14 Summary of Environmental Outcomes

14.1 General

14.1.1.1 This section summarises the overall environmental outcomes due to the construction and operation of Shuen Wan Golf Course in accordance with Section 3.6.1 of the Environmental Impact Assessment (EIA) Study Brief No.: ESB-303/2017. It can be seen in **Section 1** and **Section 2** that environmental considerations have been the key considerations throughout the development of the Project. Alternative options for designs and construction methodologies have been duly considered. Besides, all the options considered have ensured that environmental impacts could be avoided or minimised where practicable and mitigated by implementation of suitable mitigation measures to fulfil all the statutory requirements. The technical assessments conducted (**Section 3** to **Section 12**) have demonstrated that all the statutory requirements in the EIA Study Brief (ESB-303/2017) and Technical Memorandum of the Environmental Impact Assessment Ordinance (TM-EIAO) have been compiled with.

14.1.1.2 The following sections summarise the approaches that have been adopted to either avoid or minimise various environmental impacts throughout the design process, and the associated environmental enhancements.

14.2 Environmental Friendly Options Considered and Incorporated to Avoid Environmental Impact

14.2.1.1 Avoidance of environmental impacts has been one of the key considerations throughout the entire project development and design. The environmental impacts that have been avoided are listed and discussed below:

- Avoidance of marine works during construction; and
- Avoidance of effluent discharge to Tolo Harbour.

14.2.2 Avoidance of Marine Works During Construction

14.2.2.1 As discussed in **Section 2**, the Project is all land-based and would neither involve modification of the existing sea wall, dredging nor require any construction barges. Hence, the Project has avoided any adverse impacts on marine ecology and fisheries in the vicinity during construction phase.

14.2.3 Avoidance of Effluent Discharge to Tolo Harbour

Convey sewage generated to Tai Po Sewage Treatment Plant (TPSTW)

14.2.3.1 As discussed in **Section 2**, considering the daily population during operational phase, only a small amount of sewage will be generated (i.e. only about 500m^3/day of Average Dry Weather Flow (ADