponds contain extensive emergent vegetation, especially *Phragmites australis*. Bund vegetation in this area is less disturbed than those grow around commercial fishponds and is dominated by tall grasses and exotic herbs (mostly *Bidens alba*, *Euphorbia hirta*, *Conyza bonariensis* and *Ipomoea cairica*).

Water Channel / Ditch

Several water channels are located between the fishponds within the Study Area. These are moderately large and bounded by fairly high, steep bunds; the water is generally shallow but the channels do not dry out during the dry season. These channels drain into Deep Bay, and some are tidal in the lower reaches. A few channel sections, especially in the north of the Study Area, are overgrown with vegetation, especially *Brachiaria mutica* and *Eichhornia crassipes*. Riparian vegetation is dominated by *Brachiaria mutica*, *Panicum maximum* and *Bidens alba* but there are also a number of riparian trees, especially *Melia azedarach* and *Macaranga tanarius*, which are used by roosting waterbirds.

Marsh / Reedbed

Patches of marsh lie within the northeastern portion of the Study Area. These are derived from overgrown abandoned fishponds or vegetated areas alongside drainage channels. Vegetation in each site varies slightly according to local conditions and origin of the marsh habitat; dominant species include *Brachiaria mutica*, *Panicum maximum*, *Eichhornia crassipes*, *Typha angustifolia*, *Ipomoea aquatica*, *Cyclosorus interruptus* and *Ludwigia octovalvis*.

Plantation

The roadside verges of San Tin Highway and Castle Peak Road are planted with a variety of tree species, especially non-native species, used primarily for landscaping purposes. Non-native tree species used locally in plantations include *Eucalyptus citriodora*, *Bombax ceiba*, *Acacia auriculiformis*, *Acacia confusa* and *Albizia lebbeck*, while native species include *Ficus microcarpa*, *Hibiscus tiliaceus* and *Celtis sinensis*. Plantation areas have also been identified surrounding the site of WSW development. Species found in the site include *Acacia auriculiformis*, *Cinnamomum camphora*, *Hibiscus tiliaceus* and *Melaleuca quinquenervia*.

Secondary Woodland

Woodland on the small hill to the east of Mai Po Village is derived from fung shui woodland. Most of the woodland area is a designated SSSI, largely due to the former presence of a significant egretry. Dominant tree species in this area include *Macaranga tanarius*, *Melia azedarach*, *Microcos paniculata, Schefflera heptaphylla, Sterculia lanceolata*, *Sapium sebiferum* and *Schima superba*. The understorey is moderately well-developed and diverse.

Developed / Disturbed Area

Developed / Disturbed Area in the Study Area includes village land, residential developments and major roads and highways. All areas are heavily disturbed by human activities. There is little natural vegetation present.

7.4.3.3 Floral Species of Conservation Interest

A total of 165 species of plants were recorded in the WSW EIA, all of which are common or very common species in Hong Kong, e.g. *Hibiscus tiliaceus*, and a number of non-native species, e.g. *Melia azedarach*. No protected plant species or plant species of conservation interest was recorded within the Project site based on

the survey findings of the WSW EIA (MMHK, 2008). The Project site is currently a construction site with no remains of natural vegetation.

7.4.4 Bird

The Study Area covers mainly developed / disturbed area and wetland, which comprises of WRA and fishpond habitats. The WRA and fishponds located at the north of the Project site and the abandoned fishponds at the southwest of the Project site provide habitats for waterbirds within the Study Area.

7.4.4.1 Literature Review

Relevant ecological monitoring and survey report listed in **Section 7.3.3** comprising avifauna records in the Study Area have been reviewed.

The EIA report of WSW recorded 27 bird species of conservation interest within its study area (MMHK, 2008). The bird species recorded within the Study Area are typical for fishpond habitats around Deep Bay.

The XRL EIA report recorded 19 bird species of conservation interest within its study area, which include the Project site of this EIA (AECOM, 2009). Of the 19 species of conservation interest, five of them are located within the Project site of this EIA. The natural habitat of these five bird species is compensated by the WRA and no longer exist in the Project site.

The XRL EM&A programme also include an ongoing ecological monitoring. One of the monitoring locations is located at WSW (MTRC, 2016). In year 2016, the XRL EM&A Reports for ecology reported 21 bird species of conservation interest in fishponds within the Study Area.

The established WRA is regularly monitored under the EM&A programme of WSW development EIA, the WSW Biannual EM&A Reports recorded a total of 60 bird species of conservation interest in the WRA from November 2012 to October 2016 (MMHK, 2013-2016).

A list of bird species of conservation interest recorded in previous studies is provided in **Table 7.3**. Birds recorded in major habitats within the Study Area is provided in **Appendix 7.2**.

Table 7.3: Summary Table for Avifauna Species of Conservation Interest Recorded in the Study Area

Common Name	Scientific Name	Level of Concern[1]	Protection Status[2]	IUCN status[3]	WSW EIA	XRL EIA	XRL EM&A	WSW Biannual EM&A
Little Grebe	*Tachybaptus ruficollis*	LC			✓	✓	✓	✓
Great Cormorant	*Phalacrocorax carbo*	PRC			✓	✓	✓	✓
Black-crowned Night Heron	*Nycticorax nycticorax*	(LC)			✓	✓	✓	✓
Chinese Pond Heron	*Ardeola bacchus*	PRC (RC)			✓	✓	✓	✓
Grey Heron	*Ardea cinerea*	PRC			✓	✓	✓	✓
Purple Heron	*Ardea purpurea*	RC						✓
Great Egret	*Ardea alba*	PRC (RC)			✓	✓	✓	✓
Intermediate Egret	*Egretta intermedia*	RC			✓		✓	✓
Little Egret	*Egretta garzetta*	PRC (RC)			✓	✓	✓	✓
Eastern Cattle Egret	*Bubulcus coromandus*	(LC)			✓	✓	✓	✓
Striated Heron	*Butorides striata*	(LC)			✓			
Whiskered Tern	*Chlidonias hybrida*	LC						✓

Common Name	Scientific Name	Level of Concern[1]	Protection Status[2]	IUCN status[3]	WSW EIA	XRL EIA	XRL EM&A	WSW Biannual EM&A
White-winged Tern	*Chlidonias leucopterus*	LC						✓
Little Ringed Plover	*Charadrius dubius*	(LC)			✓	✓	✓	✓
Black-faced Spoonbill	*Platalea minor*	PGC	CRDB (En)	EN	✓	✓	✓	✓
Northern Pintail	*Anas acuta*	RC			✓			✓
Common Teal	*Anas crecca*	RC			✓			✓
Eurasian Wigeon	*Anas penelope*	RC			✓	✓		✓
Osprey	*Pandion haliaetus*	RC			✓	✓		✓
Yellow Bittern	*Ixobrychus sinensis*	(LC)					✓	✓
Cinnamon Bittern	*Ixobrychus cinnamomeus*	LC						✓
Tufted Duck	*Aythya fuligula*	LC						✓
Northern Shoveler	*Anas clypeata*	RC						✓
White-bellied Sea Eagle	*Haliaeetus leucogaster*	(RC)	Cap. 586		✓			
Black Kite	*Milvus migrans*	(RC)	Cap. 586, Class (II)		✓	✓	✓	✓
Black-winged Kite	*Elanus caeruleus*	LC	Cap. 586					✓
Eastern Imperial Eagle	*Aquila heliaca*	GC	Cap.586	VU				✓
Crested Serpent Eagle	*Spilornis cheela*	(LC)	Cap. 586					✓
Eurasian Hobby	*Falco subbuteo*	(LC)	Cap. 586					✓
Greater Spotted Eagle	*Clanga clanga*	GC	Cap. 586	VU				✓
Peregrine Falcon	*Falco peregrinus*	LC	Cap. 586					✓
Black-headed Gull	*Chroicocephalus ridibundus*	PRC			✓			
Japanese Quail	*Coturnix japonica*	LC						✓
Baillon's Crake	*Porzana pusilla*	LC						✓
Watercock	*Gallicrex cinerea*	RC						✓
Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	LC						✓
Greater Painted-snipe	*Rostratula benghalensis*	LC						✓
Black-winged Stilt	*Himantopus himantopus*	RC					✓	✓
Pied Avocet	*Recurvirostra avosetta*	RC						✓
Oriental Pratincole	*Glareola maldivarum*	LC			✓			✓
Pacific Golden Plover	*Pluvialis fulva*	LC						✓
Kentish Plover	*Charadrius alexandrinus*	RC						✓

Common Name	Scientific Name	Level of Concern[1]	Protection Status[2]	IUCN status[3]	WSW EIA	XRL EIA	XRL EM&A	WSW Biannual EM&A
Spotted Redshank	*Tringa erythropus*	RC						✓
Common Redshank	*Tringa totanus*	RC						✓
Common Greenshank	*Tringa nebularia*	RC						✓
Wood Sandpiper	*Tringa glareola*	LC						✓
Marsh Sandpiper	*Tringa stagnatilis*	RC					✓	
Sharp-tailed Sandpiper	*Calidris acuminata*	LC						✓
Pintail/Swinhoe's Snipe*	*Gallinago stenura/G. megala*	LC*						✓
Temminck's Stint	*Calidris temminckii*	LC						✓
Greater Coucal	*Centropus sinensis*	RC	CRDB (Vu)				✓	
Eurasian Eagle Owl	*Bubo bubo*	RC						✓
Pacific Swift	*Apus pacificus*	(LC)			✓			✓
Pied Kingfisher	*Ceryle rudis*	(LC)			✓			✓
White-throated Kingfisher	*Halcyon smyrnensis*	(LC)			✓	✓		✓
Red-throated Pipit	*Anthus cervinus*	LC					✓	
Buff-bellied Pipit	*Anthus rubescens*	LC						✓
Pallas's Grasshopper Warbler	*Locustella certhiola*	LC						✓
Thick-billed Warbler	*Acrocephalus aedon*	LC						✓
Zitting Cisticola	*Cisticola juncidis*	LC			✓	✓	✓	✓
Chinese Penduline-Tit	*Remiz consobrinus*	RC						✓
White-cheeked Starling	*Spodiopsar cineraceus*	PRC				✓		✓
Red-billed Starling	*Spodiopsar sericeus*	GC			✓	✓	✓	✓
White-shouldered Starling	*Sturnia sinensis*	(LC)			✓	✓	✓	✓
Black-napped Oriole	*Oriolus chinensis*	LC						✓
Grey Bush Chat	*Saxicola ferreus*	LC				✓		
Collared Crow	*Corvus torquatus*	LC		NT	✓		✓	✓

Notes for Table 7.3:

(1) Level of Concern refers to Fellowes et al., 2002 – LC = Local Concern, RC = Regional Concern, PRC = Potential Regional Concern, PGC = Potential Global Concern, GC = Global Concern, Letter in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.
* Species generally inseparable in field. Conservation status assessment refers to Swinhoe's Snipe *G. megala*

(2) Protection Status refers to Zheng & Weng, 1998 & State Forestry Administration and Ministry of Agriculture, 1988
Cap.586 – Listed in the Protection of Endangered Species of Animals and Plants Ordinance;
Class (II) – Listed as Class II Protected under the Wild Animals Under State Protection;
CRDB – China Red Data Book: E = Endangered, V = Vulnerable, R = Rare, I = Intermediate

(3) IUCN Status refers to IUCN, 2017: NT= Near Threatened; VU=Vulnerable; EN = Endangered

7.4.5 Mammal

In Hong Kong, large mammals inhabit in areas with low anthropogenic activities with good vegetation coverage. The Project site is within the construction site of existing WSW development. The Study Area is dominated by developed / disturbed area with low vegetation coverage and with high level of human activities. The residential villages, major roads and highways are not natural habitat for large mammals. Therefore, the Project site and Study Area are deemed not a favorable environment for large mammals.

7.4.5.1 Literature Review

Non-flying terrestrial mammals

The records of non-flying terrestrial mammals of Hong Kong included in Shek (2006) and Shek *et al.* (2007) have been reviewed. However, no specific record within the Study Area was found.

Small Asian Mongoose *Herpestes javanicus* is recorded in the Study Area during field surveys for WSW development EIA (MMHK, 2008) and WSW development EM&A (MMHK, 2014). This species is likely an introduced species to Hong Kong and found abundant in the Deep Bay Area (Shek 2006). Four small mammal species were recorded by trapping in the Project site during WSW development EIA (MMHK, 2008), including Musk Shrew *Suncus murinus*, House Mouse *Mus musculus*, Ryukyu Mouse *Mus caroli* and Brown Rat *Rattus norvegicus*. All species are common and widespread in Hong Kong in anthropogenic habitats, except for Ryukyu Mouse.

In the ecological field survey for WSW development EM&A, a Ryukyu Mouse *Mus caroli* was found during the field survey in November 2012 (MMHK, 2014). Ryukyu Mouse has a restricted distribution in Hong Kong but has previously been recorded from nearby Mai Po Nature Reserve (Shek 2006).

A Leopard Cat *Prionailurus bengalensis* was recorded by the WSW development EM&A (MMHK, 2014) in fishpond habitat outside the Project site but within the Study Area. Though listed as vulnerable in the China Red Databook, this species is found widely distributed in countryside areas throughout Hong Kong.

Bats

In the course of field surveys for WSW development EIA (MMHK, 2008) and WSW development EM&A (MMHK, 2013-2016), one bat species, Japanese Pipistrelle *Pipistrellus abramus* was observed within its study area and within the WRA respectively. This species is very common in wetland areas throughout Hong Kong. The Project site is currently an open construction site which is not suitable roosting habitat for bats, although Japanese Pipistrelle *Pipistrellus abramus* and Short-nosed Fruit Bat *Cynopterus sphinx* are known to roost at Mai Po village and Palm Springs in the Study Area. These two species were also recorded in baseline surveys conducted for the XRL EIA Study (AECOM, 2009). Shek (2006) recorded a Lesser Yellow Bat *Scotophilus kuhlii* nearby and this species may also forage over wetlands in the Study Area.

In the ecological monitoring for WSW development EM&A from November 2012 to April 2013 (MMHK, 2014), and May 2014 to October 2014 (MMHK, 2015), Japanese Pipistrelle and an indetermined bat species were recorded in WRA within the Study Area.

The list of mammal species recorded in different habitats is provided in **Appendix 7.3**.

7.4.6 Amphibian and Reptile

The Project site is currently a construction site with no vegetation and heavily disturbed by human activities. Therefore, the Project site is deemed not a favorable environment for amphibian and reptile.

7.4.6.1 Literature Review

During the course of field surveys of WSW development EIA (MMHK, 2008), five amphibians and three reptiles were recorded within its study area. All these eight herpetofauna species are common and widespread in Hong

Kong which are not species of conservation interest. These species included Asian Common Toad *Bufo melanostictus*, Brown Tree Frog *Polypedates megacephalus*, Günther's Frog *Rana guentheri*, Paddy Frog *Fejervarya limnocharis*, Ornate Pigmy Frog *Microhyla ornate*, Chinese Striped Terrapin *Ocadia sinensis*, Checkered Keelback *Xenochrophis piscator* and Long-tailed Skink *Mabuya longicaudata*.

Seven common species were recorded in the XRL EIA (AECOM, 2009). All are common and widespread in Hong Kong.

In the WSW Biannual EM&A from November 2013 to April 2014 (MMHK, 2015), Chinese Bullfrog *Hoplobatrachus chinensis*, a species considered as of local concern by Fellowes *et al.* (2002), was recorded in WRA. A single record of Chinese Soft-shelled Turtle *Pelodiscus sinensis* was also recorded in the WRA in 2013 (MMHK, 2013-2016). This species is considered as of global concern (Fellowes *et al*., 2002) and found rare and localized in reservoirs and fishpond habitats in Deep Bay Area.

The list of amphibians and reptile species recorded in different habitats is provided in **Appendix 7.4**.

7.4.7 Butterfly

The habitat within the Project site is a developed / disturbed area with no vegetation and heavily disturbed by human activities. This habitat generally supports low diversity of butterfly community in Hong Kong. In addition, no over-wintering hotspot has been identified in the Northeast New Territories (Wong *et al*., 2004).

7.4.7.1 Literature Review

During the field survey for the WSW development EIA (MMHK, 2008), a total of 21 butterfly species was recorded within its study area. An uncommon species Danaid Egg-fly *Hypolimnas misippus* was recorded in the wetland habitat previously exist in the Project site and in agricultural land within the Study Area. This species is listed as of local concern (Fellowes *et al.* 2002). The wetland habitat no longer exists in the current Project site as it has been converted into developed / disturbed area.

In the WSW Biannual EM&A from November 2012 to October 2015 (MMHK, 2013-2016), all recorded species are common in Hong Kong.

A list of butterfly species recorded in different habitat within the Study Area is provided in **Appendix 7.5**.

7.4.8 Dragonfly

7.4.8.1 Literature Review

WSW development EIA (MMHK, 2008) reported a total of 19 dragonfly species in its study area. All are common and widespread species in Hong Kong. Scarlet Basker *Urothemis signata* is considered as of Local Concern by Fellowes *et al*. (2002), but has increased considerably in recent years and is now widespread in overgrown fishponds in the Deep Bay area (Wilson, 2004). The same species has also been recorded in the XRL EIA study in the grassland habitat in the Project Site, which is now converted into the Developed / Disturbed area.

In the WSW Biannual EM&A (MMHK, 2013-2016), Scarlet Basker *Urothemis signata* has been recorded in the WRA. Other than records of the above species of conservation interest, all recorded species were common in Hong Kong. No dragonfly species of conservation interest was recorded.

A list of dragonfly species recorded in different habitat within the Study Area the is provided in **Appendix 7.6**.

7.4.9 Freshwater fish and aquatic fauna

7.4.9.1 Literature Review

Referring to the WSW development EIA (MMHK, 2008) and XRL EIA (AECOM, 2009), the water channels surrounding the Project site were found to be polluted due to runoff from adjacent residential areas, garages

and open storages. However, the garages and open storages were no longer existed after the commencement of construction of the WSW development.

WSW development EIA (MMHK, 2008) reported a low diversity of five species of freshwater fish in the Project site and in the drainage channel by Palm Springs. The species community recorded is dominated by introduced species tolerant of highly disturbed habitats.

Four freshwater fish species were recorded in the water channel / ditch habitat near Mai Po Village in the XRL EIA (AECOM, 2009). All are common and introduced species.

WRA in WSW has been artificially stocked with a low diversity of freshwater fish to establish and maintain self-sustaining fish and shrimp communities within the restored wetland (MMHK, 2013-2016 & AEC, 2009). No species of conservation interest was recorded. **Table 7.4** summarised the fish species recorded in major habitats within the Study Area.

Table 7.4: Summary Table for Fish Species Recorded in Major Habitats within Study Area

Common Name	Scientific Name	Distribution in Hong Kong[1]	Level of Concern[2]	Wetlands existed in the Project Site[3,4,5]	Water channel / Ditch[6]	Wetland Restoration Area[6]
Tilapia sp.	*Oreochromis* sp.	Common	-	✓	✓	
Redbelly Tilapia	*Tilapia zillii*	Common	-		✓	
Snakehead Murrel	*Channa striata*	Uncommon but introduced	-	✓	✓	
Swampy Eel	*Monopterus albus*	Common	-	✓		
Catfish sp.	*Clarius* sp.	Common	-	✓	✓	
Common Carp	*Cyprinus carpio*	Not common but cultivated	-		✓	
Grass Carp	*Ctenopharyn-godon idellus*	-	-			✓
Edible Goldfish	*Carassius auratus*	Not common but cultivated	-		✓	✓
Mosquito Fish	*Gambusia affinis*	Common	-	✓	✓	✓

Notes for Table 7.4:

(1) Distribution in Hong Kong refers to AFCD. 2017.

(2) Level of Concern refers to Fellowes *et al*. 2002 - LC = Local Concern, RC = Regional Concern, PRC = Potential Regional Concern, PGC = Potential Global Concern, GC = Global Concern, Letter in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.

(3) Habitat no longer exists as these habitats are converted into developed / disturbed area within the construction site.

(4) Data based on WSW EIA report (MMHK, 2008).

(5) Data based on XRL EIA report (AECOM 2009).

(6) Data based on WSW Biannual EM&A (MMHK, 2013-2016).

7.5 Evaluation of Ecological Importance of Habitats and Species

Habitats identified within the Study Area were evaluated in accordance with the guidelines stipulated in Table (2) in Annex 8 of the EIAO-TM. Overall ecological values for each habitat type were ranked. Rankings start with the highest ecological value range from:

- High
- Moderate-high
- Moderate
- Moderate-low

- Low
- Very Low

7.5.1 Evaluation of Habitats

Ecological evaluation of each habitat within the Study Area (including Project site) is presented in **Table 7.5** to **Table 7.12**.

Table 7.5: Ecological Evaluation of Wetland Restoration Area

Criteria	Wetland Restoration Area
Naturalness	Artificial habitat created for wetland restoration
Size	Approx. 4.74ha in total
Diversity	Moderate plant species diversity but they are artificially planted; Moderate diversity for wetland fauna species
Rarity	Artificial wetland is common
Re-creatability	Re-creatable
Fragmentation	Not fragmented
Ecological linkage	Ecologically linked to surrounding fishponds
Potential value	Potential for further enhancement under active management
Nursery/ breeding ground	Breeding ground for wetland dependent birds, e.g. Little Ringed Plover, but not a significant breeding ground in general
Age	Around 5 years
Abundance/ Richness of wildlife	Moderate in bird abundance; Low in other terrestrial fauna
Ecological value	Moderate-high to Moderate

Table 7.6: Ecological Evaluation of Fishpond

Criteria	Fishpond
Naturalness	Artificial habitat created for cultivation of fish species, moderately disturbed by regular human activities related to fish farming
Size	Approx. 49.85ha in total
Diversity	Low plant species diversity due to regular disturbance Moderate to high faunal diversity
Rarity	Fishpond habitats are common in the northwest New Territories
Re-creatability	Re-creatable
Fragmentation	Not fragmented
Ecological linkage	Ecologically linked to adjacent wetlands throughout the Deep Bay area
Potential value	High potential for enhancement with a suitable management regime
Nursery/ breeding ground	Not a significant breeding ground
Age	Over 35 years
Abundance/ Richness of wildlife	Abundant and diverse wetland community, especially for birds
Ecological value	Moderate-high

Table 7.7: Ecological Evaluation of Abandoned Fishpond

Criteria	Abandoned Fishpond
Naturalness	Originally created for aquaculture, but have been abandoned for a number of years and have undergone succession.
Size	Approx. 12.14ha in total
Diversity	Low in flora diversity and moderate in fauna species diversity
Rarity	A common habitat in Hong Kong.
Re-creatability	Re-creatable
Fragmentation	Not fragmented

Criteria	Abandoned Fishpond
Ecological linkage	The abandoned fishponds within WCA have significant linkage with adjacent reedbed habitat and fish pond system in the Deep Bay Area and provide an important foraging and resting areas for the waterbirds. Other ponds showed some ecological linkage with adjacent fishponds and agricultural lands
Potential value	Fishponds within the WCA has high ecological potential if properly managed
Nursery/ breeding ground	No significant nursery or breeding ground known
Age	Over 35 years, abandoned probably fairly recently (15-20 years)
Abundance/ Richness of wildlife	High in bird diversity and abundance; low abundance in other faunal groups in general
Ecological value	Moderate-high

Table 7.8: Ecological Evaluation of Drainage Channel/Ditch

Criteria	Drainage Channel/Ditch
Naturalness	Man-made drainage ditches and water channels, including concrete-lined channels.
Size	Approx. 4.44ha in total
Diversity	Moderate-low flora and fauna diversity
Rarity	A common habitat in Hong Kong
Re-creatability	Readily re-creatable
Fragmentation	Generally not fragmented
Ecological linkage	Connected with abutting wetland habitats with interflow of wetland species
Potential value	The habitat value could be enhanced through implementation of green channel enhancement measures
Nursery/ breeding ground	Breeding ground for common amphibian and dragonfly species.
Age	Over 35 years, more recent at the sections modified for residential developments.
Abundance/ Richness of wildlife	Moderate abundance of common dragonfly species; wider channel section can be used by wetland birds
Ecological value	Moderate-low

Table 7.9: Ecological Evaluation of Marsh/Reedbed

Criteria	Marsh/Reedbed
Naturalness	Derived from natural succession in wetland habitats (fishponds and drainage channels)
Size	Approx. 4.22ha in Study Area
Diversity	Low plant species diversity and moderate-low faunal species diversity
Rarity	Similar areas of marsh are fairly common in the Deep Bay area
Re-creatability	Easily re-creatable where hydrological conditions are suitable
Fragmentation	Isolated patches with different conditions
Ecological linkage	Ecologically linked to nearby fishponds
Potential value	Could be improved by appropriate management, although the small size of the habitat patches limits the potential value
Nursery/ breeding ground	Not a significant breeding ground within the Study Area
Age	Fairly recently developed from other wetland habitats
Abundance/ Richness of wildlife	Moderate-low abundance of wildlife
Ecological value	Moderate-low

Table 7.10: Ecological Evaluation of Secondary Woodland

Criteria	Secondary Woodland
Naturalness	Natural habitat
Size	Approx. 0.55ha in Study Area
Diversity	Low plant and fauna species diversity

Criteria	Secondary Woodland
Rarity	Common habitat
Re-creatability	Moderate-low; 30-50 years to re-create
Fragmentation	Moderate; this habitat is fragmented by highways and other village development
Ecological linkage	Ecologically linked with adjacent wetland habitat through the ardeid's breeding activities, if presence
Potential value	Moderate-high value could be enhanced by suitable management
Nursery/ breeding ground	An active egretry was recorded from this habitat
Age	Most secondary woodland was established since 1945.
Abundance/ Richness of wildlife	Low in general, but high when it was used as egretry.
Ecological value	Moderate; high if in presence of active egretry

Table 7.11: Ecological Evaluation of Plantation

Criteria	Plantation
Naturalness	Man-made habitat
Size	Approx. 8.11ha in Study Area
Diversity	Low species diversity
Rarity	Common habitat
Re-creatability	Readily re-creatable
Fragmentation	These habitats are patchily created and fragmented by urban land uses
Ecological linkage	Low ecological linkage
Potential value	Low potential value at lowland areas in the vicinity of developed/disturbed area as the habitat is being maintained for landscape purpose
Nursery/ breeding ground	Not significant nursery/breeding ground
Age	10 to 20 years
Abundance/ Richness of wildlife	Low
Ecological value	Low

Table 7.12: Ecological Evaluation of Developed / Disturbed Area

Criteria	Developed/Disturbed Area within Project Site	Other Developed/Disturbed Area
Naturalness	Wholly man-made habitat	Wholly man-made habitat
Size	Approx. 16.00ha	Approx. 95.40ha in total
Diversity	Low in both fauna and flora species diversity	Low in both fauna and flora species diversity
Rarity	Common habitat	Common habitat
Re-creatability	Readily re-creatable	Readily re-creatable
Fragmentation	N/A	N/A
Ecological linkage	Habitat is not functionally linked to any high ecological value resources; no ecological linkage with the WRA	Habitat is not structurally or functionally linked to any high ecological value resources
Potential value	Currently a construction site, very low potential value due to high disturbance	Very low potential value due to high disturbance by human activities
Nursery/ breeding ground	Not nursery/breeding ground	Not nursery/breeding ground
Age	7 years	20-30 years
Abundance/ Richness of wildlife	Very Low	Low
Ecological value	Very Low	Low

7.5.2 Evaluation of Species of Conservation Interest

The species of conservation interest recorded were listed and tabulated in accordance with the criteria stated in Table (3) in Annex 8 in EIAO-TM. Evaluations of fauna species of conservation interest recorded within Study Area (including Project site) from literature review are presented in **Table 7.13**.

Table 7.13: Ecological Evaluation of Fauna Species of Conservation Interest recorded within the Study Area from Literature Review

Common Name	Scientific Name	Location	Source of information (1)	Conservation & Protection Status (2)	Distribution(3)	Rarity(4)
Avifauna						
Little Grebe	*Tachybaptus ruficollis*	Wetland existed within the Project site^, fishpond area, WRA	A,B,C,D	• LC	Widespread in ponds and pools	Present all year
Black-crowned Night Heron	*Nycticorax nycticorax*	Fishpond area, WRA, drainage channels/ ditches	A, B, C, D	• (LC)	Widespread	Common resident and migrant
Chinese Pond Heron	*Ardeola bacchus*	Grassland existed within the Project site^, fishpond area, WRA, drainage channels/ ditches	A, B, C, D	• PRC(RC)	Widespread	Common resident, winter visitor and migrant
Grey Heron	*Ardea cinerea*	Grassland and wetland existed within the Project site^, fishpond area, WRA, drainage channel/ ditches	A, B, C, D	• PRC	Widespread	Abundant winter visitor and scarce in summer
Striated Heron	*Butorides striata*	Fishpond area	A, D	• (LC)	Widespread	Uncommon resident
Purple Heron	*Ardea purpurea*	WRA	D	• RC	Deep Bay Area	Uncommon passage migrant
Great Egret	*Ardea alba*	Wetland existed within the Project site^, fishpond area, WRA, drainage channel /ditches	A, B, C, D	• PRC (RC)	Mainly in wetland, Deep Bay area	Abundant and present all year, migrants and winter visitors
Intermediate Egret	*Egretta intermedia*	Wetland existed within the Project site^, fishpond area, WRA	A, C, D	• RC	Mainly in freshwater wetlands in the Deep Bay area	Uncommon, present all year, rather few in summer
Little Egret	*Egretta garzetta*	Wetland and grassland existed within the Project site^, fishpond area, drainage channel, WRA	A, B, C, D	• PRC (RC)	Widespread	Abundant and present all year
Eastern Cattle Egret	*Bubulcus coromandus*	Wetland and grassland existed within the Project site^, fishpond area, WRA	A, B, C, D	• (LC)	Widespread	Common resident and migrant
Great Cormorant	*Phalacrocorax carbo*	Wetland existed within the Project site^, fishpond area, WRA	A, B, C, D	• PRC	Ponds and inshore waters, mainly in the Deep Bay area	Abundant winter visitor

Common Name	Scientific Name	Location	Source of information [1]	Conservation & Protection Status [2]	Distribution[3]	Rarity[4]
Black Kite	*Milvus migrans*	Fishpond area, WRA	A, B, C, D	• Cap. 586 • (RC) • Class (II)	Widespread	Abundant and present all year
Whiskered Tern	*Chlidonias hybrida*	Fishpond area, WRA	D	• LC	Deep Bay Area and coastal waters	Uncommon passage migrants
White-winged Tern	*Chlidonias leucopterus*	Fishpond area	D	• LC	Deep Bay Area and coastal waters	Uncommon passage migrants
White-throated Kingfisher	*Halcyon smyrnensis*	Wetland existed with the Project site^, fishpond area, WRA, drainage channel/ ditches	A, B, D	• (LC)	Widely distributed in coastal areas	Common and present all year
Pied Kingfisher	*Ceryle rudis*	Wetland existed with the Project site^, fishpond area, WRA	A, D	• (LC)	Fishpond and other wetland areas, especially Deep Bay	Common resident
Collared Crow	*Corvus torquatus*	Wetland existed with the Project site^, fishpond area	A, C, D	• LC • IUCN (NT)	Mainly in coastal areas	Locally common resident
Black-faced Spoonbill	*Platalea minor*	Wetland existed within the Project site^, fishpond area, WRA, drainage channels/ ditches	A, B, C, D	• PGC	Deep Bay wetland areas	Common winter visitor and regular summer records
Northern Pintail	*Anas acuta*	Wetland existed within the Project site^, fishpond area	A	• RC	Deep Bay area	Abundant winter visitor
Common Teal	*Anas crecca*	Wetland existed within the Project site^, fishpond area, drainage channels / ditches	A	• RC	Primarily in the Deep Bay area	Abundant but declining winter visitor and occasional summer records
Eurasian Wigeon	*Anas penelope*	Wetland existed within the Project site^, fishpond area, WRA	A, B, D	• RC	Deep Bay wetland areas	Abundant winter visitor
Osprey	*Pandion haliaetus*	Wetland existed within the Project site^, fish pond area	A, B, D	• RC	Wetland areas, mostly Deep Bay	Common winter visitor, with a few individuals over-summering
Tufted Duck	*Aythya fuligula*	WRA	D	• LC	Deep Bay area	Uncommon winter visitor
Northern Shoveler	*Anas clypeata*	WRA	D	• RC	Deep Bay area	Abundant winter visitor
Black-headed Gull	*Larus ridibundus*	Wetland existed within the Project site^, fishpond area	A	• PRC	Deep Bay and coastal waters	Abundant winter visitor
Yellow Bittern	*Ixobrychus sinensis*	Fishpond area, WRA	C, D	• (LC)	Mainly in Deep Bay reed marsh and mangrove	Common passage migrant in spring to summer with scarce winter record

Common Name	Scientific Name	Location	Source of information [1]	Conservation & Protection Status [2]	Distribution[3]	Rarity[4]
Cinnamon Bittern	*Ixobrychus cinnamomeus*	WRA	D	• LC	Freshwater wetland areas	Uncommon passage migrant and scarce summer visitor with occasional winter records
White-bellied Sea Eagle	*Haliaeetus leucogaster*	Fishpond area	A	• (RC) • Cap. 586	Coastal areas	Uncommon resident
Black-winged Kite	*Elanus caeruleus*	WRA	D	• LC	Open country	Uncommon visitor throughout the year
Crested Serpent Eagle	*Spilornis cheela*	WRA	D	• Cap. 586 • (LC) • CRDB (V) • Class (II)	Widespread	Locally common, present all year and probably largely resident in woodland
Eurasian Hobby	*Falco subbuteo*	WRA	D	• (LC)	Open country areas	Uncommon autumn passage migrant, scarce in spring and summer
Greater Spotted Eagle	*Clanga clanga*	WRA	D	• GC	Largely confined to the Deep Bay area	Locally common winter visitor
Peregrine Falcon	*Falco peregrinus*	Fishpond area, WRA	D	• LC	Widespread	Scarce resident and winter visitor
Eastern Imperial Eagle	*Aquila heliaca*	WRA	D	• GC • Cap. 586 • IUCN: Vu • CRDB: Vu	Deep Bay, Ma Tso Lung	Common winter visitor
Japanese Quail	*Coturnix japonica*	WRA	D	• LC	Open country, often agricultural areas	Uncommon autumn passage migrant and rare winter visitor
Baillon's Crake	*Porzana pusilla*	WRA	D	• LC	Marshland	Scarce passage migrant
Watercock	*Gallicrex cinerea*	WRA	D	• RC	Freshwater wetlands	Scarce passage migrant
Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	WRA	D	• LC	Freshwater marsh	Uncommon migrant and rare winter visitor
Greater Painted-snipe	*Rostratula benghalensis*	WRA	D	• LC	Freshwater marsh and wet agricultural areas	Locally common resident breeding species

Common Name	Scientific Name	Location	Source of information [1]	Conservation & Protection Status [2]	Distribution[3]	Rarity[4]
Black-winged Stilt	*Himantopus himantopus*	Fishpond area, WRA	C, D	• RC	Wetland areas and often freshwater	Common winter visitor and migrant
Pied Avocet	*Recurvirostra avosetta*	Fishpond Area, WRA	D	• RC	Deep Bay area, primarily intertidal areas	Abundant winter visitor
Oriental Pratincole	*Glareola maldivarum*	Grassland existed within the Project site^, fishpond area	A, D	• LC	Lowland areas of NT	Passage migrant, common in spring and uncommon in autumn
Pacific Golden Plover	*Pluvialis fulva*	WRA	D	• LC	Deep Bay, coastal and agricultural areas	Winter visitor
Kentish Plover	*Charadrius alexandrinus*	WRA	D	• RC	Deep Bay intertidal areas	Abundant winter visitor and scarce migrant with some summer records
Little Ringed Plover	*Charadrius dubius*	Wetland existed within the Project site^, fishpond area, WRA	A, B, D	• (LC)	Lowland areas near water	Common and present all year
Spotted Redshank	*Tringa erythropus*	WRA	D	• RC	Mainly the Deep Bay area	Common spring passage migrant, less common in autumn and winter
Common Redshank	*Tringa totanus*	WRA	D	• RC	Deep Bay intertidal areas	Abundant passage migrant and winter visitor
Common Greenshank	*Tringa nebularia*	WRA	D	• RC	Mainly the Deep Bay area	Abundant winter visitor and migrant mainly in spring
Wood Sandpiper	*Tringa glareola*	Fishpond area, WRA	D	• LC	Freshwater marshy areas	Common migrant and winter visitor
Marsh Sandpiper	*Tringa stagnatilis*	Fishpond area	C	• RC	Freshwater marshy areas	Common winter visitor and passage migrant
Sharp-tailed Sandpiper	*Calidris acuminata*	Fishpond area	D	• LC	Freshwater marshy areas	Common passage migrant
Pintail/ Swinhoe's Snipe*	*Gallinago stenura / G. megala*	WRA	D	• LC*	Freshwater marsh, wet agricultural areas and fish ponds	Common/scarce passage migrant, with highest numbers in autumn, scarce in winter

Common Name	Scientific Name	Location	Source of information [1]	Conservation & Protection Status [2]	Distribution[3]	Rarity[4]
Temminck's Stint	*Calidris temminckii*	WRA	D	• LC	Mainly the Deep Bay area	Common winter visitor and migrant
Greater Coucal	*Centropus sinensis*	Wetland existed within the Project site^, fishpond area	C	• CRDB: Vu	Widely distributed	Common resident
Eurasian Eagle Owl	*Bubo bubo*	WRA	D	• RC	Remote areas of hill slope grassland	Scarce and locally-distributed resident
Pacific Swift	*Apus pacificus*	Grassland and wetland existed with the Project site^, WRA, drainage channel, developed / disturbed area	A, D	• (LC)	Mainly the Deep Bay area and islands	Common spring passage migrant and summer visitor, some autumn, and a few winter records.
Red-throated Pipit	*Anthus cervinus*	Fishpond area	C	• LC	Lowlands, usually in wet areas	Common passage migrant and winter visitor
Buff-bellied Pipit	*Anthus rubescens*	WRA	D	• LC	Lowland wetland areas	Uncommon passage migrant and winter visitor
Pallas's Grasshopper Warbler	*Locustella certhiola*	WRA	D	• LC	Damp grassland and reed marsh areas, though occasionally found in urban parks and other open areas on migration	Common autumn passage migrant, scarce in spring and winter
Thick-billed Warbler	*Acrocephalus aedon*	WRA	D	• LC	Shrubland and reed marsh edge	Scarce autumn migrant
Zitting Cisticola	*Cisticola juncidis*	Grassland exited within the Project site^, WRA, fishpond area, drainage channel	A, B, C, D	• LC	Grassy and reed marsh areas	Common passage migrant and winter visitor
Chinese Penduline-Tit	*Remiz consobrinus*	WRA	D	• RC	Reed marshes, mostly in the Deep Bay area	Common autumn migrant and winter visitor
White-cheeked Starling	*Spodiopsar cineraceus*	WRA	B, D	• PRC	Open-country areas, particularly Deep Bay	Locally common winter visitor
White-shouldered Starling	*Sturnia sinensis*	Wetland and grassland existed with the Project site^, fishpond area, WRA	A, B, C, D	• (LC)	Open-country and village edge habitats mainly in the northwest New Territories	Locally common passage migrant and breeding species, and uncommon winter visitor
Red-billed Starling	*Spodiopsar sericeus*	WRA	A, B, C, D	• GC	Widely distributed	Common winter visitor

Common Name	Scientific Name	Location	Source of information (1)	Conservation & Protection Status (2)	Distribution(3)	Rarity(4)
Grey Bush Chat	*Saxicola ferreus*	Grassland existed within the Project site^	B	• LC	Open cultivated fields	Scarce passage migrant and winter visitor
Black-naped Oriole	*Oriolus chinensis*	WRA	D	• LC	Open woodland areas	Passage migrant, common in autumn and scarce in spring
Mammals						
Small Asian Mongoose	*Herpestes javanicus*	WRA	D	• Cap.170	Fairly widespread	Uncommon
Japanese Pipistrelle	*Pipistrellus abramus*	Wetland existed within the Project site^, WRA	A, D	• (LC) • Cap. 170	Widely distributed	Very common
Short-nosed Fruit Bat	*Cynopterus sphinx*	Wetland existed within the Project site^	A, B	• Cap. 170	Widely distributed	Very common
Indetermined Species of Bat	-	WRA	D	• Cap. 170	-	-
Leopard Cat	*Prionailurus bengalensis*	Fishpond area	D	• Cap. 170 • CDRB (Vu)	Widely distributed	Uncommon
Herpetofauna						
Chinese Bullfrog	*Hoplobatrachus chinensis*	WRA	D	• PRC • Class (II)	Widespread in New Territories and Lantau Island	Fairly common
Chinese Soft-shelled Turtle	*Pelodiscus sinensis*	WRA	D	• GC • Cap. 170 • IUCN: Vu • CRDB: Vu	Reservoirs and Fishpond in Deep Bay Area	-
Butterfly						
Danaid Egg-fly	*Hypolimnas misippus*	Wetland existed within the Project site^	A	• LC	Common in areas with abandoned fish ponds	Common
Dragonfly						
Scarlet Basker	*Urothemis signata*	Water channel/ ditches, WRA	A, B, D	• LC	Common in areas with abandoned fish ponds	Common

Notes:
(1) Source of information refers to A = WSW EIA; B = XRL EIA; C = XRL EM&A; D = WSW Biannual EM&A
(2) Abbreviations for Protection and Conservation Status:
Cap. 170 – Listed in Wild Animals Protection Ordinance;
Cap. 586 – Listed in Protection of Endangered Species of Animals and Plants Ordinance;
Level of Concern refers to Fellowes *et al*., 2002: LC = Local Concern, RC = Regional Concern, PRC = Potential Regional Concern, PGC = Potential Global Concern, GC = Global Concern. Letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence;
IUCN – IUCN Red List of Threatened Species (Version 2016.3); EN = Endangered, VU = Vulnerable, NT = Near Threatened;
CRDB refers to Zheng & Wang 1998, Zhao 1998; E = Endangered, V = Vulnerable, R = Rare, I = Indeterminate;
CSMPS refers to State Forestry Administration and Ministry of Agriculture, 1988; CSMPS (II) = Class II Protected Species
(3) & (4) Distribution and Rarity refers to: Avifauna: AFCD, 2017; Allcock *et al*., 2013; Mammal: Bats – Shek and Chan, 2006; Non-flying mammals – Shek *et al*., 2007; Amphibian: Chan *et al*., 2005; Butterfly: AFCD, 2017

* Species generally inseparable in field. Conservation status assessment refers to Swinhoe's Snipe *G. megala*
^ Habitat no longer exists as these habitats are converted into Developed / Disturbed Habitat within the construction site.

7.6 Identification and Evaluation of Ecological Impacts

This section identifies and evaluates the potential ecological impacts on habitats and species, caused by the proposed works during the construction, operation and decommissioning phases. It is worth noting that the works for the STP will be undertaken within the existing WSW development works site, which is no longer a natural habitat.

The major construction elements will include site formation, basement excavation, foundation works, superstructure construction and laying of associated piping network inside the existing construction site for WSW development within the Project site. Construction of the Project is targeted to commence in Q3 2018 and complete by 2021 in time for occupation of the WSW development. Construction method and programme of the Project is described in Chapter 2. The Project will be decommissioned once the planned public sewer on Castle Peak Road is available while the structure of the STP and its associated infrastructure will only cease operation but not be demolished.

The water quality impact due to operation of the onsite STP including onsite reuse of reclaimed water, discharge of reclaimed water and emergency discharge of sewage from the onsite STP has been assessed in Chapter 5 which identified no adverse impact on water quality.

The potential impacts described below were evaluated in accordance with the criteria stipulated in Annexes 8 and 16 of the EIAO-TM and technical requirements given in Appendix F of the EIA Study Brief No. ESB-289/2015.

7.6.1 Construction and Decommissioning Phases

The Project site is confined to the existing construction site boundary of the Proposed Comprehensive Development at Wo Shang Wai. Construction for the residential part and STP will be conducted simultaneously, thus the project site is currently a works area with daily construction activities. The mitigation measures provided for the residential portion of the development such as noise and visual mitigation could also help mitigate impact due to this Project.

7.6.1.1 Direct Ecological Impacts on Habitat due to the Project

Since the Project site is confined to the existing construction site boundary with daily construction activities and no natural habitat remains, no primary direct impact, in terms of additional habitat loss is anticipated due to the Project.

In decommissioning phase, the infrastructure installed for STP will be ceased but not demolished, thus the associated ecological impact is negligible.

7.6.1.2 Direct Ecological Impact on Species of Conservation Interest due to the Project

Twenty-five bird species, one mammal species, one butterfly species and one dragonfly species of conservation interest were recorded within the Project site in the WSW development EIA, XRL EIA, XRL EM&A programme and biannual EM&A report for WSW. Due to the current residential development in WSW, the grassland and wetland habitats previously exist in the Project site have already been converted into developed / disturbed area, and thus no primary direct impact to the species of conservation interest associated with the above habitats is anticipated due to this Project.

7.6.1.3 Indirect Ecological Impacts to Offsite Habitat

Given the limited ecological resources in the developed / disturbed area habitat, the potential direct and indirect ecological impacts due to disturbance from human activities, traffic noise and operating machinery during the construction and decommissioning phases of the Project are considered to be minor. It is noted that the construction activities for the STP is minor, thus the potential impact on noise and air quality is controllable, especially with various noise barrier and site hoarding currently in place for the WSW development which have minimized the impact to adjacent environment. The predicted indirect ecological impacts due to aboveground

works proposed under the Project to the adjacent wetland habitats during the construction and decommissioning phases are elaborated below.

Wetland Habitats in Inner Deep Bay area

Wetland habitats in Inner Deep Bay area are considered as of conservation interest. The wetland habitat outside the Project site comprises of a number of fish ponds and water channel/ditch. With adequate separations from the Project boundary to the nearby offsite wetland habitats and Mai Po Inner Deep Bay Ramsar Site as well as implementation of good site practices outlined in ProPECC Note PN1/94 to minimise site surface runoff from construction works areas, and to control the dispersion of sediments and contaminants to inland waters (as mentioned in **Section 5.6**), disturbance to offsite wetland habitats is considered as negligible. Furthermore, the concern on ground water drain down is also negligible as the excavation works for the basement is relatively minor.

Wetland Restoration Area (WRA) within the Study Area

WRA within the WSW development outside the Project site is considered as habitats with conservation interest referring to Section 2(v)(b) of Appendix F of the EIA Study Brief. The WRA is linked to the surrounding wetland habitat. As the construction work is relatively small in scale, with implementation of good site practices outlined in ProPECC Note PN1/94 to minimise site surface runoff from construction works areas and to control the dispersion of sediments and contaminants to inland waters (as mentioned in **Section 5.6)**, disturbance to offsite wetland habitats is considered as negligible (as summarised in **Table 7.14**). It is noted that mitigation measures have been implemented for the current construction activities for the WSW development with no adverse impact shown to the WRA, which suggested that the mitigation measures implementing are effective with no adverse indirect impact to the WRA.

Potential changes in water quality as a result of surface runoff are taken into account for identification of any potential indirect ecological impacts, as specified in Section 2(vi)(a) of Appendix F of the EIA Study Brief. As no adverse water quality impacts are anticipated with the adoption of good site practices, the potential indirect ecological impacts as a result of construction activities from the construction works area is also considered negligible (as summarised in **Table 7.14**).

Table 7.14: Evaluation of Indirect Ecological Impact on Habitats

Criteria	Indirect Impact on Wetland Habitats in Deep Bay Area	Indirect Impact on WRA
Habitat quality	Moderate low to moderate high	WRA is well managed for ecological enhancement. It supported moderate wetland associated fauna and plant species diversity.
Species	These habitats supported considerable amount of migratory birds population as well as several internationally protected bird species. Mainly riparian vegetation, flora and fauna species, wetland-dependent birds, dragonfly and amphibian species.	Constant record of protected target species of conservation interest. Mainly riparian vegetation, flora and fauna species, wetland-dependent bird, dragonfly and amphibian species
Size / Abundance	This area accounts for 62.83 ha within the Study Area. The general species diversity in this habitat is moderate to high.	This area is of 4.74 ha. It supported a high diversity of wetland associated bird with 127 species recorded since completion of site formation, of which 85 of them are species of conservation interest (MMHK, 2013-2016), but the quantity is relatively low compared to the Deep Bay population.
Duration	Disturbance to these wetlands is expected only during construction phase if without mitigation in place.	Disturbance to the WRA is expected only during construction phase if without mitigation in place.
Reversibility	Construction phase disturbance would be reversible.	Construction phase disturbance would be reversible.
Magnitude	Scale of disturbance impacts is potentially small due to the existing mitigation measures at the construction site to contain water and sediment within the site for removal. And various noise barrier and site hoarding currently in place also	Scale of disturbance impacts is potentially small due to the existing mitigation measures at the construction site to contain water and sediment within the site for removal. And various noise barrier and site hoarding currently in place also help minimize the noise impact to adjacent habitat.

Criteria	Indirect Impact on Wetland Habitats in Deep Bay Area	Indirect Impact on WRA
	help minimize the noise impact to adjacent habitat.	
Overall Impact Evaluation	Minor No adverse ecological impact is predicted.	Minor No adverse ecological impact is predicted.

Egretries

Two Egretries are located near the Project site. It is noted that construction activities are being undertaken for the WSW development. There was no sign of disturbance to the breeding activities of the ardeids during the WSW development and the XRL construction activities. Thus, the minor construction works for the STP which is taken place in the Project site as part of the WSW development will unlikely cause additional disturbance impact to the egretries. The impact evaluation is presented in **Table 7.15**.

Table 7.15: Evaluation of Indirect Ecological Impact on Egretries

Criteria	Disturbance Impact on Egretries
Habitat quality	Two active egretries located at Mai Po Village and Mai Po Lung Village provided breeding ground for ardeids during the breeding season.
Species	Two ardeid species of conservation interest Little Egret *Egretta garzetta* and Chinese Pond Heron *Ardeola bacchus* nest and breed in the egretries.
Size / Abundance	Breeding colonies in the two egretries are representative during the breeding season.
Duration	Limited to the breeding season (April to July) or the active egretries.
Reversibility	Construction phase disturbance would be short term and reversible.
Magnitude	Minimal
Overall Impact Evaluation	Minor given the far distance from the egretries and the Project site is currently a construction site not suitable for ardeids use.

7.6.1.4 Indirect Ecological Impacts to Fauna Species of Conservation Interest

Species of Conservation Interest in Study Area

Within the Study Area, a total of 67 bird species, five mammal species, two herpetofauna species, one butterfly species and one dragonfly species of conservation interest were previously recorded (as summarised in **Table 7.13**). A number of the fauna species of conservation interest was recorded in the WRA and fishpond habitats. These fauna species are potentially impacted by disturbance during the construction phase without mitigation measures. In addition to good site practices and implementation of mitigation measures, precautionary measures for various environmental aspects in general, such as dust control, selection of quieter plant, use of movable noise barrier, in combination of the waste management and water quality monitoring programme, have been proposed in relevant chapters. Given the relative minor scale of the construction works in developed / disturbed area, the associated disturbance impact to fauna species of conservation interest is minor. The impact evaluation is presented in **Table 7.16.**

Table 7.16: Evaluation of Indirect Ecological Impact on Fauna Species of Conservation Interest

Criteria	Disturbance Impact on Fauna Species of Conservation Interest
Habitat quality	Qualities of habitats where fauna species of conservation interest recorded ranged from low to moderate-high
Species	67 bird species, five mammal species, one amphibian species, one reptile species, one butterfly species, one dragonfly species of conservation interest recorded within the Study Area.
Abundance	Numbers of most species present in the Project site are relatively low in comparison to Deep Bay populations.

Criteria	Disturbance Impact on Fauna Species of Conservation Interest
Duration	Construction phase
Reversibility	Potential disturbance impact is short term and reversible.
Magnitude	Minor for the species of conservation interest within the Project site and minor magnitude of off-site disturbance impact on fauna species within the Study Area.
Overall Impact Severity	Minor impact on the fauna species of conservation interest.

7.6.2 Operation Phase

The operation of the Project may impose potential indirect impact of air quality or noise due to the STP and sludge generated, and fixed plant noise from the operation of the STP. However, the interim on-site STP and associated treated effluent reuse facility are designed to be enclosed, small scaled and primarily located underground. Odour will be removed before emitting into open air by the high efficiency deodorizer with a forced ventilation system. There would be insignificant odour impacts anticipated and no other emissions during the operation phase of the Project would be anticipated. For fixed plant noise impact during the operation phase, with the proper design of the STP and implementation of the recommended noise mitigation measures including the control of maximum allowable sound power levels at source by installation of silencer, the potential noise impacts will be insignificant. Since the Project site is relatively low in ecological value and the above ground STP building would be well separated from the WRA and other wetland habitats to the north by the future residential houses under the WSW Development, the disturbance impact due to noise and odour emission is anticipated to be negligible in operation phase. The impact evaluation is presented in **Table 7.17**.

Table 7.17: Evaluation of Disturbance Impact during Operation Phase

Criteria	Disturbance Impact during Operation Phase
Habitat quality	Qualities of habitats ranged from very low to moderate-high
Species	Flora and fauna species utilizing the habitats near the Project site
Abundance	Relatively low compared to Deep Bay Area
Duration	Throughout operation phase
Reversibility	Reversible
Magnitude	Minor, owing to relatively low abundance of fauna and adequate separation from the WRA and other wetland habitat; no unacceptable emission of air or noise.
Overall Impact Severity	Negligible

7.6.2.1 Indirect Impact due to treatment of sewage effluent to aquatic habitat

As described in **Chapter 5** of this report, sewage generated by the WSW development is proposed to be handled by an STP until the government trunk sewer is available. reclaimed water from the onsite STP would be fully reused onsite. Contingency and emergency measures have been proposed to minimize the likelihood and frequency of excess reclaimed water and sewage from discharging into the Deep Bay Area (as mentioned in **Section 5.6.2**). With a comprehensive contingency program and careful implementation of the specifications stipulated by statutory standards (as mentioned in **Section 5.5.2.5**), no offsite discharge of effluent would be anticipated during the normal operation, the disturbance impact to identified offsite aquatic habitats within the Study Area is thus considered to be negligible. The impact evaluation is presented in **Table 7.18**.

Table 7.18: Evaluation of Indirect Ecological Impact to Aquatic Habitats during Operation Phase

Criteria	Indirect Ecological Impact to Aquatic Habitats during Operation Phase
Habitat quality	Qualities of aquatic habitats ranged from moderate-low to moderate-high
Species	The fauna species utilizing the adjacent aquatic habitat, including water channels and ditches.
Abundance	Low and dominated by common species tolerant of polluted conditions.
Duration	Throughout operation phase.
Reversibility	Reversible

Criteria	Indirect Ecological Impact to Aquatic Habitats during Operation Phase
Magnitude	Minor, owing to a comprehensive list of contingency programs to be imposed to avoid offsite discharge of effluent; no unacceptable discharge of effluent into the Deep Bay Water Control Zone is anticipated.
Overall Impact Severity	Negligible

7.6.3 Cumulative Impact

A total of two projects located within the Study Area of this Project is identified as concurrent projects. These projects include:

- Comprehensive Development at Wo Shang Wai, Yuen Long (WSW Development); and
- Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL).

It is noted that the extent of the construction works for the proposed Project represent a part of the WSW development, which is currently a construction site with very low ecological value. Given the small scale and localized nature of works, the cumulative impact on top of the concurrent projects is insignificant. The cumulative impact due to the XRL is insignificant as the whole project is targeted to complete in third quarter in 2018, whilst the relevant part of the work in Wo Sang Wai have been completed by the time this EIA report is prepared.

7.7 Precautionary and Mitigation Measures

7.7.1 Precautionary Measures for Minimization of Indirect Disturbance on Ecology

Mitigation measures for air quality, noise, water quality, waste and landscape aspects proposed in respective sections of this EIA Report could serve as precautionary measures to prevent and minimize any indirect disturbance impact on pollution arisen from the construction and decommissioning activities as well as operation of the STP and associated effluent reuse facility on the local ecology and offsite habitats. These measures include dust control measures, selection of quieter plants, use of movable noise barriers, good site practices for waste and wastewater handling, surface runoff control measures and landscape buffer planting etc., according to relevant sections of this EIA Report. No ecological specific mitigation measure is considered necessary.

The Project site is currently situated in the construction site for the WSW development. Some of the mitigation measures suggested above have been in place already and will continue to function for this EIA project also.

7.8 Evaluation of Residual Ecological Impact

The project would result in minor / negligible indirect impacts on nearby wetland habitats and associated fauna. As no significant ecological impact is identified for construction, operation and decommissioning phases, while no specific mitigation measure for ecology is required, significant residual impact is not anticipated.

7.9 Environmental Monitoring and Audit Requirements

No ecological specific mitigation measure is proposed but the mitigation measures for air, noise, water, waste and landscape aspects proposed in respective sections which are indirectly beneficial to the local ecology shall be checked as part of the environmental monitoring and audit procedures during construction period as presented in the standalone EM&A Manual. No specific ecological monitoring and audit programme is considered necessary.

7.10 Summary

The Project site is currently a construction site dominated by developed/disturbed area forming part of the WSW development. No flora and fauna species of conservation interest present in the Project site and the area is generally not ecologically significant owing to the developed/disturbed area nature in the Project site.

Ecological impact to adjacent habitat due to air quality, noise and groundwater impact is minor owing to the minor scale of works involved. Although the fishponds within the Inner Deep Bay and WRA are important for wildlife, with the implementation of good site practices to minimise site surface runoff from construction works areas and to control the dispersion of sediments, and contaminants to inland waters, disturbance to offsite wetland habitats is considered negligible.

No significant ecological impact will be resulted from the operation of the Project as all potential air quality, noise and water quality impacts will be controlled to environmentally acceptable levels. Two concurrent projects are identified but owing to the limited extent of the construction activities, no cumulative impact is identified. No ecological specific mitigation is considered necessary for the proposed Project.

7.11 References

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8 Landscape and Visual Impact

8.1 Introduction

This section assesses the likely landscape and visual impacts that may arise from the construction and operation of the Project and associated works and proposes strategic mitigation measures to alleviate the anticipated potential impacts. This includes the description of Landscape Resources (LRs), Landscape Character Areas (LCAs) and Visually Sensitive Receivers (VSRs). The potential landscape and visual impacts are assessed in accordance with the criteria and guidelines stated in Annexes 10 and 18 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM). Mitigation measures were proposed to mitigate the potential adverse impacts to an acceptable level.

8.2 Relevant Legislation, Standards and Guidelines

The environmental legislations, standards and guidelines below are relevant to the landscape and visual baseline survey for the Project:

- Environmental Impact Assessment Ordinance (Cap.499.S.16) – Technical Memorandum on EIA Process (EIAO-TM), particularly Annexes 3,10, 11, 18, 20 and 21;
- Environmental Impact Assessment Ordinance Guidance Note (EIAO GN) No. 8/2010;
- Forests and Countryside Ordinance (Cap.96);
- Town Planning Ordinance (Cap.131);
- Protection of Endangered Species of Animals And Plants Ordinance (Cap. 586);
- Environment, Transport and Works Bureau Technical Circular (Works) No. 29/2004 - Registration of Old and Valuable Trees, and Guidelines for their Preservation;
- Guidelines on Tree Preservation during Development by DEVB;
- Lands Administration Office Practice Note No. 7/2007 - Tree Preservation and Tree Removal Application for Building Development in Private Projects;
- Guideline for Tree Risk Assessment and Management Arrangement by DEVB (8th edition);
- Hong Kong Planning Standards and Guidelines, particularly Chapter 4, Chapter 8 and Chapter 11; and
- Study on Landscape Value Mapping of Hong Kong.

8.3 Assessment Methodology

Potential landscape and visual impacts arising from the Project are assessed in accordance with the requirements as stipulated in EIAO GN No. 8/2010. The assessment also follows the requirements as stipulated in Appendix G of the EIA Study Brief No. ESB-289/2015.

8.3.1 Study Area

The Study Area for landscape impact assessment is shown in **Figure 8.1**. It includes all areas within a 100m distance from the site boundary of the Project as defined in Paragraph 3.4.8.2 of the EIA Study Brief No. ESB-289/2015. The aerial view of the Study Area for landscape impact assessment is shown in **Figure 8.2**.

The Study Area for visual impact assessment is defined by the visual envelope of the Project. By definition of EIAO GN No. 8/2010, the visual envelope is generally the viewshed formed by natural or manmade features such as ridgeline or building blocks. It contains areas which are fully, partially visible or unseen from the Project and its associated works. The zone of visual influence (ZVI), which is illustrated in **Figure 8.3**, is defined as the portion of the visual envelope where views of the above-ground structure of the Project could potentially be seen by VSRs.

8.3.2 Review of Planning and Development Control Framework

A review of the existing planning studies and documents has been undertaken to gain an insight to the future outlook of the area affected so as to assess whether the Project can fit into surrounding setting. The assessment does not consider all of the areas zoned on the relevant OZP(s) but focuses on those that may be directly affected by the proposed works. The study reviews the following information:

- Plan title/number;
- Land use zonings;
- Potential impacts and approximate area of the land use zones to be affected by the Project;
- Design and conservation intention; and
- Mitigation measures and future outlook of the area.

8.3.3 Landscape Baseline Survey

LRs and LCAs identified are numbered and assessed by a combination of desktop studies and site surveys.

Landscape elements that are in consideration include:

- Local topography;
- Woodland extent and type;
- Other Vegetation types;
- Built form;
- Patterns of settlement;
- Land use;
- Scenic spots;
- Details of local materials, styles, streetscapes, etc.;
- Prominent watercourses; and
- Cultural and religious identity.

After identification of baseline LRs and LCAs, each of the LRs and LCAs is analyzed and evaluated by the following factors.

Sensitivity of landscape framework

To analyze sensitivity, a number of factors need to be evaluated. These factors include:

- the quality, maturity, condition and value of LRs or LCAs;
- importance and rarity of LRs or LCAs;
- whether the site is considered to be of local, regional, national or global significance;
- any statutory or regulatory limitations or requirements relating to the LRs or LCAs on this site; and
- ability of LRs and LCAs to accommodate change.

The above factors are considered and analyzed before each of the LRs and LCAs is classified into the following three categories:

High: LR or LCA has a distinctive character or is of high importance and sensitive to relatively small changes.

Medium: LR or LCA has a moderately valued landscape character that is reasonably tolerant to change.

Low: LR or LCA has a low-valued landscape character that is highly tolerant to change.

8.3.4 Landscape Impact Assessment

Magnitude of change on landscape impact arising from the Project

A number of factors can influence the magnitude of change on landscape impact. They are as follows:

- duration of impact, i.e. whether it is temporary or long-term;
- scale of impact;
- reversibility of change; and
- compatibility of the Project and associated works with existing and planned landscape.

The above factors will be analyzed carefully and the results of each of the LRs and LCAs will be classified into four different categories. They are as follows:

Large: Landscape resource or area will have a major change

Intermediate: Landscape resource or area will have a moderate change

Small: Landscape resource or area will have a slight change

Negligible: Landscape resource or area will have no discernible change

It should be noted that the landscape impact assessment for construction phase and operation phase is conducted separately due to the different potential sources affecting the magnitude of change on landscape impacts.

Evaluation of the sensitivity and magnitude of change on various LRs and LCAs is conducted in a logical, reasonable and consistent manner for both construction and operation phases. Each of the LRs and LCAs is given a degree of impact significance depending on the severity of sensitivity and magnitude. **Table 8.1** illustrates the underlying principle for each of the four significance thresholds.

Table 8.1: Sensitivity and Magnitude of Change on the Degree of Impact Significance

Magnitude of Change	Sensitivity		
	Low	Medium	High
Large	Moderate	Moderate / Significant	Significant
Intermediate	Slight / Moderate	Moderate	Moderate / Significant
Small	Slight	Slight / Moderate	Moderate
Negligible	Insubstantial	Insubstantial	Insubstantial

Notes:
Significant – Adverse / beneficial impact where the Project would cause significant deterioration or improvement.
Moderate – Adverse / beneficial impact where the Project would cause noticeable deterioration or improvement.
Slight – Adverse / beneficial impact where the Project would case barely noticeable deterioration or improvement.
Insubstantial – The Project would cause no discernible change.

8.3.5 Broad Brush Tree Survey

To facilitate landscape impact assessment, a broad brush tree survey was conducted to identify all tree groups within the Study Area for landscape impact assessment.

In accordance with Lands Administration Office Practice Note No. 7/2007 - Tree Preservation and Tree Removal Application for Building Development in Private Projects, a plant is considered as a “tree” if its trunk diameter measures 95 mm or more at a height of 1.3 m (i.e. Diameter at Breast Height, DBH) above the ground level. Measurement of DBH follows the methodology specified in Nature Conservation Practice Note No. 02 – Measurement of Diameter at Breast Height (DBH) issued by Agriculture, Fisheries and Conservation Department in June 2006.

The identification of registered Old and Valuable Tree (OVT) and potentially registrable OVT refers to Environment, Transport and Works Bureau Technical Circular (Works) (ETWB TCW) No. 29/2004 – Registration of Old and Valuable Trees, and Guidelines for their Preservation.

Trees are surveyed in groups and the boundary of tree groups is generally defined by their outermost crown spread of the sharing canopies of the trees. For those trees sparsely distributed throughout a habitat, the tree group is defined by the boundary of the topographical feature (such as slope) / habitat type (such as grassland).

Tree groups in large size are sub-divided into smaller polygons to prevent overlooking. For ease of reference, an identity number is given for each tree group.

All the surveyed tree groups are recorded with the following information, with photographic record provided:

- Tree Group Number;
- Estimated Quantity of Trees in the Tree Group;
- Species (Scientific Name and Chinese Common Name);
- Species proportion within the Tree Group with various range of Diameter at Breast Height (DBH);
- Average Height (in m);
- Average Crown Spread (in m);
- Health Condition;
- Tree Form;
- Amenity Value; and
- Special Features (if any, recorded in Remarks).

In the tree survey, all the trees are assessed and evaluated in accordance with the following criteria for health, tree form, amenity value and suitability for transplanting:

Health Condition:	Estimated according to the foliage, branches, trunk and exposed roots.
Good	Without any visible disease or defect, sound and healthy tree
Fair	With few visible defects or health problem
Poor	With many visible defects or health problem such as rot, cavities in the main trunk, insect or fungi attack, lack of vigor and crown die back, etc
Tree Form:	Estimated according to the canopy, branch and trunk.
Good	Well-balanced canopy and straight strong trunk(s) without major branch failure
Fair	Slightly unbalanced canopy and non-straight trunk(s)
Poor	Heavily leaning, unbalanced canopy, poor branching

Special attention is given to significant trees such as tree of species of conservation importance and trees of mature sizes. Individuals or groups of these concerned trees are surveyed separately.

8.3.6 Impact Assessment on Trees

The extent of each surveyed tree group is clearly demarcated on a tree survey plan. The tentative boundary of the works area is overlaid onto the tree survey plan. The percentage of area of each tree group which falls within the works area is then calculated and used to estimate the approximate number of trees that will potentially be affected by the Project within each tree group.

Any significant trees which are within the tentative boundary of the works area and likely to be affected by the Project are also highlighted.

8.3.7 Visual Baseline Survey

All VSRs within the identified ZVI are identified. Each of the VSRs is given an identity number and used in all relevant tables and figures. Type of VSRs is classified according to the activities, the number, availability of alternative views, duration and frequency of the view and the degree of visibility from a sensitive receiver's point of view. In general, the type of receivers can be separated into five categories:

- **Residents** - These VSRs can view the impact from their homes. They are considered to be highly sensitive as their visual perception has a substantial effect on their quality of life and home environment.
- **Workers** – These VSRs can view the impact from their workplace or school. They are considered to be moderately sensitive as the visual perception is less important and has a lesser effect on their quality of life. The degree of impact is dependent on the type of workplace, i.e. industrial, retail or commercial.

- **Outdoor leisure activity participants** – These VSRs can view the impact whilst taking part in an outdoor leisure activity. The degree of sensitivity is denoted by the type and duration of the leisure activity.
- **Travelers** – These VSRs can view the impact whilst travelling to another location. The degree of sensitivity is dependent on the duration and speed of their travel.
- **Community** – These VSRs can view the impact whilst in a community building. The degree of sensitivity is dependent on the type of activities and services that takes place.

Sensitivity of Visually Sensitive Receivers

To analyze sensitivity of VSRs, a number of factors need to be evaluated. These factors include:

- Value and quality of existing views;
- Availability and amenity of alternative views;
- Type of VSRs
- Number of VSRs;
- Duration and frequency of view; and
- Degree of visibility.

The above factors are considered and analyzed before each of the VSRs is classified into the following three categories:

High: The VSRs are highly sensitive to any changes in their visual experience.

Medium: The VSRs are moderately sensitive to any changes in their visual experience.

Low: The VSRs are slightly sensitive to any changes in their viewing experience.

8.3.8 Visual Impact Assessment

Magnitude of Change on views of VSRs arising from the Project

Magnitude of change for VSRs is evaluated by a number of different factors such as:

- Duration of impact, i.e. whether the impact is temporary or permanent;
- The number of sensitive receivers;
- Reversibility of the impact;
- Scale and distance of the impact from the viewer;
- Degree of visibility of the impact; and
- Compatibility of the project with the surrounding landscape.

The above factors are carefully analyzed and classified in the following categories:

Large: The VSRs will suffer a major change in their visual experience

Intermediate: The VSRs will suffer a moderate change in their visual experience

Small: The VSRs will suffer a slight change in their visual experience

Negligible: The VSRs will suffer no discernible change in their visual experience

The visual impact assessment is conducted individually for the construction phase and operation phase due to the disparate visual experience from different potential sources of visual impact from this Project and its associated works.

Evaluation of the sensitivity and magnitude of VSRs is conducted in a logical, reasonable and consistent manner for both construction and operation phases. Each of the VSRs is given a degree of visual impact significance depending on the severity of sensitivity and magnitude. The rationale for categorizing the degree of visual impact significance into four thresholds is illustrated in **Table 8.1**.

8.3.9 Recommended Mitigation Measures

After identifying the LRs, LCAs and VSRs that require mitigation measures to reduce the degree of impact, possible mitigation measures that can be implemented for the Project and its associated works will be reviewed and evaluated. Identification of potential mitigation measures may include:

- Alternative design or revisions to basic engineering or architecture design to prevent or minimize adverse impacts;
- Remedial measures during and after construction phase; and
- Compensatory measures for unavoidable adverse impacts and attempt to generate beneficial long term impacts.

Recommended mitigation measures are evaluated for comparison before adopting as mitigation or compensatory measures. This is conducted through evaluating possible mitigation measures by the degree of residual impact assessment to illustrate mitigation effectiveness.

8.3.10 Assessment of Residual Impact

Residual impacts are evaluated by the sensitivity and magnitude of change for LVIA after the implementation of proposed mitigation measures. Overall assessment of residual landscape and visual impacts for the Project is placed into one of the following five thresholds:

- **Beneficial** – The Project complements the landscape and visual character of its setting and follows the relevant planning objectives. It will improve overall landscape or visual quality.
- **Acceptable** – There are no significant effects on landscape or visual effects caused by this Project.
- **Acceptable with mitigation measures** – There will be some adverse effects that may be eliminated, reduced, or offset by specific mitigation measures.
- **Unacceptable** – The adverse effects are considered to be excessive with implemented mitigation measures.
- **Undetermined** – Significant adverse effects are likely but the extent of which they occur or may be mitigated cannot be determined from this study. Further detailed study may be required.

8.4 Baseline Survey Findings

8.4.1 Review of Development Control Framework

A review of the existing and planned development for the proposed works and for the surroundings has been undertaken. It aims in identifying issues with neighbouring planned land uses, identifying potential resources and sensitive receivers and ensuring a high compatibility between the Project and the surroundings.

The assessment covers areas shown on the approved Mai Po & Fairview Park OZP No. S/YL-MP/6. Zoning in this OZP is overlaid onto the Study Area and illustrated in **Figure 8.4**.

A review on this OZP reveals that the Project site is within the Other Specified Uses (Comprehensive Development to include Wetland Restoration Area) “OU(CDWRA)” zone, while the rest of the landscape Study Area is covered by Residential (Group C) “R(C)” zone, Village Type Development “V” zone, Open Space “O” zone, Other Specified Uses (Comprehensive Development to include Wetland Restoration Area) “OU(CDWRA)” zone and Conservation Area “CA” zone. The proposed construction of a Sewage Treatment Plant with associated works is considered “Utility Installation for Private Project” which is a land use under Column 2 (Uses that may be permitted with or without conditions on application to the Town Planning Board) for “OU(CDWRA)” zone in the Schedule of Uses of the approved Mai Po & Fairview Park OZP No. S/YL-MP/6. The proposed interim STP is part of to the proposed residential development approved under planning Application No. A/YL-MP/229.

Table 8.2 summarizes the findings of the planning and development control review on areas within the landscape Study Area.

Table 8.2: Review of Existing Planning and Development Control Framework

Landuse zoning	Landscape Planning, Design and Conservation Intention of Zoning	Potential Impacts	Recommended Mitigation Measures and Future Outlook of the Area with the Proposed Works
Approved Mai Po & Fairview Park OZP No. S/YL-MP/6			
Residential (Group C) "R(C)"	This zone is intended primarily for low-rise, low-density residential developments where commercial uses serving the residential neighbourhood may be permitted on application to the Town Planning Board.	No works is proposed within this zone. No impact on this zone due to the Project is anticipated.	No works is proposed within this zone. The proposed works of the Project will not affect the future outlook of this zone. No mitigation measure is proposed.
Village Type Development "V"	The planning intention of this zone is to reflect existing recognized and other villages, and to provide land considered suitable for village expansion and reprovisioning of village houses affected by Government projects. Land within this zone is primarily intended for development of Small Houses by indigenous villagers. It is also intended to concentrate village type development within this zone for a more ordered development pattern, efficient use of land and provision of infrastructures and services. Selected commercial and community uses serving the needs of the villagers and in support of the village development are always permitted on the ground floor of a New Territories Exempted House. Other commercial, community and recreational uses may be permitted on application to the Town Planning Board.	No works is proposed within this zone. No impact on this zone due to the Project is anticipated.	No works is proposed within this zone. The proposed works of the Project will not affect the future outlook of this zone. No mitigation measure is proposed.
Open Space "O"	This zone is intended primarily for the provision of outdoor open-air space for active and/or passive recreational uses serving the needs of local residents as well as the general public.	No works is proposed within this zone. No impact on this zone due to the Project is anticipated.	No works is proposed within this zone. The proposed works of the Project will not affect the future outlook of this zone. No mitigation measure is proposed.
Other Specified Uses (Comprehensive Development to include Wetland Restoration Area) "OU(CDWRA)"	This zone is intended to provide incentive for the restoration of degraded wetlands adjoining existing fish ponds through comprehensive residential and/or recreational development to include wetland restoration area. It is also intended to phase out existing sporadic open storage and port back-up uses on degraded wetlands. Any new building should be located farthest away from Deep Bay.	The Project is within this zone. It is considered as part of the overall development within this zone. Therefore, no adverse impact on this zone due to the Project is anticipated.	Precautionary / enhancement / mitigation measures are shown in **Table 8.14** and **Table 8.15** Upon completion of the Project, a single-storey Sewage Treatment Plant will be situated in the Project site within this zone. The future outlook is anticipated to be compatible with the low-rise, low density residential development planned in the remaining parts of this zone.

Landuse zoning	Landscape Planning, Design and Conservation Intention of Zoning	Potential Impacts	Recommended Mitigation Measures and Future Outlook of the Area with the Proposed Works
Conservation Area "CA"	The planning intention of this zone is to conserve the ecological value of wetland and fish ponds which form an integral part of the wetland ecosystem in the Deep Bay Area. The "no-net-loss in wetland" principle is adopted for any change in use within this zone. The primary intention is to discourage new development unless it is required to support the conservation of the ecological integrity of the wetland ecosystem or the development is an essential infrastructure project with overriding public interest.	No works is proposed within this zone. No impact on this zone due to the Project is anticipated.	No works is proposed within this zone. The proposed works of the Project will not affect the future outlook of this zone. No mitigation measure is proposed.

8.4.2 Landscape Resources

Existing LRs within the landscape Study Area were identified by desktop study and verified in the site visits. Identified LRs are mapped on **Figure 8.5**. Representative photographs of these LRs are illustrated in **Figure 8.6**.

LR1 – Screen Planting

This LR (approximately 0.24 ha) is the strip planting behind the noise barrier planted as a recommended mitigation measures for the WSW Development to screen the views of the noise barrier from external VSRs. It consists of both tree and shrub planting. Trees in this LR are young to semi-mature with height mainly ranging from 5 to 12 m. Trees commonly observed include *Melaleuca cajuputi* subsp. *cumingiana*, *Hibiscus tiliaceus*, *Cinnamomum camphora*, *Acacia mangium*, *Casuarina equisetifolia* and *Melia azedarach*, while the shrub species recorded include *Alpinia zerumbet* 'Variegata', *Ligustrum sinense*, *Nephrolepis auriculata*, *Rhapis excelsa*, *Schefflera arboricola* and *Schefflera arboricola* 'Variegata'. Although the screen planting is relatively young and this type of resource is locally common, it is properly maintained and serves a particular function as screen planting. Sensitivity of this LR is therefore considered **medium**.

LR2 – Periphery Planting

This LR (approximately 1.58 ha) includes part of the tree planting along the boundary walls of Palm Spring and Royal Palms which is dominated by semi-mature to mature trees with heights mainly range from 6 to 15 m. The dominant tree species observed include *Casuarina equisetifolia*, *Cinnamomum burmannii*, *Hibiscus tiliaceus* and *Acacia confusa*. Although this type of periphery planting is locally common, it is well maintained and serves a particular function to create a sense of privacy for the properties. Sensitivity of this resource is considered **high**.

LR3 – Roadside Planting

This LR (approximately 0.10 ha) includes part of a strip of tree planting between San Tin Highway and Castle Peak Road – Mai Po, where *Eucalyptus* species of various sizes dominate, and roadside planting on the west side of Castle Peak Road – Mai Po, where the weedy tree species *Leucaena leucocephala* dominates. Trees in this LR are mostly young to semi-mature with height mainly ranging from 6 to 12 m, with a few mature trees of *Acacia confusa* and *Ficus miccrocarpa*. Although the roadside planting is locally common, the presence of a few mature trees indicates that this LR is not readily replaceable. Sensitivity of this LR is therefore considered **high**.

LR4 – Amenity Planting

This LR (approximately 3.54 ha) includes part of the landscape planting within Palm Spring and Royal Palms which is dominated by semi-mature trees with heights mainly range from 6 to 10 m and shrub planting along roadside. It also includes the private gardens of residences. The tree species observed include *Livistona chinensis*, *Cinnamomum burmannii*, *Roystonea regia*, *Delonix regia*, *Casuarina equisetifolia* and *Dypsis lutescens*. Shrub and groundcover planting is also observed within this LR with *Cordyline fruticosa*, *Ixora chinensis*, *Juniperus chinensis*, *Ligustrum sinense*, *Loropetalum chinense* f. *rubrum* and *Wedelia trilobata*. Although this type of resource is locally common, it is well maintained. Sensitivity of this resource is considered **medium**.

LR5 – Tree Plantation

This LR (approximately 0.43 ha) includes a tree plantation area to the northwest of Wo Shang Wai. This tree plantation area is dominated by the weedy tree species *Leucaena leucocephala*,

with common landscape trees such as *Acacia auriculiformis*, *Casuarina equisetifolia* and *Alstonia scholaris* also observed. Trees in this plantation are mostly young to semi-mature with heights about 8 to 10 m. The dominance by the weedy tree species *Leucaena leucocephala* suggests that the area has been disturbed and not fully reinstated with tree planting. Given the low quality of the existing tree plantation, sensitivity of this resource is considered **medium** despite its high coverage of woody vegetation.

LR6 – Restored Wetland

This LR (approximately 4.71 ha) is a restored wetland area, which is currently under the maintenance of the contractor of the WSW Development. It contains wetland areas with open water as well as reed planting dominated by *Phragmites australis* and shrub planting with predominantly native species such as *Bridelia tomentosa*, *Ficus microcarpa*, *Ligustrum sinense*, *Macaranga tanarius* var. *tomentosa*, *Melastoma malabathricum*, *Rhaphiolepis indica* and *Zanthoxylum avicennae*. This type of resource is locally uncommon. Sensitivity of this LR is considered **high**.

LR7 – Pond

This LR (approximately 2.01 ha) includes parts of a few fish ponds north of the Project site and part of the pond adjacent to Wo Shang Wai. The fish ponds to the north are actively used for aquaculture with pond bunds covered with grasses. The one adjacent to Wo Shang Wai is likely only a water retaining feature serving the village with common weedy species such as *Bidens alba* dominating the edges. Fish ponds were once common in rural Hong Kong, but are becoming less so in the past decades. Sensitivity of this LR is therefore considered **high**.

LR8 – Watercourse

This LR (approximately 0.48 ha and approximately 450 m in total length) includes two sections of drainage channel, one north of the Project site adjacent to fish ponds and the other east of Palm Springs.

LR8.1 – Drainage Channels at the East of Palm Springs

The one east of Palm Springs is largely modified with sloped artificial stream banks covered with either hard surfaces or self-grown vegetation. The stream bed is mainly covered with hard surface with stones, cobbles and sandy substrate. Water in the drainage channels looks turbid with no fish observed. This type of drainage channel is locally common, the sensitivity of which is considered **medium**.

LR8.2 – Drainage Channels at the North of the Project Site

The drainage channel north of the Project site is relatively natural with riparian zone dominated by grasses and *Musa* x *paradisiaca*. The stream bed is not observable due to turbidity of the water, but likely with soft bottom substrate for this type of channels. Water quality of this stream section is regularly monitored for the WSW Development and is considered fair. This type of resource is locally common. Sensitivity of this drainage channel is considered **high**.

Table 8.3 summarizes the sensitivity of all identified LRs.

Table 8.3: Sensitivity of Landscape Resources

ID No.	Name	Quality of existing landscape (Low / Medium / High)	Importance / Rarity of landscape elements (Low / Medium / High)	Ability to accommodate change (Low / Medium / High)	Maturity of Landscape (Young / Semi-mature / Mature)	Significance of change in local context (Low / Medium / High)	Significance of change in regional context (Low / Medium / High)	Sensitivity (Low / Medium / High)
LR1	Screen Planting	Medium	Low	Low	Young	Medium	Low	Medium
LR2	Periphery Planting	Medium	Medium	Low	Semi-mature	Medium	Low	High
LR3	Roadside Planting	Medium	Low	Medium	Mature	Low	Low	High
LR4	Amenity Planting	High	Low	Medium	Semi-mature	Medium	Low	Medium
LR5	Tree Plantation	Medium	Low	Medium	Semi-mature	Low	Low	Medium
LR6	Restored Wetland	High	High	Low	Semi-mature	High	Medium	High
LR7	Pond	High	Medium	Low	Mature	Medium	Low	High
LR8.1	Watercourse – Drainage Channels at the East of Palm Springs	Medium	Low	Medium	Semi-mature	Low	Low	Medium
LR8.2	Watercourse – Drainage Channels at the North of the Project Site	Medium	Low	Medium	Semi-mature	Medium	Low	High

8.4.3 Landscape Character Types

The Landscape Character Types (LCTs) within the landscape Study Area as shown in the Landscape Character Map of Hong Kong (Edition 2005) are illustrated in **Figure 8.7** and listed in **Table 8.4**.

Table 8.4: Descriptions on Landscape Character Types within the Study Area

LCT	Description in Explanatory Notes for Landscape Character Map of Hong Kong
LOWLAND COUNTRY SIDE LANDSCAPE	
7. Rural Coastal Plan Landscape	These are flat and expansive lowland landscapes lying at an elevation below 40mPD and which adjoin the coast. Often partly or wholly reclaimed from sea over the centuries, their character is defined to a large extent by their proximity to the sea. Villages, knolls and blocks of woodland are scattered across these plains, connected by winding lanes and footpaths amongst active or disused fishponds. In certain areas, fishponds are densely packed over an extensive area, forming landscapes that are almost as much water as land. Formerly expansive and open landscapes of small-scale landscape features, agricultural land uses today have often been discontinued with the filling of fishponds, the abandoning of fields and the increase in land uses such as storage yards and housing developments resulting in a landscape of contrasting components and colours.
8. Rurual Inland Plain Landscape	These are flat and expansive lowland landscape, lying between ranges of hills, at elevations below 40mPD. Such plains are generally flat or gently undulating and may be studded with low hills and wooded knolls. Generally long-settled, they comprise fields around meandering streams, scattered groups of trees and villages (at the bases of hills) connected by winding lanes and footpaths. Where these features persist in their traditional patterns, one experiences a largely agrarian landscape of small-scale, natural and human landscape features. However, increasingly in recent times, fields are being abandoned or are being replaced by other land uses such as village housing or storage yards, resulting a landscape of contrasting components and colours.
URBAN FRINGE LANDSSCAPE	
15. Comprehensive Residential Development Landscape	These are comprehensively planned and constructed landscapes associated with self-contained residential developments, situated in what are predominantly rural areas. Usually developed by a single developer, often in phases, they are characterised by their comprehensive planning, high sense of self-containment and structured character. They consist of generally low-rise residential buildings, all of fairly recent construction, situated on a layout of suburban roads, often with generous soft landscape provision. At the core of the development, there may be community facilities, including club house, schools and shops. These landscapes are highly ordered and are characterised by a high degree of coherence and a sense of tranquillity.

8.4.4 Landscape Character Areas

Existing LCAs within the landscape Study Area are also identified by desktop study and verified in the site visits. Identified LCAs are mapped on **Figure 8.8**. Representative photographs of these LCAs are illustrated in **Figure 8.9a** to **Figure 8.9b**.

LCA1 – Low-rise Rural Residential Development

This LCA includes part of Palm Spring and Royal Palms which are low-lying landscape comprises numerous low-rise residences developed to a single co-ordinated master plan. Housing is set within a network of roads and amenity space at the periphery of the development. Vegetation is typically street tree planting and amenity planting. Generally, this is a varied landscape of small scale domestic features which is both enclosed and intensively maintained. This type of landscape character is quite common in rural Hog Kong. Sensitivity of this LCA is considered **medium**.

LCA2 – Planned Comprehensive Residential Development

This LCA is the site for the planned WSW Development. It is currently a construction site covered with mainly bare land and surrounded by noise barriers and hoardings along the site boundary. This LCA is temporary in nature and will be replaced by low-rise, low-density residential development similar to that in LCA1. This type of landscape character is quite common in rural Hong Kong. With due consideration on the planned land use of the area, the future sensitivity of this LCA is considered **medium** while the existing sensitivity is considered **low**.

LCA3 – Village Type Development

This LCA covers part of the village of Wo Shang Wai, which is a traditional village. It is characterized by closely spaced low-rise village houses typical for this type of traditional village with a pond to the west of the village and not much soft landscaping. Within the village of Wo Shang Wai, there is a brick house with a plaque labelled “Wo Shang Wai”, where altars for worshipping of various gods, such as “Tin Hau”, are present. This type of traditional village landscape character is quite common in rural Hong Kong, but such a traditional rural village surrounded by modern residential development gives this LCA a unique landscape character. With due consideration on its historical and cultural significance and uniqueness, sensitivity of this LCA is considered **high**.

LCA4 – Rural Open Area

This LCA includes land adjacent to Castle Peak Road-Mai Po where the major land uses include open areas such as open storage and car park. This LCA also includes the existing construction site of a ventilation building for the Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL). This type of landscape character is quite common in rural Hong Kong. Sensitivity of this LCA is considered **low**.

LCA5 – Restored Wetland

This LCA is the restored wetland area for the WSW Development. It contains wetland areas with open water as well as shrub planting and reed planting. It serves the function as a buffer zone between the WSW Development and the adjacent conservation areas of high ecological sensitivity. Its ecological value is considered high because it also serves the function as a habitat for numerous avifauna species. This type of landscape character is uncommon in Hong Kong. Sensitivity of this LCA is considered **high**.

LCA6 – Fish Ponds

This LCA includes some active fish ponds north of the Project site. This type of landscape is becoming less common in Hong Kong. Also, it provides ecological linkage to the wetland in Mai Po. Sensitivity of this LCA is considered **high**.

Table 8.5 summarizes the sensitivity of all identified LCAs.

Table 8.5: Sensitivity of Landscape Character Areas

ID No.	Name	Quality of existing landscape (Low / Medium / High)	Importance / Rarity of landscape elements (Low / Medium / High)	Ability to accommodate change (Low / Medium / High)	Maturity of Landscape (Young / Semi-mature / Mature)	Significance of change in local context (Low / Medium / High)	Significance of change in regional context (Low / Medium / High)	Sensitivity (Low / Medium / High)
LCA1	Low-rise Rural Residential Development	High	Medium	Medium	Semi-mature	Medium	Low	Medium
LCA2	Planned Comprehensive Residential Development	Low (existing); Medium (future)	Low (existing); Medium (future)	High (existing); Medium (future)	N/A (under construction)	Low (existing); Medium (future)	Low (existing); Low (future)	Low (existing); Medium (future)
LCA3	Village Type Development	Medium	Medium	Medium	Mature	High	Medium	High
LCA4	Rural Open Area	Low	Low	High	Semi-mature	Low	Low	Low
LCA5	Restored Wetland	High	High	Low	Semi-mature	Medium	Medium	High
LCA6	Fish Ponds	High	High	Low	Semi-mature	Medium	Medium	High

8.4.5 Zone of Visual Influence

During construction, the existing noise barriers and site hoardings surrounding the site of the WSW Development will act as an effective visual barrier and block the views of any construction activities of the Project from external viewers. The limit of ZVI during construction is therefore defined by the locations of the noise barriers and site hoardings.

During operation, the planned WSW Development will have been completed. Given that the proposed Sewage Treatment Plant is a single-storey structure while the residential buildings surrounding it are taller, the ZVI will be limited by the residential buildings is shown in **Figure 8.3**. In addition, due to the small scale of the Project and the effects of distance and the panoramic qualities of many views, visual receivers beyond the distance of 500 m from the Project will hardly notice any elements of the Project in their wider views. The Project will not form a feature of any significance in these visual receivers' frame of view and will not influence their visual experience. Therefore, the limit of the ZVI is defined as 500 m from the proposed Project site.

8.4.6 Visually Sensitive Receivers

Since the ZVI is limited to within the WSW Development site, no VSR is identified during construction of the Project. During operation, all identified VSRs are planned VSRs as identified by the updated layout of the WSW Development and shown in **Figure 8.3**. Their existing view, which shows a construction site with mainly bare ground, is irrelevant for visual assessment. Hence, the description of their anticipated views without the Project will be described as the baseline condition based on the latest proposed layout as shown in **Figure 8.3**.

VSR1 – Residents from the Northwest

This VSR includes the residents of a few 3-storey houses with a minimum horizontal viewing distance of approximately 50 m towards the location of the proposed Sewage Treatment Plant. The views of this VSR will be dominated by the water features in the foreground with the proposed location of the Sewage Treatment Plant at the background, at least partially blocked from view by tree planting. Despite the relatively short viewing distance, given that the partial view of the location of the proposed Sewage Treatment Plant only constitute as a background, the sensitivity of this VSR is considered **medium**.

VSR2 – Residents from the Northeast

This VSR includes the residents of a few 3-storey houses with a minimum horizontal viewing distance of approximately 50 m towards the location of the proposed Sewage Treatment Plant. The views of this VSR will be dominated by the access road and proposed tree planting at the central median, which will act as visual barrier to the location of the proposed Sewage Treatment Plant with a partial screening effect. Despite the relatively short viewing distance, given that trees at the central median will at least partially block the location of the proposed Sewage Treatment Plant from view, the sensitivity of this VSR is considered **medium**.

VSR3 – Recreationists from Club Houses and Swimming Pools

This VSR includes the visitors of the club houses as well as the swimmers in the swimming pools with a minimum horizontal viewing distance of approximately 20 m towards the location of the proposed Sewage Treatment Plant. The views of this VSR will be a direct view across the roundabout towards the location of the proposed Sewage Treatment Plant. Visual obstruction by proposed tree planting adjacent to the proposed Sewage Treatment Plant will depend on the exact locations of the VSRs. Given that the views are relatively unimportant to recreationists

and the views are in most cases at least partially screened by tree planting, the sensitivity of this VSR is considered **low**.

VSR4 – Pedestrians and Passengers in Vehicles along Access Roads

This VSR includes pedestrians walking along the footpaths and the passengers in vehicles on the access roads adjacent to the location of the proposed Sewage Treatment Plant with a minimum horizontal viewing distance of approximately 5 m towards the location of the proposed Sewage Treatment Plant. This VSR will have an unobstructed direct view of the location of the proposed Sewage Treatment Plant only at two particular locations along the access roads. At other locations, the view will be at least partially blocked by proposed tree planting adjacent to the proposed Sewage Treatment Plant or trees along the access roads and at the central median. Given that the views are in most cases at least partially screened and the views are transient in nature and relatively unimportant to the viewers, the sensitivity of this VSR is considered **low**.

Table 8.6 summarizes the sensitivity of all identified VSRs.

Table 8.6: Sensitivity of Visually Sensitive Receivers

ID No.	Name	Type of Receivers (Residents / Students / Workers / Recreationists / Travelers)	Population of Receivers (Small / Medium / Large)	Amenity Value of Existing View (Low / Moderate / High)	Availability of Alternative View (Yes / No)	Amenity of Alternative View (Low / Moderate / High)	Duration of View (Short / Medium / Long)	Frequency of view (Low / Medium / High)	Degree of visibility (Low / Medium / High)	Sensitivity (Low / Medium / High)
VSR1	Residents from the Northwest	Residents	Small	High	Yes	Moderate	Long	High	Low	Medium
VSR2	Residents from the Northeast	Residents	Small	Moderate	Yes	Moderate	Long	High	Low	Medium
VSR3	Recreationists from Club Houses and Swimming Pools	Recreationists	Medium	Moderate	Yes	Moderate	Moderate	Medium	Medium	Low
VSR4	Pedestrians and Passengers in Vehicles along Access Roads	Travelers	Medium	Moderate	Yes	Moderate	Short	Medium	Low	Low

8.4.7 Vantage Points

One vantage point is selected to show the representative visual context of the mostly affected planned VSRs. The view of the vantage point is particularly selected with reference to the number and sensitivity of the identified VSRs to cover the view of the location of the proposed Sewage Treatment Plant with the shortest viewing distance and least visual obstruction. It can represent the most affected views due to the proposed Sewage Treatment Plant from VSR1, VSR2 and VSR3. The photomontage showing the view at this vantage point without the Project as well as the existing view are illustrated in **Figure 8.10**.

8.5 Tree Survey Findings

8.5.1 Existing Tree Groups

Tree group survey was undertaken within the landscape Study Area as shown in **Figure 8.1**. Demarcation of identified tree groups follows that of LRs and is shown in **Figure 8.5**.

Trees in the landscape Study Area are grouped into 5 tree groups with a total of approximately 2,788 trees. The estimated number of trees in each of the tree groups is summarized in **Table 8.7**. Tree assessment schedule of the surveyed tree groups is presented in **Appendix 8.1**.

Table 8.7: Estimated Number of Trees in Tree Groups

Tree Group No.	Location of Trees	Approximate No. of Trees
T-LR1	Trees in Screen Planting	452
T-LR2	Trees in Periphery Planting	1,409
T-LR3	Trees in Roadside Planting	162
T-LR4	Trees in Landscape Planting	590
T-LR5	Trees in Tree Plantation	175
	Total:	**2,788**

During the broad brush tree survey, no registered / potentially registrable OVT was observed and no significant trees of large sizes, cultural significance or species of conservation interest were identified.

8.5.2 Potential Impact on Trees

All trees within the landscape Study Area are located outside the Project site, except trees in Screen Planting (T-LR1) where trees are located within the Project site but outside the works area behind the noise barriers. Hence, none of the trees identified will be affected by the Project.

8.6 Sources of Potential Impact

Since the only above-ground structure of the Project is a 1-storey Sewage Treatment Plant, which will be incorporated into the overall layout plan of the WSW Development, no adverse impact on the layout and the implementation of recommended landscape and visual mitigation measures in the approved EIA for WSW Development (Register No. AEIAR-120/2008) is anticipated.

8.6.1 Sources of Impact during Construction

During the construction phase, the Project will be implemented simultaneously with the construction of the WSW Development. Sources of potential landscape and visual impacts would arise from the following:

- Construction activities associated with the construction of the Sewage Treatment Plant

8.6.2 Sources of Impact during Operation

During the operation phase, the Sewage Treatment Plant will be a temporary measure to handle the sewage generated from the WSW Development after occupation of Phase 1 development. Sources of potential landscape and visual impacts would arise from the following:

- Presence of the single-storey above-ground structure of the Sewage Treatment Plant

8.6.3 Sources of Impact during Decommissioning

During the decommissioning phase, the structure of the Sewage Treatment Plant and its associated infrastructure will only cease operation and will not be demolished. The sources of potential landscape and visual impacts is therefore identical to those for the operation phase.

8.7 Magnitude of Change

8.7.1 Magnitude of Change on Landscape Resources

LR1 – Screen Planting

This LR is located within the Project site behind the noise barrier where no construction works will be carried out. No impact on this LR due to the construction and operation of the Project is anticipated. Magnitude of change on this LR is considered **negligible**.

LR2 – Periphery Planting

This LR is located outside the Project site and will not be affected by the proposed works of the Project. No impact on this LR due to the construction and operation of the Project is anticipated. Magnitude of change on this LR is considered **negligible**.

LR3 – Roadside Planting

This LR is located outside the Project site and will not be affected by the proposed works of the Project. No impact on this LR due to the construction and operation of the Project is anticipated. Magnitude of change on this LR is considered **negligible**.

LR4 – Amenity Planting

This LR is located outside the Project site and will not be affected by the proposed works of the Project. No impact on this LR due to the construction and operation of the Project is anticipated. Magnitude of change on this LR is considered **negligible**.

LR5 – Tree Plantation

This LR is located outside the Project site and will not be affected by the proposed works of the Project. No impact on this LR due to the construction and operation of the Project is anticipated. Magnitude of change on this LR is considered **negligible**.

LR6 – Restored Wetland

This LR is located outside the Project site and will not be affected by the proposed works of the Project. No impact on this LR due to the construction and operation of the Project is anticipated. Magnitude of change on this LR is considered **negligible**.

LR7 – Pond

This LR is located outside the Project site and will not be affected by the proposed works of the Project. No impact on this LR due to the construction and operation of the Project is anticipated. Magnitude of change on this LR is considered **negligible**.

LR8.1 – Drainage Channels at the East of Palm Springs (Watercourse)

This LR is located outside the Project site and will not be affected by the proposed works of the Project. No impact on this LR due to the construction and operation of the Project is anticipated. Magnitude of change on this LR is considered **negligible**.

LR8.2 – Drainage Channels at the North of the Project Site (Watercourse)

This LR is located outside the Project site and will not be affected by the proposed works of the Project. No impact on this LR due to the construction and operation of the Project is anticipated. Magnitude of change on this LR is considered **negligible**.

Table 8.8 summarises the magnitude of change on all LRs. The magnitude of change on all LRs is expected to be the same for construction, operation and decommissioning phases.

Table 8.8: Magnitude of Change on Landscape Resources

ID No.	Name	Scale of Works (Negligible / Small /Medium / Large)	Reversibility (Reversible / Irreversible)	Compatibility with surrounding landscape (Low / Medium / High)	Duration of Impacts (Short / Medium / Long)	Magnitude of Change (Negligible / Small / Intermediate / Large)
LR1	Screen Planting	Negligible	N/A	N/A	N/A	Negligible
LR2	Periphery Planting	Negligible	N/A	N/A	N/A	Negligible
LR3	Roadside Planting	Negligible	N/A	N/A	N/A	Negligible
LR4	Amenity Planting	Negligible	N/A	N/A	N/A	Negligible
LR5	Tree Plantation	Negligible	N/A	N/A	N/A	Negligible
LR6	Restored Wetland	Negligible	N/A	N/A	N/A	Negligible
LR7	Pond	Negligible	N/A	N/A	N/A	Negligible
LR8.1	Watercourse – Drainage Channels at the East of Palm Springs	Negligible	N/A	N/A	N/A	Negligible
LR8.2	Watercourse – Drainage Channels at the North of Project Site	Negligible	N/A	N/A	N/A	Negligible

8.7.2 Magnitude of Change on Landscape Character Areas

LCA1 – Low-rise Rural Residential Development

This LCA is located outside the Project site and will not be affected by the proposed works of the Project. No impact on this LCA due to the construction and operation of the Project is anticipated. Magnitude of change on this LCA is considered **negligible**.

LCA2 – Planned Comprehensive Residential Development

The Project site is entirely within this LCA. During construction of the Project, this LCA will also be under construction for the WSW Development. Hence, the magnitude of change on this LCA is considered **negligible** for construction phase.

Given the scale of the proposed works is small and the proposed above-ground structure of the Sewage Treatment Plant is similar in scale with the planned residential buildings within this LCA as illustrated in **Figure 8.3**, the Project is considered compatible with the planned land use of this LCA. Magnitude of change on this LCA during operation and decommissioning phases is also considered **negligible**.

LCA3 – Village Type Development

This LCA is located outside the Project site and will not be affected by the proposed works of the Project. No impact on this LCA due to the construction and operation of the Project is anticipated. Magnitude of change on this LCA is considered **negligible**.

LCA4 – Rural Open Area

This LCA is located outside the Project site and will not be affected by the proposed works of the Project. No impact on this LCA due to the construction and operation of the Project is anticipated. Magnitude of change on this LCA is considered **negligible**.

LCA5 – Restored Wetland

This LCA is located outside the Project site and will not be affected by the proposed works of the Project. No impact on this LCA due to the construction and operation of the Project is anticipated. Magnitude of change on this LCA is considered **negligible**.

LCA6 – Fish Ponds

This LCA is located outside the Project site and will not be affected by the proposed works of the Project. No impact on this LCA due to the construction and operation of the Project is anticipated. Magnitude of change on this LCA is considered **negligible**.

Table 8.9 summarises the magnitude of change on all LCAs. The magnitude of change on all LCAs is expected to be the same for construction, operation and decommissioning phases.

Table 8.9: Magnitude of Change on Landscape Character Areas

ID No.	Name	Scale of works (Negligible / Small / Medium / Large)	Reversibility (Reversible / Irreversible)	Compatibility with surrounding landscape (Low / Medium / High)	Duration of Impacts (Short / Medium / Long)	Magnitude of change (Negligible / Small / Intermediate / Large)
LCA1	Low-rise Rural Residential Development	Negligible	N/A	N/A	N/A	Negligible
LCA2	Planned Comprehensive Residential Development	Small	Irreversible	High	Short	Negligible

ID No.	Name	Scale of works (Negligible / Small / Medium / Large)	Reversibility (Reversible / Irreversible)	Compatibility with surrounding landscape (Low / Medium / High)	Duration of Impacts (Short / Medium / Long)	Magnitude of change (Negligible / Small / Intermediate / Large)
LCA3	Village Type Development	Negligible	N/A	N/A	N/A	Negligible
LCA4	Rural Open Area	Negligible	N/A	N/A	N/A	Negligible
LCA5	Restored Wetland	Negligible	N/A	N/A	N/A	Negligible
LCA6	Fish Ponds	Negligible	N/A	N/A	N/A	Negligible

8.7.3 Magnitude of Change on Visually Sensitive Receivers

VSR1 – Residents from the Northwest

The above-ground structure of the proposed Sewage Treatment Plant will be partially visible by this VSR with a minimum horizontal viewing distance of approximately 50 m. The views will be dominated by the water features in the foreground with the proposed location of the Sewage Treatment Plant at the background, at least partially blocked from view by tree planting. Given that the partial view of the proposed Sewage Treatment Plant only constitute as a background, the magnitude of change to this VSR is considered **small**.

VSR2 – Residents from the Northeast

The above-ground structure of the proposed Sewage Treatment Plant will be partially visible by this VSR with a minimum horizontal viewing distance of approximately 50 m. The views will be dominated by the access road and proposed tree planting at the central median, which will act as visual barrier to the proposed Sewage Treatment Plant with a partial screening effect. Given that trees at the central median will at least partially block the proposed Sewage Treatment Plant from view, the magnitude of change to this VSR is considered **small**.

VSR3 – Recreationists from Club Houses and Swimming Pools

The above-ground structure of the proposed Sewage Treatment Plant will be visible by this VSR with a minimum horizontal viewing distance of approximately 20 m. The views of will be a direct view across the roundabout towards the proposed Sewage Treatment Plant. Visual obstruction by proposed tree planting adjacent to the proposed Sewage Treatment Plant will depend on the exact locations of the VSRs. Given that the views are sometimes direct but in most cases at least partially screened by tree planting, the magnitude of change to this VSR is considered **intermediate**.

VSR4 – Pedestrians and Passengers in Vehicles along Access Roads

The above-ground structure of the proposed Sewage Treatment Plant will be visible by this VSR with a minimum horizontal viewing distance of approximately 5 m. This VSR will have an unobstructed direct view of the proposed Sewage Treatment Plant only at two particular locations along the access roads. At other locations, the view will be at least partially blocked by proposed tree planting adjacent to the proposed Sewage Treatment Plant or trees along the access roads and at the central median. Given that the views are in most cases at least partially screened, the magnitude of change to this VSR is considered **small**.

Table 8.10 summarises the magnitude of change for all VSRs. The magnitude of change on all VSRs is expected to be the same for operation and decommissioning phases since the decommissioning only involves cease of operation but demolishing of the above-ground structure.

Table 8.10: Magnitude of Change on Visually Sensitive Receivers

ID No.	Name	Scale of Works (Small / Medium / Large)	Reversibility (Reversible / Irreversible)	Blockage (None / Partial / Substantial)	Minimum Viewing Distance (m)	Compatibility with Surrounding Landscape (Low / Medium / High)	Duration of Impacts (Operation) (Short / Medium / Long)	Duration of Impacts (Decommissioning) (Short / Medium / Long)	Magnitude of Change (Operation) (Negligible / Small / Intermediate / Large)	Magnitude of Change (Decommissioning) (Negligible / Small / Intermediate / Large)
VSR1	Residents from the Northwest	Small	Irreversible	Partial	50	Medium	Medium	Long	Small	Small
VSR2	Residents from the Northeast	Small	Irreversible	Partial	50	Medium	Medium	Long	Small	Small
VSR3	Recreationists from Club Houses and Swimming Pools	Small	Irreversible	Partial	20	Medium	Short	Medium	Intermediate	Intermediate
VSR4	Pedestrians and Passengers in Vehicles along Access Roads	Small	Irreversible	Substantial	5	Medium	Short	Short	Small	Small

8.8 Assessment of Potential Impact without Mitigation

8.8.1 Potential Impact on Landscape Resources without Mitigation

The potential landscape impacts without mitigation measures on individual LRs are derived from the sensitivities and magnitude of changes in accordance with **Table 8.1** and summarized in **Table 8.11**. The potential impacts are expected to be the same for construction, operation and decommissioning phases.

Table 8.11: Potential Impact on Landscape Resources without Mitigation

ID No.	Name	Sensitivity (Low / Medium / High)	Magnitude of Change (Negligible / Small / intermediate / Large)	Significant Threshold (Unmitigated) (Insubstantial / Slight / Moderate / Significant)
LR1	Screen Planting	Medium	Negligible	Insubstantial
LR2	Periphery Planting	High	Negligible	Insubstantial
LR3	Roadside Planting	High	Negligible	Insubstantial
LR4	Amenity Planting	Medium	Negligible	Insubstantial
LR5	Tree Plantation	Medium	Negligible	Insubstantial
LR6	Restored Wetland	High	Negligible	Insubstantial
LR7	Pond	High	Negligible	Insubstantial
LR8.1	Watercourse – Drainage Channels at the East of Palm Springs	Medium	Negligible	Insubstantial
LR8.2	Watercourse – Drainage Channels at the North of Project Site	High	Negligible	Insubstantial

8.8.2 Potential Impact on Landscape Character Areas without Mitigation

The potential landscape impacts without mitigation measures on individual LCAs are derived from the sensitivities and magnitude of changes in accordance with **Table 8.1** and summarized in **Table 8.12**. The potential impacts are expected to be the same for construction, operation and decommissioning phases.

Table 8.12: Potential Impact on Landscape Character Areas without Mitigation

ID No.	Name	Sensitivity (Low / Medium / High)	Magnitude of Change (Negligible / Small / intermediate / Large)	Significant Threshold (Unmitigated) (Insubstantial / Slight / Moderate / Significant)
LCA1	Low-rise Rural Residential Development	Medium	Negligible	Insubstantial
LCA2	Planned Comprehensive Residential Development	Low (existing); Medium (future)	Negligible	Insubstantial
LCA3	Village Type Development	High	Negligible	Insubstantial
LCA4	Rural Open Area	Low	Negligible	Insubstantial
LCA5	Restored Wetland	High	Negligible	Insubstantial
LCA6	Fish Ponds	High	Negligible	Insubstantial

8.8.3 Potential Impact on Visually Sensitive Receivers without Mitigation

The potential visual impacts without mitigation measures on individual VSRs are derived from the sensitivities and magnitude of changes in accordance with **Table 8.1** and summarized in **Table 8.13**.

Table 8.13: Potential Impact on Visually Sensitive Receivers without Mitigation

ID No.	Name	Sensitivity (Low / Medium / High)	Magnitude of Change (Operation) (Negligible / Small / Intermediate / Large)	Magnitude of Change (Decommiss-ioning) (Negligible / Small / intermediate / Large)	Significant Threshold (Unmitigated) (Operation) (Insubstantial / Slight / Moderate / Significant)	Significant Threshold (Unmitigated) (Decommiss-ioning) (Insubstantial / Slight / Moderate / Significant)
VSR1	Residents from the Northwest	Medium	Small	Small	Slight adverse	Slight adverse
VSR2	Residents from the Northeast	Medium	Small	Small	Slight adverse	Slight adverse
VSR3	Recreationists from Club Houses and Swimming Pools	Low	Intermediate	Intermediate	Slight adverse	Slight adverse
VSR4	Pedestrians and Passengers in Vehicles along Access Roads	Low	Small	Small	Slight adverse	Slight adverse

8.9 Recommended Precautionary / Enhancement / Mitigation Measures

Precautionary / enhancement / mitigation measures for potential landscape and visual impacts have been carefully considered to achieve the following:

- Avoid impacts on important landscape resources and visual sensitive receivers;
- Lessen unavoidable impacts by location, design and reducing the extent of works; and
- Enhancement of existing landscape resources and visual quality.

A preliminary landscape master plan showing the recommended precautionary / enhancement / mitigation measures for potential landscape and visual impacts is shown in **Figure 8.11**.

8.9.1 Recommended Construction Phase Precautionary / Enhancement Measures

Although insubstantial landscape impacts are anticipated for all identified LRs and LCAs even without mitigation and no VSRs are identified for the construction stage, precautionary / enhancement measures for construction phase impacts are recommended and summarized in **Table 8.14** for minimization of potential landscape impacts, if any, and enhancement of landscape and visual quality. The construction phase mitigation measures listed below shall be adopted from the commencement of construction and throughout the entire construction period.

Table 8.14: Recommended Construction Phase Precautionary / Enhancement Measures

Mitigation Code	Mitigation Measure	Target LR(s), LCA(s) and / or VSR(s)	Responsible Agent for Mitigation Implementation	Responsible Agent for Management and Maintenance
CP1	**Integration of Construction Programme with that of the WSW Development** – The construction programme should be carefully integrated into the	LCA2	Project Proponent via Design Team & Contractor	N/A

Mitigation Code	Mitigation Measure	Target LR(s), LCA(s) and / or VSR(s)	Responsible Agent for Mitigation Implementation	Responsible Agent for Management and Maintenance
	overall programme of the WSW Development, so that the construction of the Project will not cause any delay and thereby lengthen the construction period of the WSW Development.			
CP2	**Advance Planting** – Proposed landscape planting should be undertaken at the earliest practicable stage of the construction phase of the Project.	LCA2	Project Proponent via Contractor	Project Proponent via Landscape Contractor
CP3	**Dust and Erosion Control for Exposed Soil** – Exposed soil shall be covered or "camouflaged" and watered frequently as dust suppression. Areas that are expected to be left with bare soil for a long period of time should be hydroseeded and / or covered with suitable protective fabrics to minimize dust impact.	LCA2	Project Proponent via Contractor	N/A

8.9.2 Recommended Operation Phase Mitigation Measures

To minimize potential impact during operation, mitigation measures for operation phase impacts are recommended and summarized in **Table 8.15**. The operation phase mitigation measures shall be adopted during detailed design and built in as part of the construction works so that they shall be in place at the Day 1 of operation phase.

Table 8.15: Recommended Operation Phase Mitigation Measures

Mitigation Code	Mitigation Measure	Target LR(s), LCA(s) and / or VSR(s)	Responsible Agent for Mitigation Implementation	Responsible Agent for Management and Maintenance
OP1	**Sensitive Design and Disposition** – The above-ground structure of the Sewage Treatment Plant should be sensitively designed in a manner that responds to the planned landscape context of the WSW Development to minimize potential adverse visual impacts. The structural design should seek to reduce the apparent visual mass. Subdued tones should be considered for the colour palette with non-reflective finishes to reduce glare effect. The layout of buildings and their windows should take into account the location of the proposed Sewage Treatment Plant so as to avoid and minimize any potential views of the Sewage Treatment Plant by potential VSRs.	VSR1; VSR2; VSR3; VSR4	Project Proponent via Design Team	Project Proponent via Estate Management Agent
OP2	**Visual Screening** – Visual screening such as boundary fences / walls at the periphery of the swimming pool should	VSR1; VSR3	Project Proponent via Design Team	Project Proponent via Estate Management

Mitigation Code	Mitigation Measure	Target LR(s), LCA(s) and / or VSR(s)	Responsible Agent for Mitigation Implementation	Responsible Agent for Management and Maintenance
	be considered as far as practicable to obstruct the views of the above-ground structure of the proposed Sewage Treatment Plant from the VSRs.			Agent
OP3	**Screen Planting** – Trees with mature height of at least 10 m should be planted around the proposed Sewage Treatment Plant as far as practicable for screening purpose to minimize the visual impact to the VSRs.	LCA2; VSR1; VSR2; VSR3; VSR4	Project Proponent via Design Team	Project Proponent via Estate Management Agent
OP4	**Enhancement Planting** – Other than screen planting, additional trees, shrubs and groundcovers should also be considered to maximize greening within the Project site upon completion of the Project. Use of native plant species should be considered as far as practicable to maximize the ecological value of the enhancement planting.	LCA2; VSR1; VSR2; VSR3; VSR4	Project Proponent via Design Team	Project Proponent via Estate Management Agent
OP5	**Green Roofs and Vertical Greening** – Green roofs and vertical greening should be provided where feasible and appropriate to screen and soften the hard edges of the above-ground structure of the proposed Sewage Treatment Plant.	LCA2; VSR1; VSR2; VSR3; VSR4	Project Proponent via Design Team	Project Proponent via Estate Management Agent

8.9.3 Recommended Decommissioning Phase Mitigation Measures

Since the decommissioning of the Project only involves cease of operation of the Sewage Treatment Plant without demolishing or modifying any above-ground structure, the potential impact during decommissioning phase will be identical to those during the operation phase. No additional mitigation measures is required specifically for decommissioning phase other than those for operation phase as listed in **Table 8.15**.

8.10 Assessment of Potential Impact with Mitigation

8.10.1 Photomontages

Series of computer generated images or photomontages have been prepared to illustrate the proposed works and recommended mitigation measures. The photomontages are presented in **Figure 8.12**. The photomontages show the condition without the Project, after the completion of the construction phase of the Project with no mitigation, and Day 1 and Year 10 of the operation phase with the implementation of the recommended mitigation measures. Year 10 of the operation phase is designed to demonstrate predicted residual impacts, which would exist in the design year during the operation phase, 10 years after the completion of the construction phase.

8.10.2 Potential Impact on Landscape Resources with Mitigation

As discussed in **Section 8.8.1**, potential impacts on all identified LRs within the landscape Study Area are anticipated to be insubstantial during construction, operation and decommissioning phases even without any mitigation. After the implementation of precautionary

/ enhancement measures as listed in **Table 8.14** and **Table 8.15**, potential impact on LRs are anticipated to remain insubstantial in construction, operation and decommissioning phases.

Table 8.16 summarises the results of the landscape impact assessment for the LRs, which are also illustrated in **Figure 8.13**.

Table 8.16: Summary of Impact Assessment on Landscape Resources

ID No.	Name	Significance Threshold (Unmitigated) (Construction) (Insubstantial / Slight / Moderate / Significant)	Significance Threshold (Unmitigated) (Operation) (Insubstantial / Slight / Moderate / Significant)	Recommended Mitigation Measures	Significance Threshold (Mitigated) (Construction) (Insubstantial / Slight / Moderate / Significant)	Significance Threshold (Mitigated) (Operation) (Insubstantial / Slight / Moderate / Significant)	Significance Threshold (Mitigated) (Decommissioning) (Insubstantial / Slight / Moderate / Significant)
LR1	Screen Planting	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LR2	Periphery Planting	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LR3	Roadside Planting	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LR4	Amenity Planting	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LR5	Tree Plantation	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LR6	Restored Wetland	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LR7	Pond	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LR8.1	Watercourse – Drainage Channels at the East of Palm Springs	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LR8.2	Watercourse – Drainage Channels at the North of Project Site	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial

8.10.3 Potential Impact on Landscape Character Areas with Mitigation

As discussed in **Section 8.8.2**, potential impacts on all identified LCAs within the landscape Study Area are anticipated to be insubstantial during construction, operation and decommissioning phases even without any mitigation. After the implementation of precautionary / enhancement measures as listed in **Table 8.14** and **Table 8.15**, potential impact on LCAs are anticipated to remain insubstantial in construction, operation and decommissioning phases.

Table 8.17 summarizes the results of the landscape impact assessment for the LCAs.

Table 8.17: Summary of Impact Assessment on Landscape Character Areas

ID No.	Name	Significance Threshold (Unmitigated) (Construction) (Insubstantial / Slight / Moderate / Significant)	Significance Threshold (Unmitigated) (Operation) (Insubstantial / Slight / Moderate / Significant)	Recommended Mitigation Measures	Significance Threshold (Mitigated) (Construction) (Insubstantial / Slight / Moderate / Significant)	Significance Threshold (Mitigated) (Operation) (Insubstantial / Slight / Moderate / Significant)	Significance Threshold (Mitigated) (Decommissioning) (Insubstantial / Slight / Moderate / Significant)
LCA1	Low-rise Rural Residential Development	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LCA2	Planned Comprehensive Residential Development	Insubstantial	Insubstantial	CP1; CP2; CP3; OP3; OP4; OP5	Insubstantial	Insubstantial	Insubstantial
LCA3	Village Type Development	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LCA4	Rural Open Area	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LCA5	Restored Wetland	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LCA6	Fish Ponds	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial

8.10.4 Potential Impact on Visually Sensitive Receivers with Mitigation

As discussed in **Section 8.8.3**, potential impacts on all identified planned VSRs are anticipated to be slight adverse during both the operation and decommissioning phases without any mitigation. After the implementation of mitigation measures as listed in **Table 8.15**, potential impact on the VSRs are anticipated to remain slight adverse in operation and decommissioning phases because the visual presence of the proposed Sewage Treatment Plant cannot be completely eliminated by the recommended mitigation measures.

Table 8.18 summarizes the results of the visual impact assessment for VSRs, which are also illustrated in **Figure 8.14**.

Table 8.18: Summary of Impact Assessment on Visually Sensitive Receivers

ID No.	Name	Significance Threshold (Unmitigated) (Operation) (Insubstantial / Slight / Moderate / Significant)	Significance Threshold (Unmitigated) (Decommissioning) (Insubstantial / Slight / Moderate / Significant)	Recommended Mitigation Measures	Significance Threshold (Mitigated) (Operation) (Insubstantial / Slight / Moderate / Significant)	Significance Threshold (Mitigated) (Decommissioning) (Insubstantial / Slight / Moderate / Significant)
VSR1	Residents from the Northwest	Slight adverse	Slight adverse	OP1; OP2; OP3; OP4; OP5	Slight adverse	Slight adverse
VSR2	Residents from the Northeast	Slight adverse	Slight adverse	OP1; OP3; OP4; OP5	Slight adverse	Slight adverse
VSR3	Recreationists from Club Houses and Swimming Pools	Slight adverse	Slight adverse	OP1; OP2; OP3; OP4; OP5	Slight adverse	Slight adverse
VSR4	Pedestrians and Passengers in Vehicles along Access Roads	Slight adverse	Slight adverse	OP1; OP3; OP4; OP5	Slight adverse	Slight adverse

8.11 Assessment of Cumulative Impact

8.11.1 Potential Concurrent Project

Potential concurrent project(s) include the following:

- Proposed Comprehensive Development at Wo Shang Wai, Yuen Long
- Hong Kong Section of Guangzhou – Shenzhen – Hong Kong Express Rail Link

8.11.2 Potential Cumulative Impact

Proposed Comprehensive Development at Wo Shang Wai, Yuen Long

Since the Project is to serve the need of the WSW Development, the construction of the Project will tie in with the construction of the proposed WSW Development. As the existing WSW Development site is covered with bare land with no identified landscape resource except for the restored wetland which will not be adversely affected by the construction of the comprehensive development, both the landscape and visual quality of the site is anticipated to greatly improve upon completion of the construction of the WSW Development. No cumulative landscape and visual impact is therefore anticipated.

Hong Kong Section of Guangzhou – Shenzhen – Hong Kong Express Rail Link

The construction site for the Mai Po Ventilation Building is adjacent to the Project site to the northeast. The construction of the Ventilation Building is largely completed with few further construction activities expected. Therefore, cumulative landscape and visual impacts, if any, will be minor and insignificant.

8.12 Summary

8.12.1 Review of Planning and Development Control Framework

A review of the existing and planned development for the proposed works and for the surroundings reveals that the Project site is within the Other Specified Uses (Comprehensive Development to include Wetland Restoration Area) “OU(CDWRA)” zone in the approved Mai Po & Fairview Park OZP No. S/YL-MP/6. The proposed construction of a Sewage Treatment Plant and associated works is considered “Utility Installation for Private Project” which is a land use under Column 2 (Uses that may be permitted with or without conditions on application to the Town Planning Board) for “OU(CDWRA)” zone in the Schedule of Uses of the approved Mai Po & Fairview Park OZP No. S/YL-MP/6. The proposed interim STP is part of to the proposed residential development approved under planning Application No. A/YL-MP/229.

8.12.2 Potential Impact on Trees

All trees within the landscape Study Area are either located outside the Project site or within the Project site behind the noise barrier where no construction works will be carried out. Hence, none of the trees identified will be affected by the Project.

8.12.3 Residual Landscape Impact

A total of 8 LRs and 6 LCAs are identified within the landscape Study Area. Impacts to all identified LRs and LCAs are anticipated to be insubstantial even without mitigation during construction, operation and decommissioning phases. The residual landscape impact after the implementation of precautionary / enhancement measures will remain insubstantial.

8.12.4 Residual Visual Impact

No VSR is identified for the construction phase and a total of 4 planned VSRs are identified within the ZVI of the Project for the operation and decommissioning phases. Impacts to all identified planned VSRs are anticipated to be slight adverse after implementation of mitigation for both operation and decommissioning phases since the visual presence of the proposed Sewage Treatment Plant cannot be completely eliminated by the recommended mitigation measures.

8.13 Conclusion

8.13.1 Overall Landscape Impact

Given that the existing site is bare land with no LRs and the scale of the Project is small and will be integrated into and compatible with the WSW Development, the landscape impact due to the Project is considered insubstantial for construction, operation and decommissioning phases.

8.13.2 Overall Visual Impact

No construction phase visual impact is anticipated as no VSRs are identified during construction due to the enclosure of the site by noise barriers and screen hoardings. Planned VSRs during operation and decommissioning phases will experience a slight adverse visual impact due to unavoidable partial views of the above-ground structure of the proposed Sewage Treatment Plant.

8.13.3 Overall Acceptability

Overall, in terms of Annex 10, Clause 1.1 (c) of the EIAO – TM, it is concluded that the landscape and visual impacts are acceptable with mitigation measures.

9 Conclusion

9.1 General

In accordance with the EIA Study Brief (No. ESB-289/2015) issued under the Environmental Impact Assessment Ordinance (EIAO) for this Project, an assessment of the potential environmental impacts associated with construction, operation and decommissioning of the proposed Sewage Treatment Plant (STP) and effluent reuse facility has been conducted. Environmental issues covered in this EIA include:

- Air Quality Impact
- Noise Impact
- Water Quality Impact
- Waste Management Implication
- Ecological Impact
- Landscape and Visual Impact

The findings of this EIA study have determined the likely nature and extent of environmental impacts and identified environmental control measures for incorporation into the planning and design of the proposed STP and effluent reuse facility to ensure compliance with environmental legislation and standards during construction and operation phase. The implementation schedule for the recommended mitigation measures are presented in **Chapter 11**.

The conclusions of individual technical assessments are presented in **Sections 9.3** to **9.8**.

9.2 Summary of Environmental Outcomes

The EIA study for the proposed STP and effluent reuse facility has predicted that with implementation of the recommended mitigation measures, the Project would be environmentally acceptable to the surrounding population and environmental sensitive receivers. The key environmental outcomes accrued from the environmental considerations and analysis during the EIA process and the implementation of environmental control measures of the Project are summarised in the following sections.

9.2.1 Estimated Population Protected from Various Environmental Impacts

The Project is located in close proximity to the following populations:

- Residents in Palm Springs – protected from adverse air quality and noise impacts;
- Residents in Royal Palms – protected from adverse air quality and noise impacts;
- Residents in Mai Po San Tsuen – protected from adverse air quality and noise impacts; and
- Planned Residents within WSW Development – protected from adverse air quality, noise, visual and water quality impacts.

Through the adoption of environmental designs as described below, the aforementioned populations have been protected from adverse environmental impacts.

9.2.2 Environmentally Sensitive Areas Protected

Sensitive areas in the vicinity of the Project include:

- Wetland Conservation Area
- Wetland Buffer Area
- Wetland Restoration Area (within Wo Shang Wai Development)
- Mai Po Inner Deep Bay Ramsar Site
- Egretries
- Deep Bay Water Control Zone

The nature of this Project is to collect sewage from the WSW Development for treatment and reuse on-site. The Project on its own will be a protection measure to the aforementioned sensitive areas by preventing wastewater from the WSW Development to be discharged to the Deep Bay area. Consequently, the important habitats and wildlife of the Deep Bay region will be protected, which is also the underlying principle of the "no net increase in pollution load to Deep Bay" under the prevailing water quality control policy.

9.2.3 Environmental Designs Recommended

The Project is of small scale, and is only a temporary measure serving the WSW Development prior to the availability of public sewer, with minimal environmental impact. Nevertheless, environmentally friendly designs have been incorporated to minimise potential environmental impacts as far as practicable (subject to detailed designs):

- Use of reclaimed water for toilet flushing and landscape irrigation;
- Ventilation opening with noise reduction measures located away from noise sensitive receivers as far as possible;
- Selection of siting to minimise air, noise and visual impact to sensitive receivers; and
- Locate components of the project with potential odour impact underground.

9.2.4 Key Environmental Problems Avoided

The primary aim of this Project is to prevent increase of net pollution load to Deep Bay from the sewerage discharge within WSW Development. The Project will treat all sewerage generated from the WSW Development, for full reuse onsite and thereby avoiding impacts to the important habitats and wildlife in the Deep Bay region. Other environmental problems have also been avoided or minimised:

- Locating all components associated with the handling, treatment and storage of sewerage, reclaimed water and sludge underground, and hence minimising potential odour impact to nearby residents;
- Installation of deodorizer with at least 99.5% odour removal efficiency with forced ventilation system to remove odour, minimising potential odour impact to nearby residents;
- Integrate with the WSW Development basement, allowing tankers to collect sludge from the underground storage tank and leave the property through the basement access road, thereby minimising potential odour and noise impact to nearby residents;
- Minimise Project footprint by locating major components underground and avoid significant visual impacts, which also free up more space for landscaping;
- Use of sodium hypochlorite during treatment process rather than chlorine gas containers to avoid potential hazard to life impact;

- Reuse of inert construction and demolition (C&D) materials on-site as far as practicable to avoid off-site delivery of surplus inert C&D materials and associated environmental impacts; and
- Termination of STP operation only for decommissioning phase, thereby avoiding potential dust and noise impacts to nearby residents from demolition of facilities and potential accidental contamination of fresh water.

9.2.5 Compensation Areas Included

As mentioned in **Section 2.2.1**, the Project is located within the WSW Development and has been a construction site since Year 2010. Under the WSW Development EIA, Wetland Restoration Area had been proposed to compensate for ecological impacts. The WRA has been established, and will not be affected by this Project, as such, no further compensation is required.

Furthermore, compensatory measures had been proposed in the WSW Development EIA for mitigating landscape impacts. All felled trees within the WSW Development, which is also the location of this Project, will be compensated for. Hence, the Project will not cause further impacts that will require additional compensation.

In view of the above and given no impacts on environmentally sensitive area are expected, and the Project is located within the construction site of the WSW Development, no compensation has been proposed in this EIA.

9.2.6 Main Concerns of General Public

In October 2013, the Project Proponent submitted a Section 16 (S16) Application for an amendment to the approved application No. A/YL-MP/185, and was approved in February 2015 (Application No. A/YL-MP/229). The proposed amendments under this S16 application included change in the master layout plan of the WSW Development (e.g., increased house numbers, relocation of clubhouse), revision to landscaping, and the interim on-site sewerage treatment facility.

The S16 application was made available for public inspection in accordance with statutory requirement. During the statutory publication period and the publication of further information, a total of 278 public comments were received, none of which objected the interim on-site sewerage treatment facility (i.e., this Project) element of the application. The objections received mainly concerned on potential adverse impact of the overall WSW Development, especially on the nearby wetland habitat, groundwater table, extra pollution loading to Deep Bay Area, surrounding traffic and road safety, sewage management and hygiene. The nature of this Project is to collect sewage from the WSW Development for on-site treatment and reuse. As detailed in the impact assessments in **Chapter 3 to 8** have concluded that the Project's potential environmental impacts will not be significantly adverse. The mitigation measures proposed in this EIA study will alleviate potential environmental impacts to an acceptable level. Therefore, the potential impacts from relevant public concerns, such as impact to nearby habitats, is not expected.

9.3 Air Quality Impact

9.3.1 Construction Phase

Given the small scale and localized nature of the STP building construction works together with implementation of the recommended mitigation measures, no adverse air quality impacts on the surrounding ASRs are anticipated during the construction phase of the Project.

9.3.2 Operation Phase

With proper operation of the proposed STP and effluent reuse facility, as well as the recommended odour containment and control measures in place to confine and reduce the potential odour emissions at sources, adverse odour impacts on the surrounding ASRs are not anticipated.

9.4 Noise Impact

9.4.1 Construction Phase

Construction works are expected to be of small scale and localized. Potential cumulative construction noise impacts from the construction of the proposed Project and the WSW Development have been identified and assessed. Under the consideration of the prevailing site condition with vertical noise barriers during the whole construction period of the proposed interim STP, no adverse construction noise impact is anticipated.

9.4.2 Operational Phase

Potential cumulative fixed noise impacts from the operation of the proposed Project and the existing noise sources have been identified and assessed. The maximum allowable sound power levels for the operation of the proposed interim STP have been determined as 92 dB(A) for day-time and evening periods and 86 dB(A) for night-time period.

With the adoption of the maximum allowable sound power levels for the proposed STP, no exceedances in relevant noise criteria is expected. No adverse fixed noise impact during operation phase is anticipated.

A noise commissioning test should be conducted prior to the operation of the proposed STP and implemented as specified in the standalone Environmental Monitoring and Audit (EM&A) Manual.

9.5 Water Quality Impact

9.5.1 Construction Phase

For construction phase, potential water quality impacts, which are mainly land-based, have been identified which include construction site runoff, accidental spillage of chemicals, sewage from the construction workforce and general construction activities. With implementation of environmental best practices for construction site management as well as water pollution preventive and mitigation measures, no adverse water quality impacts are anticipated during construction phase.

9.5.2 Operational Phase

For operation phase, potential water quality impacts identified include discharge of treated sewage, emergency discharge of untreated sewage, and use of reclaimed water onsite. The interim STP will employ Membrane Bioreactor technology to treat the sewage generated from the WSW development and the effluent will be further polished by disinfection to meet the WSD water reuse standards. With treatment to the required WSD reuse standards and full use of the reclaimed water at the WSW Development, alongside preventive and contingency measures for avoidance and minimisation of treated or untreated effluent discharge to Deep Bay, the Project would comply with the ‘no net increase in pollution load’ requirement. In addition, preventive measures for cross-contamination and mis-use of reclaimed water will be implemented through

engineering and management measures. Decommissioning of the onsite STP would not occur until all sewage from the WSW Development is fully diverted to the permanent Government sewers. With implementation of these recommended measures, no adverse water quality impacts would arise due to implementation of the Project.

9.6 Waste Management Implications

9.6.1 Construction Phase

The major waste types generated by the construction activities will include construction and demolition (C&D) materials from excavation works, foundation works, STP construction works; sediment from excavation works; chemical waste from maintenance and servicing of construction plant and equipment and general refuse from the workforce. Provided that all these identified wastes are handled, transported and disposed of in accordance with the relevant legislative and recommended requirements and the recommended good site practices and mitigation measures are properly implemented, no adverse environmental impact is expected during the construction phase.

9.6.2 Operation Phase

During the operation phase, the waste types generated will be sewage sludge from the operation of the on-site STP, general refuse from staff, and chemical waste from regular maintenance activities. Provided that all these wastes are handled, transported and disposed of in accordance with the relevant legislative requirements and the recommended mitigation measures are properly implemented, no adverse environmental impact is expected during the operation phase.

9.7 Ecological Impact

9.7.1 Construction Phase

The Project Site is currently a construction site dominated by developed area forming part of the WSW Development. No primary direct impact in terms of habitat loss is anticipated due to the Project. Due to the current residential development in WSW, the grassland and wetland habitats existed within the Project Area have already been converted into developed / disturbed habitat and thus loss of natural habitat is not a concern in this assessment. Currently, the area is generally not ecologically significant owing to the relatively low ecological value of the developed / disturbed area, which is the dominant habitat of the Project Site. Ecological impact to adjacent habitat due to air quality, noise and groundwater impact is minor owing to the minor scale of works involved. Although the fishponds within the Inner Deep Bay and WRA are important for wildlife, with the implementation of good site practices outlined in ProPECC Note PN1/94 to minimise site surface runoff from construction works areas and to control the dispersion of sediments and contaminants to inland waters, indirect disturbance to offsite wetland habitats is considered negligible.

9.7.2 Operation Phase

No significant ecological impact will be resulted from the operation of the Project as all potential air quality, noise, water quality, waste and landscape impacts will be controlled to environmentally acceptable levels. Treated sewage effluent from the onsite STP would be fully reused onsite. With a comprehensive contingency program and careful implementation of the specifications stipulated by statutory standards, no offsite discharge of effluent would be

anticipated during the normal operation, the disturbance impact to identified offsite aquatic habitats within the Study Area is thus considered to be negligible.

Two concurrent projects are identified but owing to the limited extent of the construction activities, no cumulative impact is identified. No specific ecological mitigation is considered necessary for the proposed Project.

9.8 Landscape and Visual Impact

9.8.1 Overall Landscape Impact

A total of 8 LRs and 6 LCAs are identified within the landscape Study Area. Impacts to all identified LRs and LCAs are anticipated to be insubstantial even without mitigation during construction, operation and decommissioning phases. The residual landscape impact after the implementation of precautionary / enhancement measures will remain insubstantial.

Given that the existing site is bare land with no LRs and the scale of the Project is small and will be integrated into and compatible with the WSW Development, the landscape impact due to the Project is considered insubstantial for construction, operation and decommissioning phases.

9.8.2 Overall Visual Impact

No VSR is identified for the construction phase and a total of 4 planned VSRs are identified within the ZVI of the Project for the operation and decommissioning phases. Impacts to all identified planned VSRs are anticipated to be slight adverse after implementation of mitigation for both operation and decommissioning phases since the visual presence of the proposed STP cannot be completely eliminated by the recommended mitigation measures.

No construction phase visual impact is anticipated as no VSRs are identified during construction due to the enclosure of the site by noise barriers and screen hoardings. Planned VSRs during operation and decommissioning phases will experience a slight adverse visual impact due to unavoidable partial views of the above-ground structure of the proposed STP.

9.8.3 Overall Acceptability

Overall, in terms of Annex 10, Clause 1.1 (c) of the EIAO – TM, it is concluded that the landscape and visual impacts are acceptable with mitigation measures.

9.9 Summary of Environmental Impacts

An overall summary of environmental impacts is shown in **Table 9.1**.

Table 9.1: Summary of Environmental Impacts

Assessment Points	Results of Impact Prediction	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impact for Mitigation
Air Quality Impact						
Air Sensitive Receivers within 500m assessment area	Construction Phase • Insignificant fugitive dust emission and construction vehicle and machine emission are anticipated. • Potential odour impact from excavation of sediment is considered to be short-term and controllable with proper control measures. Operation Phase • Insignificant odour impact due to the proposed STP and sludge generated on the nearby ASRs is anticipated. Decommissioning Phase • No adverse air quality impacts on the surrounding ASRs are anticipated.	• Annex 4 and 12 of Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) • Air Pollution Control Ordinance • Air Pollution Control (Construction Dust) Regulation • Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation	Construction Phase N/A Operation Phase N/A Decommissioning Phase N/A	Construction Phase N/A Operation Phase N/A Decommissioning Phase N/A	Construction Phase • General practices for dust control. • Relevant measures stipulated in Air Pollution Control (Construction Dust) Regulation. • Complete covering using plastic tarpaulin sheets of all stockpiled malodour excavated material. Operation Phase For potential odour impact due to the proposed STP: • The STP will be totally enclosed. • Negative pressure ventilation will be provided within the enclosure to avoid any fugitive odorous emission from the STP. • Further odour containment will be achieved by covering or confining the sewage channels, sewage tanks, and equipment with potential odour emission. • Proper mixing will be provided at the equalization and sludge holding tanks to prevent sewage septicity. • Chemical or biological deodorization facilities with 99.5% odour removal efficiency will be	Construction Phase No adverse residual air quality impacts are anticipated. Operation Phase No adverse residual air quality impacts are anticipated. Decommissioning Phase N/A

Assessment Points	Results of Impact Prediction	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impact for Mitigation
					provided to treat potential odorous emissions from the STP including sewage channels / tanks, filter press and screening facilities so as to minimize any potential odour impact to the nearby ASRs. • The deodorization facilities should be regularly maintained so as to ensure at least 99.5% odour removal efficiency. • The deodorization facilities should be designed such that the discharge point is directed away from nearby ASRs. Decommissioning Phase N/A	
Noise Impact						
The first layer of NSRs (nearest to the noise sources in various directions) has been selected as the assessment points within 300m assessment area.	Construction Phase • Under the prevailing site condition with existing vertical noise barriers, no significant noise impact is anticipated. Operation Phase With the adoption of the maximum allowable sound power levels for the proposed STP, no exceedances in relevant noise criteria is expected. Decommissioning Phase • No adverse noise impact is anticipated.	• Environmental Impact Assessment Ordinance (Cap. 499); • Noise Control Ordinance (Cap. 400); • EIAO-TM: relevant Guidance Notes under EIAO; • TM on Noise from Construction Work other than Percussive Piling (GW-TM); and • TM on Places other than Domestic Premises, Public Places or Construction Sites (IND-TM).	Construction Phase N/A Operation Phase N/A	Design Phase Appropriate noise reduction measures will be adopted (such as acoustic louver blade or ventilation silencers) at the noise source to ensure the required maximum allowable SWLs is achieved. Construction Phase N/A Operation Phase N/A	Construction Phase • Adoption of good site practice to limit noise emission at source; • Adoption of QPME; • Use of Noise Enclosure/Acoustic Shed; • Use of Noise Insulating Fabric; and • Schedule construction works carefully to avoid overlapping of works involving PME that emit loud noises. Operation Phase Noise commissioning test	Construction Phase No adverse residual noise impacts are anticipated. Operation Phase No adverse residual noise impacts are anticipated. Decommissioning Phase No adverse residual noise impacts are anticipated.

Assessment Points	Results of Impact Prediction	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impact for Mitigation
					prior to the operation of the STP. Decommissioning Phase N/A	
Water Quality Impact						
Water Sensitive Receivers within 500m assessment area	Construction Phase With implementation of good site management practices and recommended mitigation measures, there will be: • No adverse water quality impacts due to construction site runoff • No adverse water quality impacts due to accidental spillage of chemicals • No adverse water quality impacts due to sewage from construction workforce • No adverse water quality impacts due to general construction activities Operation Phase • No adverse water quality impacts due to use of reclaimed water onsite • No discharge of reclaimed water to Deep Bay • Risk of untreated sewage effluent discharge to Deep Bay due to emergency event is negligible Decommissioning Phase • No adverse water quality impacts due to decommissioning of the	• Environmental Impact Assessment Ordinance (Cap. 499) • Water Pollution Control Ordinance (Cap. 358) • Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters • "No Net Increase in Pollution Load" Requirement in Deep Bay • Practice Note for Professional Persons on Construction Site Drainage (ProPECC Note PN1/94) • Guidelines for the Design of Small Sewage Treatment Plant.	Construction Phase N/A Operation Phase N/A Decommissioning Phase N/A	Construction Phase N/A Operation Phase Full onsite use of reclaimed water to avoid discharge to Deep Bay Decommissioning Phase The onsite STP would not be decommissioned until the sewerage connection to the Government sewer has been commissioned	Construction Phase • Adoption of good site practices and precautionary measures for inclement weather as outlined in ProPECC Note PN1/94 • Proper storage of chemicals • Provision of portable toilets onsite • Implementation of general good site management Operation Phase • Use of Membrane Bioreactor technology with ultraviolet disinfection and chlorine dosing to treat the sewage generated by the WSW Development • Implementation of preventive measures for cross-contamination and mis-use of reclaimed water • Contingency measures including standby power supply, alarms and storage tank to prevent discharge of treated or untreated sewage effluent to Deep Bay Decommissioning Phase • Any wastewaters	Construction Phase No adverse residual water quality impacts are anticipated. Operation Phase No adverse residual water quality impacts are anticipated. Decommissioning Phase No adverse residual water quality impacts are anticipated.

Assessment Points	Results of Impact Prediction	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impact for Mitigation
	onsite STP				generated from the decommissioning process and any residual untreated sewage or reclaimed water would be pumped out and tanked away to the public sewage treatment work for offsite treatment and disposal.	
Waste Management Implication						
Study Area	<u>Construction Phase</u> • Inert construction and demolition (C&D) materials of about 14,000m^3 will be generated from excavation; foundation; sewage treatment plant (STP) construction works; • Very minor amount of non-inert C&D materials generated from excavation; foundation; STP construction works; • Sediment of 800m^3 will be generated from excavation works; • General refuse of maximum daily arising of up to 20kg from construction workforce; • Small quantity of chemical waste from maintenance and servicing of construction plant and equipment. <u>Operation Phase</u>	• Annexes 7 and 15 of EIAO-TM • Waste Disposal Ordinance (Cap. 354); • Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C); • Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N); • Dumping at Sea Ordinance (Cap. 466); • Public Cleansing and Prevention of Nuisances Regulation (Cap. 132BK); and • Land (Miscellaneous Provisions) Ordinance (Cap. 28).	<u>Construction Phase</u> N/A <u>Operation Phase</u> N/A <u>Decommissioning Phase</u> N/A	<u>Construction Phase</u> N/A <u>Operation Phase</u> N/A <u>Decommissioning Phase</u> N/A	<u>Construction Phase</u> • Good site practices and waste reduction measures for C&D materials • The inert C&D materials should be reused on-site as fill material as far as practicable • The loading, unloading, handling, transfer or storage of treated and untreated sediment should be carried out in such a manner to prevent or minimise dust emissions • Handling of chemical wastes in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes, and disposal of chemical wastes at licensed chemical waste recycling/ treatment facilities • Employ a reputable licensed waste collector	<u>Construction Phase</u> No residual impacts would be anticipated. <u>Operation Phase</u> No residual impacts would be anticipated. <u>Decommissioning Phase</u> N/A

Assessment Points	Results of Impact Prediction	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impact for Mitigation
	• The total quantity of screening and grits generated in the proposed STP is expected to be 0.075 m^3/day; • About 13m^3/day of sewage sludge will be generated from sewage treatment plant; • About 3.5 kg/day of general refuse will be generated from operation activities; • Chemical waste refuse will be generated from maintenance activities. <u>Decommissioning Phase</u> • No adverse waste impact is anticipated.				for disposal of general refuse at designated landfill sites <u>Operation Phase</u> • Screening and grits generated will be transferred to closed containers before transportation and disposal at designated landfill sites • The collected sludge will be transported to the designated landfill site or public sewage treatment works by designated sewage tankers for disposal • Employ a reputable licensed waste collector to collect general refuse on a daily basis and dispose of the general refuse at designated landfill sites • Handling of chemical wastes in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes, and disposal of chemical wastes at licensed chemical waste recycling/ treatment facilities <u>Decommissioning Phase</u> N/A	
Ecological Impact						
Ecological sensitive	<u>Construction &</u>	• Forests and Countryside	<u>Construction Phase</u>	<u>Construction Phase</u>	• Given that the mitigation	<u>Construction, Operation</u>

Assessment Points	Results of Impact Prediction	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impact for Mitigation
receivers, habitats and species potentially affected by the proposed works within 500m assessment area	<u>Decommissioning Phase</u> • No direct impact on species and habitats loss is anticipated. • Minor indirect impact to wetland restoration area, offsite habitats. • Minor ecological impacts on the faunal species of conservation interest recorded within the Wetland Restoration Area and other offsite habitats are anticipated. <u>Operation Phase</u> • Indirect ecological impact due to noise and odour emission is anticipated to be negligible. • Indirect impact on treatment of sewage effluent to aquatic habitat is anticipated to be negligible.	Ordinance (Cap. 96) • Forestry Regulations (Cap. 96 sub. leg.) • Wild Animals Protection Ordinance (Cap. 170) • Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) • EIAO-GN No. 6/2010, 7/2010 and 10/2010 • Annexes 8 and 16 of the EIAO-TM • Town Planning Ordinance (Cap. 131) • Town Planning Board Guideline no. 12C • Hong Kong Planning Standards and Guidelines Chapter 10	N/A <u>Operation Phase</u> N/A <u>Decommissioning Phase</u> N/A	N/A <u>Operation Phase</u> N/A <u>Decommissioning Phase</u> N/A	measures for air, noise, water, waste and landscape aspects proposed in respective sections which are indirectly beneficial to the local ecology shall be checked as part of the environmental monitoring and audit procedures during construction period as presented in the standalone EM&A Manual, no specific ecological monitoring and audit programme is considered required.	<u>and Decommissioning Phase</u> Residual loss of habitat with low ecological value in the Project Area would be anticipated. Minor / negligible impacts on nearby wetland habitats and associated fauna would be anticipated.
Landscape and Visual Impacts						
Landscape Resources (LRs) and Landscape Character Areas (LCAs) within 100 m Study Area and Visually Sensitive Receivers (VSRs) within the Zone of Visual Influence (ZVI)	<u>Construction Phase</u> Landscape impact is anticipated to be insubstantial and no VSRs have been identified. <u>Operation Phase</u> Landscape impact is anticipated to be insubstantial and visual impact is anticipated to be slight adverse to a small number of VSRs. <u>Decommissioning Phase</u> Landscape impact is anticipated to be insubstantial and visual impact is anticipated to be	• Annexes 10, 11, 18, 20 and 21 EIAO-TM • EIAO GN No. 8/2010	<u>Construction Phase</u> N/A <u>Operation Phase</u> N/A <u>Decommissioning Phase</u> N/A	<u>Construction Phase</u> N/A <u>Operation Phase</u> N/A <u>Decommissioning Phase</u> N/A	<u>Construction Phase</u> • Integration of Construction Programme with that of the WSW Development • Advance Planting • Dust and Erosion Control for Exposed Soil <u>Operation Phase</u> • Sensitive Design and Disposition • Visual Screening • Screen Planting • Enhancement Planting • Green Roofs and Vertical Greening	<u>Construction Phase</u> Landscape impact remains insubstantial and no visual impact. <u>Operation Phase</u> Landscape impact remains insubstantial and visual impact remains slight adverse. <u>Decommissioning Phase</u> Landscape impact remains insubstantial and visual impact remains slight adverse.

Assessment Points	Results of Impact Prediction	Relevant Standards / Criteria	Extent of Exceedances Predicted	Impact Avoidance Measures Considered	Mitigation Measures Proposed	Residual Impact for Mitigation
	slight adverse to a small number of VSRs.				Decommissioning Phase Same as operation phase	

9.10 Key Assessment Assumptions, Limitations of Assessment Methodologies and related Prior Agreement

A summary of key assessment assumptions, limitation of assessment methodologies and related prior agreements with relevant Government Departments is presented in **Table 9.2.**

Table 9.2: Key Assessment Assumptions, Limitations of Assessment Methodologies and Prior Agreements

Assessment Methodology	Key Assessment Assumptions	Limitations of Assessment Methodologies / Assumptions	Prior Agreements with the Director or other Authorities	Proposed Alternative Assessment Tools / Assumptions (if applicable)	Justification / Supporting Documents for Alternative Assessment Tools / Assumptions (if applicable)
Air Quality – Construction Phase					
Fugitive dust impacts are anticipated to be short-term and could be controlled with the mitigation measures presented in Section 3.6.1. As reviewed in Section 3.3.2, the environmental monitoring and audit (EM&A) data recorded for the WSW Development at the Project site shows no exceedances of the hourly TSP criterion. Therefore, a qualitative assessment of the dust impact is carried out.	N/A	N/A	N/A	N/A	N/A
Air Quality – Operation Phase					
During operation phase, it is anticipated that the ASRs would be subject to potential odour impacts proposed and existing odour emission sources within the 500m Study Area. As the proposed STP will be fully enclosed and is not of a large scale, the potential odour impact is assessed in a qualitative manner.	N/A	N/A	N/A	N/A	N/A
Air Quality – Decommissioning Phase					
The proposed STP will be decommissioned, but the structures will be retained in-situ and will not be demolished. Hence no adverse air quality impacts on the surrounding ASRs are anticipated.	N/A	N/A	N/A	N/A	N/A
Noise Impact – Construction Phase					
Assessment in accordance with Appendix C of EIA Study Brief No. ESB-289/2015 and Annex 5 and 13 of the EIAO-TM	Construction works carried out in the present of existing continuous vertical noise barriers. All lines of sight from existing NSRs blocked by vertical noise barriers.	N/A	N/A	N/A	See noise barriers photos in Figure 4.4
No ground-borne noise sources are identified, hence no ground-borne noise impact assessment is carried out.	No drill and blast method carried out for underground work.	N/A	N/A	N/A	N/A
Noise Impact – Operation Phase					

Assessment Methodology	Key Assessment Assumptions	Limitations of Assessment Methodologies / Assumptions	Prior Agreements with the Director or other Authorities	Proposed Alternative Assessment Tools / Assumptions (if applicable)	Justification / Supporting Documents for Alternative Assessment Tools / Assumptions (if applicable)
In the absence of detailed information and noise specification for the proposed interim STP, the maximum allowable noise emission level at the opening is determined for future detail design.	The maximum allowable sound power levels are determined by adopting standard acoustics principles.	N/A	N/A	N/A	N/A
Noise Impact – Decommissioning Phase					
The structure of the STP and its associated infrastructure will only cease operation and will not be demolished. No noise impact is anticipated during decommissioning phase.	N/A	N/A	N/A	N/A	N/A
Water Quality Impact – Construction Phase					
Assessment in accordance with Appendix D of EIA Study Brief No. ESB-289/2015 and Annex 6 and 14 of the EIAO-TM	N/A	Qualitative assessment only	N/A	N/A	N/A
Water Quality Impact – Operation Phase					
Assessment in accordance with Appendix D of EIA Study Brief No. ESB-289/2015 and Annex 6 and 14 of the EIAO-TM	Design population of 1,245 persons	The accumulative average dry weather flows are estimated based on the “Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning” published by EPD	N/A	N/A	N/A
Water Quality Impact – Decommissioning Phase					
Assessment in accordance with Appendix D of EIA Study Brief No. ESB-289/2015 and Annex 6 and 14 of the EIAO-TM	N/A	Qualitative assessment only	N/A	N/A	N/A
Waste Management Implications – Construction Phase					
Assessment in accordance with Appendix E of EIA Study Brief No. ESB-289/2015 and Annex 7 and 15 of the EIAO-TM	N/A	N/A	N/A	N/A	N/A
Waste Management Implications – Operation Phase					
Assessment in accordance with Appendix E of EIA Study Brief No. ESB-289/2015 and Annex 7 and 15 of the EIAO-TM	Design population of 1,245 persons	The estimation of sewage sludge to be generated will be varied if the design population of 1,245 persons is revised	N/A	N/A	N/A
Waste Management Implications – Decommissioning Phase					
Assessment in accordance with Appendix E of EIA Study Brief No. ESB-289/2015 and Annex 7 and 15	N/A	N/A	N/A	N/A	N/A

Assessment Methodology	Key Assessment Assumptions	Limitations of Assessment Methodologies / Assumptions	Prior Agreements with the Director or other Authorities	Proposed Alternative Assessment Tools / Assumptions (if applicable)	Justification / Supporting Documents for Alternative Assessment Tools / Assumptions (if applicable)
of the EIAO-TM					
Ecological Impact (Terrestrial and Aquatic) – Construction Phase					
Assessment in accordance with Appendix F of EIA Study Brief No. ESB-289/2015 and Annexes 8 and 16 of the EIAO-TM	Since the construction is only limited to WSW residential development site, anticipated impact would not exceed that anticipated in the WSW EIA	Assessment is based on literature review on data reported in EIA and concurrent EM&A reports only	N/A	N/A	N/A
Ecological Impact (Terrestrial and Aquatic) – Operation Phase					
Assessment in accordance with Appendix F of EIA Study Brief No. ESB-289/2015 and Annexes 8 and 16 of the EIAO-TM	Since the operation of the proposed Project is only limited to WSW residential development site, anticipated impact would not exceed that anticipated in the WSW EIA	Assessment is based on literature review on data reported in EIA and concurrent EM&A reports only	N/A	N/A	N/A
Ecological Impact (Terrestrial and Aquatic) – Decommissioning Phase					
Assessment in accordance with Appendix F of EIA Study Brief No. ESB-289/2015 and Annexes 8 and 16 of the EIAO-TM	N/A	Assessment is based on literature review on data reported in EIA and concurrent EM&A reports only	N/A	N/A	N/A
Landscape and Visual Impact – Construction Phase					
Assessment in accordance with EIAO GN No. 8/2010 and Appendix G of EIA Study Brief No. ESB-289/2015	This Project will be integrated into and compatible with the WSW Development, and noise barriers / screen hoardings will be maintained throughout the construction phase	N/A	N/A	N/A	N/A
Landscape and Visual Impact – Operation Phase					
Assessment in accordance with EIAO GN No. 8/2010 and Appendix G of EIA Study Brief No. ESB-289/2015	Planned VSRs are identified from the latest available development layout and building plans of the WSW Development	The assumptions on the locations and views of the identified planned VSRs will be invalid should the development layout / building plans of the WSW Development be revised	N/A	N/A	N/A
Landscape and Visual Impact – Decommissioning Phase					
Assessment in accordance with EIAO GN No.	Planned VSRs are identified from	The assumptions on the	N/A	N/A	N/A

Assessment Methodology	Key Assessment Assumptions	Limitations of Assessment Methodologies / Assumptions	Prior Agreements with the Director or other Authorities	Proposed Alternative Assessment Tools / Assumptions (if applicable)	Justification / Supporting Documents for Alternative Assessment Tools / Assumptions (if applicable)
8/2010 and Appendix G of EIA Study Brief No. ESB-289/2015	the latest available development layout and building plans of the WSW Development	locations and views of the identified planned VSRs will be invalid should the development layout / building plans of the WSW Development be revised			

10 Environmental Monitoring and Audit

10.1 General

This Section presents a summary of Environmental Monitoring and Audit (EM&A) requirements for each impact assessment described in this EIA Report.

10.2 Air Quality Impact

10.2.1.1 Construction Phase

The extent of the STP building construction works for the proposed Project represent only a small part of the proposed WSW Development. Therefore, regular dust monitoring is not considered necessary during the construction of the Project. Moreover, the on-going EM&A programme for the proposed WSW Development would overlap with any monitoring proposed for this Project.

10.2.1.2 Operation Phase

As the proposed STP will be fully enclosed, installed with a high-efficiency deodorizer with a forced ventilation system, and is not of a large scale; it is anticipated that there would not be significant odour impact due to the proposed STP and sludge generated on the nearby ASRs. Therefore, no monitoring during the operation phase is required.

10.2.1.3 Decommissioning Phase

Upon commissioning of the public trunk sewer, the sewage from the proposed development will be connected to the public sewerage system and the STP will be decommissioned. However, as the STP will remain on-site and not be demolished, no monitoring during the decommissioning phase is required.

10.3 Noise Impact

10.3.1.1 Construction Phase

The extent of the STP construction works represent only a small part of the proposed WSW Development. As regular noise monitoring of the on-going EM&A programme for the proposed WSW Development would be carried out during the whole construction period of the Project, no noise monitoring is proposed under this project during the construction phase of the proposed STP.

10.3.1.2 Operational Phase

Prior to the operation of the proposed STP, a noise commissioning test should be conducted by the Contractor to check for the compliance of the noise levels from the operation of the fixed plant with the stipulated noise criteria. The testing results should be checked and signed by the Contractor, the Engineer's Representative and the Environmental Team and verified by Independent Environmental Checker respectively.

10.4 Water Quality Impact

During construction phase, regular site audits shall be conducted to check implementation of the recommended mitigation measures.

During operation phase, the management, maintenance and operation of the onsite STP shall follow the O&M Manual for the onsite STP and the Management Manual of the Development, which shall cover the mitigation measures specified in this EIA report. An EM&A program will be implemented according to the EM&A manual. An Environmental Monitoring Team, who will be responsible to conduct reclaimed water quality sampling and testing and reclaimed water supply and use monitoring, should be appointed by the Project Proponent / Estate Manager. For the reclaimed water quality sampling and testing, samples of treated effluent should be taken regularly and tested by a HOKLAS or other internationally accredited laboratory to ensure the quality meet the reuse standard specified in the "Water Supplies Department Inter-departmental Working Group on the Implementation of Reclaimed Water Supply in Sheung Shui and Fanling".

10.5 Waste Management Implications

It would be the Contractor's responsibility to ensure that all wastes produced during the construction of the Project are handled, stored and disposed of in accordance with good waste management practices and EPD's regulations and requirements. The recommended mitigation measures should form the basis of the WMP to be developed by the Contractor throughout the Project period. The WMP shall be prepared and implemented in accordance with ETWB TC (W) No. 19/2005 Environmental Management on Construction Site.

Throughout the construction phase of the Project, regular site inspections as part of the EM&A procedures should be carried out to determine if wastes are being managed in accordance with the WMP. Different aspects of waste management including waste generation, storage, recycling, treatment, transport and disposal would be included in the programme.

10.6 Ecological Impact

Mitigation measures for air, noise, water, waste and landscape aspects proposed in respective sections of this EIA Report could serve as precautionary measures to prevent and minimize any indirect disturbance impact or pollution arisen from the construction activities on the local ecology and offsite habitats. These measures include dust control measures, selection of quieter plants, use of movable noise barriers, good site practices for waste and wastewater handling, measures outlined in ProPECC Note PN1/94 to minimise surface runoff from construction site, landscape buffer planting, etc., according to relevant sections of this EIA Report. No ecological specific mitigation measure is considered necessary.

10.7 Landscape and Visual Impact

The implementation of the landscape and visual precautionary / enhancement / mitigation measures proposed in **Table 8.14** and **Table 8.15** should be checked as part of the EM&A procedures during the construction phase and the first year of operation phase during the establishment period of the proposed planting as presented in the separate EM&A Manual.

11 Implementation Schedule

11.1 General

The implementation schedule containing the EIA study recommendations and mitigation measures with reference to the implementation programme is presented in **Table 11.1**.

Table 11.1: Implementation Schedule

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location/Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stages				Relevant Legislation & Guidelines
					Des	C	O	Dec	
Air Quality Impact – Construction Phase									
3.6.1	2.2	General Practices for Dust Control It is recommended that the following dust mitigation measures are implemented to maintain dust emissions at acceptable levels during the construction phase: • Any dusty activities should be regularly sprayed with water to maintain damp conditions of the works area. • Any dusty materials should be covered with tarpaulin or similar material during transportation. • Any dusty materials stockpiles should be either (i) covered entirely by impervious sheeting; or (ii) sprayed with water. Best Practices for Dust Control It is recommended that the relevant best practices for dust control as stipulated in the Air Pollution Control (Construction Dust) Regulation should also be adopted to further reduce the construction dust impacts of the Project. These best practices include: Good Site Management • Good site management is important to help reduce potential air quality impact down to an acceptable level. As a general guide, the Contractor should maintain high standard of housekeeping to prevent emission of fugitive dust. Loading, unloading, handling and storage of raw materials, wastes or by-products should be carried out in a manner so as to minimise the release of visible dust emissions. Any piles of materials accumulated on or around the work areas should be cleaned up regularly. Cleaning, repair and maintenance of all plant facilities within the work areas should be carried out in a manner minimising generation of fugitive dust emissions. The material should be handled properly to prevent fugitive dust emission before cleaning. Loading, Unloading or Transfer of Dusty Materials • All dusty materials should be sprayed with water immediately prior to any loading or transfer operation so as to keep the dusty material wet. Debris Handling • Any debris should be covered entirely by impervious sheeting or stored in a debris collection area sheltered on the top and the three sides. • Before debris is dumped into a chute, water should be sprayed so that it remains wet	Project construction site / Duration of the construction phase / Prior to commencement of operation	Contractor		✓			EIA Recommendation and Air Pollution Control (Construction Dust) Regulation

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location/Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stages				Relevant Legislation & Guidelines
					Des	C	O	Dec	
		when it is dumped. Transportation of Dusty Materials • Vehicle used for transporting dusty materials/spoils should be covered with tarpaulin or similar material. The cover should extend over the edges of the sides and tailboards. Wheel washing • Vehicle wheel washing facilities should be provided at each project site exit. Immediately before leaving the project site, every vehicle should be washed to remove any dusty materials from its body and wheels. Use of vehicles • Immediately before leaving the project site, every vehicle should be washed to remove any dusty materials from its body and wheels. • Where a vehicle leaving the project site is carrying a load of dusty materials, the load should be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle. Site hoarding • Where a site boundary adjoins a road, street, service lane or other area accessible to the public, hoarding of not less than 2.4m high from ground level should be provided along the entire length of that portion of the site boundary except for a site entrance or exit. Odour control measures During excavation works, the following mitigation measures are recommended in order to contain potential odour from excavated sediment: • all malodorous excavated material should be placed as far as possible from any ASRs; • the stockpiled malodorous materials should be removed from site as soon as possible; and • the stockpiled malodorous materials should be covered entirely by plastic tarpaulin sheets.							
Air Quality Impact – Operation Phase									
3.6.2	2.3	For the potential odour impact due to the proposed on-site STP, it is recommended to implement the following measures to contain and mitigate the potential odour impact: • The STP will be totally enclosed;	Duration of the operation phase	Future Operator			✓		EIA Recommendation and EPD's Guidelines for the

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location/Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stages				Relevant Legislation & Guidelines
					Des	C	O	Dec	
		• Negative pressure ventilation will be provided within the enclosure to avoid any fugitive odorous emission from the STP; • Further odour containment will be achieved by covering or confining the sewage channels, sewage tanks, and equipment with potential odour emission; • Proper mixing will be provided at the equalization and sludge holding tanks to prevent sewage septicity; • Chemical or biological deodorization facilities with 99.5% odour removal efficiency will be provided to treat potential odorous emissions from the STP including sewage channels / tanks, filter press and screening facilities so as to minimize any potential odour impact to the nearby ASRs. • The deodorization facilities should be regularly maintained so as to ensure a minimum of 99.5% odour removal efficiency. • The deodorization facilities should be designed such that the discharge point is directed away from nearby ASRs.							Design of Small Sewage Treatment Plants
Noise Impact – Construction Phase									
4.9.1	3.2	Good Site Practice Good site practice and noise management can significantly reduce the impact of construction site activities on nearby NSRs. The following package of measures should be followed during each phase of construction: • only well-maintained plant to be operated on-site and plant should be serviced regularly during the construction works; • machines and plant that may be in intermittent use to be shut down between work periods or should be throttled down to a minimum; • plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from the NSRs; • mobile plant should be sited as far away from NSRs as possible; and • material stockpiles and other structures to be effectively utilised, where practicable, to screen noise from on-site construction activities.	Within the Project site / During construction phase / Prior to commencement of operation.	Contractor		✓			EIAO and Noise Control Ordinance
4.9.1	3.2	Adoption of QPME • QPME should be adopted as far as applicable.	Within the Project site / During construction phase / Prior to commencement of operation.	Contractor		✓			EIAO and Noise Control Ordinance
4.9.1	3.2	Use of Noise Enclosure/ Acoustic Shed • Noise enclosure or acoustic shed should be used to cover stationary PME such as air compressor and generator.	Within the Project site / During construction phase / Prior to commencement of operation.	Contractor		✓			EIAO and Noise Control Ordinance
4.9.1	3.2	Use of Noise Insulating Fabric	Within the Project site /	Contractor		✓			EIAO and Noise

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location/Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stages				Relevant Legislation & Guidelines
					Des	C	O	Dec	
		• Noise insulating fabric can also be adopted for certain PME.	During construction phase / Prior to commencement of operation.						Control Ordinance
4.9.1	3.2	Schedule of the Use of PME • The construction activities should be scheduled, where applicable, to prevent the use of multiple PMEs simultaneously.	Within the Project site / During construction phase / Prior to commencement of operation.	Contractor		✓			EIAO and Noise Control Ordinance
Noise Impact – Operation Phase									
4.8.2	3.3	Specification of the maximum allowable sound power levels of the STP should be followed. Appropriate noise reduction design at source at the louver opening will be considered (such as acoustic louver blade or ventilation silencers, etc.) during the detailed design stage to ensure the required maximum allowable SWLs is achieved.			✓		✓		EIAO and Noise Control Ordinance
4.8.2	3.3	Noise commissioning test prior to the operation of the STP is required to ensure noise criteria compliance.					✓		EIAO and Noise Control Ordinance
Water Quality – Construction Phase									
5.6.1.1	4.2	Construction Site Runoff Good site practices should be adopted, including but not limited to the following: • Temporary site drainage facilities shall be designed and implemented prior to commencement of construction. The design of the silt/ sand removal traps and sediment basins shall follow the design in ProPECC Note PN1/94 • Perimeter cut-off drains shall be installed in advance of any excavation and site formation works to convey site runoff from the works areas to the silt removal facilities; • Runoff into the excavation areas during rainstorm events shall be minimised as far as practicable. Any wastewater pumped out of the excavation areas shall be treated to remove suspended solids prior to discharge; • Maintenance and inspection of the drainage system and sediment removal facilities should be carried out regularly to remove any sediment and blockages, especially when rainstorms are forecast; • Final surface levels should be compacted and final surface protections installed to prevent erosion by rainstorms; • Open stockpiles of material should be covered on site with waterproof layers such as tarpaulin. • The wheels of all vehicles and plant should be cleaned before leaving the works areas. The washwater should be treated to remove any suspended sediment; • Surface water from concrete batching areas and the rest of the site should be separated as far as possible. Wastewater from any concrete batching plant (if required) shall be	Within the Project site / During construction phase	Contractor		✓			ProPECC Note PN1/94 Water Pollution Control Ordinance Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location/Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stages				Relevant Legislation & Guidelines
					Des	C	O	Dec	
		treated to the required standards including pH adjustment and settlement of suspended sediments before discharging to stormwater drains; • Manholes (including those constructed as part of the Project) should be adequately covered and temporarily sealed at all times. Precautionary measures relating to inclement weather should also be adopted, including but not limited to the following: • Silt removal facilities, channels and manholes should be maintained and deposited silt and grit should be removed regularly; • Temporarily exposed slope surfaces should be covered; • Temporary access road should be protected by crushed stone or gravel; • Intercepting channels should be provided to prevent storm runoff from washing across exposed soil surfaces; and • Trenches should be dug and backfilled in short sections. Measures should be taken to minimize the ingress of rainwater into trenches.							
5.6.1.2	4.2	Accidental Spillage of Chemicals The following measures shall be observed: • The labelling and storage of chemicals should be in accordance with the "Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes" and maintained at all times by the Contractor; • Oils and fuels should only be stored in designated areas which have appropriate pollution prevention control facilities such as oil and grease traps and petrol interceptors; • The maintenance of vehicles should only be undertaken in areas of the site served by these pollution prevention measures; and • All fuel tanks and storage areas should be locked and located on sealed areas of the site, within bunded areas with a capacity equal to 110% of the storage capacity of the largest container. The bund should be drained of surface water after each rainfall event.	Within the Project site / During construction phase	Contractor		✓			Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes
5.6.1.3	4.2	Sewage from Construction Workforce Portable toilets shall be provided throughout construction phase and shall be regularly maintained, collected and disposed by a licensed waste collector.	Within the Project site / During construction phase	Contractor		✓			Technical Memorandum on Standards for Effluents Discharged into Drainage and

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location/Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stages				Relevant Legislation & Guidelines
					Des	C	O	Dec	
									Sewerage Systems, Inland and Coastal Waters
5.6.1.4	4.2	General Construction Activities Mitigation measures to be adopted include the following: • Construction waste, debris and refuse generated onsite should be stored in designated areas and properly contained. • Waste materials should be regularly removed offsite. • Stockpiles of construction materials such as cement and excavated material should be covered when not in use.	Within the Project site / During construction phase	Contractor		✓			EIAO
Water Quality Impact – Operation Phase									
5.6.2.1	4.3	Reclaimed Water Use Onsite The following measures shall apply: • The onsite STP shall comprise MBR technology with post-process disinfection via ultraviolet (UV) treatment and chlorine dosing; • Sewage effluent shall be treated to meet the Water Supplies Department's reclaimed water standards specified in the EIA for non-portable uses. Samples of reclaimed water shall be taken regularly and tested by a HOKLAS or other internationally accredited laboratory to ensure the effluent quality meets the required reuse standard. In addition, preventive measures for cross-contamination and mis-use of reclaimed water shall include the following: Engineering Measures • Water to be supplied for portable use, toilet flushing and irrigation should be stored in three different tanks in different colors and clearly labeled; • All pipes and fittings used for the reclaimed water supply and associated distribution system should be purple in color (exact color code to be reviewed) for distinguishing them from the pipes and fittings used for the fresh water supply and its distribution systems; • Regular checking/inspections of the reclaimed water supply and associated distribution systems should be carried out to identify any possible cross connection to the fresh water supply and distribution system. Non-toxic dye may be adopted in the checking/inspections; • Non-return valves should be installed on both the inlet pipes feed from reclaimed water storage tank and WSD's supply mains, to the toilet flushing and irrigation waters storage tanks; and	At the onsite STP and associated sewage / reclaimed water network / Throughout operation of the onsite STP	Project Proponent / Estate Manager			✓		Water Supplies Department Inter-departmental Working Group on the Implementation of Reclaimed Water Supply in Sheung Shui and Fanling "no net gain" in pollution load as specified in the Town Planning Board Guidelines No. 12C

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location/Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stages				Relevant Legislation & Guidelines
					Des	C	O	Dec	
		• All precaution measures should be clearly stated in the O&M manual of the STP, toilet flushing and irrigation systems. Management Measures • Warning plate with sign and letter "NOT FOR PORTABLE USE 不能飲用" would be shown on the toilet flushing and irrigation water storage tanks, and tagged on all accessible water taps supplying reclaimed water if any within the developments, notifying the staff, visitors and the public at large that reclaimed water is being used and is not suitable for drinking; • All water taps of reclaimed water at communal areas, if any should be locked in order to avoid mis-use of reclaimed water for other non-planned use; • Proper signage, promotion and training workshops will be provided periodically to all management and operation staffs of the Development, as well as future land owners on the proper use of reclaimed water and portable water; and • All precaution measures should be clearly stated in the management manual of the Development.							
5.6.2.2	4.3	Discharge of Reclaimed Water to Deep Bay WCZ • The following measures shall be incorporated as part of the onsite STP: • Provision of a minimum capacity of 1,180 m3 reclaimed water storage tank to store excessive reclaimed water in case of emergency (e.g. extreme adverse weather) or maintenance of landscape area; • Reclaimed water storage tank should be partitioned into several compartment to allow partial shut-down of the tank for maintenance; • The operation of the project will maintain the reclaimed water demands for toilet flushing and landscape irrigation as detailed in the SIA in Appendix 2.1 to ensure the reclaimed water can be totally reused. A minimum of 50,850m2 landscape areas within the development will be maintained (as committed in the Town Planning Board application for this development) using reclaimed water for irrigation; • Level sensors connected with alarm signalizing system should be installed to keep monitoring on storage volume of reclaimed water to avoid overflow of reclaimed water. The warning signal should be automatically generated and sent to the Estate Manager when the flow in the tank reaches a pre-set level. The Estate should arrange and mobilize tanker service to tank away the excessive reclaimed water as necessary to maintain 1-day reclaimed water storage capacity reserved as contingency. • As a last resort and when irrigation is stopped due to continuous adverse weather or prolonged suspension of irrigation or flushing water supply systems for maintenance / repairing, any further excessive reclaimed water shall be tanked away to the public STW for offsite treatment and disposal.	At the onsite STP / Throughout operation of the onsite STP	Project Proponent / Estate Manager			✓		Water Pollution Control Ordinance "no net gain" in pollution load as specified in the Town Planning Board Guidelines No. 12C

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location/Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stages				Relevant Legislation & Guidelines
					Des	C	O	Dec	
		For prevention of excessive irrigation leading to surface runoff, the following measures shall be adopted: • A pre-set semi-automatic control irrigation system with underground drip pipes would be installed in the private garden and managed by the Deed of Mutual Covenant manager to ensure that reclaimed water would be used properly for irrigation. • Installation of flow meters to monitor the irrigation water demand, with daily cut-off limits applied to prevent excessive irrigation using the reclaimed water. All the recommended measures for collection, treatment and disposal to ensure no net increase in Pollution to Deep Bay shall be incorporated in the Project contract document.							
5.6.2.3	4.3	Emergency Discharge of Untreated Sewage Effluent from the Onsite STP The following measures shall be incorporated as part of the onsite STP: • Regular test, maintenance and replacement of membranes or equipment will be carried out according to the recommendations from manufacturers to lower the chances of facilities breakdown; • Provision of equalization tank to store three times of ADWF for a period of 4 hours (i.e. minimum 241 m^3); • Provision of emergency storage tank to store the overflow of raw sewage with a capacity of approximate 130 m^3 based on the latest information (actual size to be confirmed in the detailed design stage). • Dual or standby power supply; • Standby unit for major equipment to allow for partial shut down for maintenance; and • Installation of flow measurement and level sensors connected with alarm signalizing system to keep monitoring on inflow rate to avoid sewage overflow. In case operation of the STP cannot be resumed after all the above mitigation measures have been exhausted, raw sewage shall be tanked away to the public STW for offsite treatment and disposal. Details of these and other specific contingency measures shall be documented in a contingency plan to be prepared by the operator of the STP. The contingency plan shall cover situations when the reclaimed water cannot meet the proposed criteria as well as situations when the STP is out of service, and shall be implemented throughout operation of the onsite STP.	At the onsite STP / Throughout operation of the onsite STP	Project Proponent / Estate Manager			✓		Water Pollution Control Ordinance "no net gain" in pollution load as specified in the Town Planning Board Guidelines No. 12C
5.6.3	4.4	Decommissioning Phase • The onsite STP shall not be decommissioned until the sewerage connection to the Government sewer has been fully established and implemented. Any wastewaters generated from the decommissioning process and any residual untreated sewage or	At the onsite STP / before decommissioning of the onsite STP	Project Proponent / Estate Manager				✓	Water Pollution Control Ordinance "no net gain" in

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location/Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stages				Relevant Legislation & Guidelines
					Des	C	O	Dec	
		reclaimed water would be pumped out and tanked away to the public sewage treatment work for offsite treatment and disposal.							pollution load as specified in the Town Planning Board Guidelines No. 12C
Waste Management Implications – Construction Phase									
6.5.1.1.	5.2	Good Site Practice Recommendations for good site practices during the construction activities include: • Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site • Training of site personnel in proper waste management and chemical handling procedures • Provision of sufficient waste disposal points and regular collection of waste • Appropriate measures to minimise windblown litter and dust/odour during transportation of waste by either covering trucks or by transporting wastes in enclosed containers • Stockpiles of C&D materials should be kept covered by impervious sheets to avoid wind-blown dust. • All dusty materials including C&D materials should be sprayed with water immediately prior to any loading transfer operation so as to keep the dusty material wet during material handling at the stockpile areas • Provision of wheel washing facilities before the trucks leaving the works area so as to minimise dust introduction to public roads • Well planned delivery programme for offsite disposal such that adverse environmental impact from transporting the inert or non-inert C&D materials is not anticipated	Project construction site / Throughout construction stage / Until completion of all construction activities	Contractor		✓			Waste Disposal Ordinance (Cap 354); Waste Disposal (Chemical Wastes) (General) Regulation (Cap 354C); and ETWB Technical Circular (Works) No. 19/2005 Environmental Management on Construction Site
6.5.1.2	5.2	Waste Reduction Measures Good management and control can prevent the generation of a significant amount of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include: • Sort inert C&D materials to recover any recyclable portions • Segregation and storage of different types of waste in different containers or skips or stockpiles to enhance reuse or recycling of materials and their proper disposal • Encourage collection of recyclable waste such as waste paper and aluminium cans by providing separate labelled bins to enable such waste to be segregated from other general refuse generated by the work force • Proper site practices to minimise the potential for damage or contamination of inert C&D	Project construction site / Throughout construction stage / Until completion of all construction activities	Contractor		✓			Waste Disposal Ordinance (Cap 354)

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location/Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stages				Relevant Legislation & Guidelines
					Des	C	O	Dec	
		materials • Plan the use of construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste							
6.5.1.3	5.2	Inert and Non-inert C&D Materials In order to minimise impacts resulting from collection and transportation of inert C&D materials for off-site disposal, the inert C&D materials should be reused on-site as fill material as far as practicable. In addition, inert C&D materials generated from excavation works could be reused as fill materials in local projects that require public fill for reclamation. The surplus inert C&D materials will be disposed of at the Government's PFRFs for beneficial use by other projects in Hong Kong. The C&D materials generated from general site clearance should be sorted on site to segregate any inert materials for reuse or disposal of at PFRFs whereas the non-inert materials will be disposed of at the designated landfill site. In order to monitor the disposal of inert and non-inert C&D materials at respectively PFRFs and the designated landfill site, and to control fly-tipping, it is recommended that the Contractor should follow the DEVB Technical Circular (Works) No. 6/2010 for Trip Ticket System for Disposal of Construction & Demolition Materials issued by Development Bureau. In addition, it is also recommended that the Contractor should prepare and implement a Waste Management Plan detailing their various waste arising and waste management practices in accordance with the relevant requirements of the ETWB Technical Circular (Works) No. 19/2005 Environmental Management on Construction Site	Project construction site / Throughout construction stage / Until completion of all construction activities	Contractor		✓			Waste Disposal Ordinance (Cap 354); DEVB Technical Circular (Works) No.6/2010 for Trip Ticket System for Disposal of Construction & Demolition Materials; and ETWB Technical Circular (Works) No. 19/2005 Environmental Management on Construction Site
6.5.1.4	5.2	Excavated Sediment • The loading, unloading, handling, transfer or storage of treated and untreated sediment should be carried out in such a manner to prevent or minimise dust emissions; • Temporary stockpiling shall be avoided as far as possible. In case temporary storage is needed, the untreated sediment should be placed at a designated area paved with either concrete or liner and covered properly with tarpaulins; • Speed control shall be implemented for vehicles carrying untreated sediment within the site to minimise dust emission; and • All necessary measures should be employed to prevent cross-contamination of untreated sediment with other excavated / fill materials	Project construction site / Throughout construction stage / Until completion of all construction activities	Contractor		✓			Waste Disposal Ordinance (Cap 354)
6.1.15	5.2	Chemical Waste If chemical wastes are produced at the construction site, the Contractor will be required to register with the EPD as a chemical waste producer and to follow the guidelines stated in the "Code of Practice on the Packaging Labelling and Storage of Chemical Wastes". Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately. Appropriate labels should be securely attached on	Project construction site / Throughout construction stage / Until completion of all construction activities	Contractor		✓			Code of Practice on the Packaging Labelling and Storage of Chemical Wastes; Waste Disposal

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location/Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stages				Relevant Legislation & Guidelines
					Des	C	O	Dec	
		each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidising, irritant, toxic, harmful, corrosive, etc. The Contractor should use a licensed collector to transport and dispose of the chemical wastes at the approved Chemical Waste Treatment Centre or other licensed recycling facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation. Potential environmental impacts arising from the handling activities (including storage, collection, transportation and disposal of chemical waste) are expected to be minimal with the implementation of appropriate mitigation measures as recommended							(Chemical Waste) (General) Regulation (Cap 354C)
6.5.1.6	5.2	General Refuse General refuse should be stored in enclosed bins or compaction units separated from inert C&D materials. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from inert C&D materials. Preferably an enclosed and covered area should be provided to reduce the occurrence of 'wind blown' light material.	Project construction site / Throughout construction stage / Until completion of all construction activities	Contractor		✓			Waste Disposal Ordinance (Cap 354); Public Health and Municipal Services Ordinance (Cap 132) - Public Cleansing and Prevention of Nuisances Regulation
Waste Management Implications – Operation Phase									
6.5.2.1	5.3	Screening and Grits • Screens should be cleaned regularly to remove any accumulated organic debris; • Screening and grit transfer system should be flushed regularly with water to remove organic debris; • Screening and grits generated should be transferred to closed containers before transportation and disposal at designated landfill sites.	Project area / On a regular basis / Throughout operation stage	Future user			✓		Waste Disposal Ordinance (Cap 354)
6.5.2.2	5.3	Sludge • Frequent sludge withdrawal from tanks is necessary to prevent the production of gases; • Sludge should be transferred to closed containers before transportation and disposal at designated landfill sites or public sewage treatment works by designated sewage tankers; • Sludge tankers and containers should be flushed with water regularly; • Sludge tankers should be washed thoroughly before leaving the proposed sewage treatment plant to avoid any odour nuisance during transportation; • All wastewater, if any, generated from the sludge dewatering process should be diverted to the proposed sewage treatment plant for proper treatment.	Project area / On a regular basis / Throughout operation stage	Future user			✓		Waste Disposal Ordinance (Cap 354)

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location/Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stages				Relevant Legislation & Guidelines
					Des	C	O	Dec	
6.5.2.3	5.3	General Reuse General refuse should be collected on daily basis and delivered to the refuse collection point accordingly. A reputable waste collector should be employed to remove general refuse regularly to avoid odour nuisance or pest/vermin problem. Sufficient recycling containers are recommended to be provided at suitable locations of the Project to encourage recycling of such waste as aluminium cans, plastics and waste paper.	Project area / On a regular basis / Throughout operation stage	Future user			✓		Waste Disposal Ordinance (Cap 354)
6.5.2.4	5.3	Chemical Waste If chemical wastes are expected to be produced during the operation phase, the Project Proponent should register with the EPD as a chemical waste producer and follow the guidelines stated in the "Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes". Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately. Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidising, irritant, toxic, harmful, corrosive, etc. Licensed collector should be deployed to transport and dispose of the chemical wastes at the approved Chemical Waste Treatment Centre or other licensed recycling facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.	Project area / On a regular basis / Throughout operation stage	Future user			✓		Code of Practice on the Packaging Labelling and Storage of Chemical Wastes; Waste Disposal (Chemical Waste) (General) Regulation (Cap 354C)
Ecological Impact									
		No specific ecological mitigation measure is required.							EIAO and EIAO-TM
Landscape and Visual Impacts – Construction Phase									
Table 8.14	Table 7.1	CP1 – Integration of Construction Programme with that of the WSW Development – The construction programme should be carefully integrated into the overall programme of the WSW Development, so that the construction of the Project will not cause any delay and thereby lengthen the construction period of the WSW Development.	Project area / During design stage and construction phase	Project Proponent via Design Team & Contractor		✓			EIAO-TM
Table 8.14	Table 7.1	CP2 – Advance Planting – Proposed landscape planting should be undertaken at the earliest practicable stage of the construction phase of the Project.	Project area / During design stage and construction phase	Project Proponent via Contractor		✓			EIAO-TM
Table 8.14	Table 7.1	CP3 – Dust and Erosion Control for Exposed Soil – Exposed soil shall be covered or "camouflaged" and watered frequently as dust suppression. Areas that are expected to be left with bare soil for a long period of time should be hydroseeded and / or covered with suitable protective fabrics to minimize dust impact.	Project area / During construction phase	Project Proponent via Contractor		✓			EIAO-TM
Landscape and Visual Impacts – Operation Phase									
Table 8.15	Table 7.2	OP1 – Sensitive Design and Disposition – The above-ground structure of the Sewage Treatment Plant should be sensitively designed in a manner that responds to the planned landscape context of the WSW Development to minimize potential adverse visual impacts.	Project area / During design stage	Project Proponent via Design Team	✓	✓			EIAO-TM; PNAP 152 – Sustainable

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location/Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stages				Relevant Legislation & Guidelines
					Des	C	O	Dec	
		The structural design should seek to reduce the apparent visual mass. Subdued tones should be considered for the colour palette with non-reflective finishes to reduce glare effect. The layout of buildings and their windows should take into account the location of the proposed Sewage Treatment Plant so as to avoid and minimize any potential views of the Sewage Treatment Plant by potential VSRs.							Building Design Guidelines; Hong Kong Planning Standards and Guidelines; Urban Design Guidelines
Table 8.15	Table 7.2	OP2 – Visual Screening – Visual screening such as boundary fences / walls at the periphery of the swimming pool should be considered as far as practicable to obstruct the views of the above-ground structure of the proposed Sewage Treatment Plant from the VSRs.	Project area / During design stage	Project Proponent via Design Team		✓			EIAO-TM
Table 8.15	Table 7.2	OP3 – Screen Planting – Trees with mature height of at least 10 m should be planted around the proposed Sewage Treatment Plant as far as practicable for screening purpose to minimize the visual impact to the VSRs.	Project area / During design stage and construction phase	Project Proponent via Design Team		✓			EIAO-TM
Table 8.15	Table 7.2	OP4 – Enhancement Planting – Other than screen planting, additional trees, shrubs and groundcovers should also be considered to maximize greening within the Project site upon completion of the Project.	Project area / During design stage and construction phase	Project Proponent via Design Team		✓			EIAO-TM; DEVB TC(W) No. 2/2012 - Allocation of Space for Quality Greening on Roads
Table 8.15	Table 7.2	OP5 – Green Roofs and Vertical Greening – Green roofs and vertical greening should be provided where feasible and appropriate to screen and soften the hard edges of the above-ground structure of the proposed Sewage Treatment Plant.	Project area / During design stage and construction phase	Project Proponent via Design Team		✓			EIAO-TM; PNAP 152 – Sustainable Building Design Guidelines; Hong Kong Planning Standards and Guidelines; Urban Design Guidelines

Notes: Des = Design; C = Construction; O = Operation; Dec = Decommissioning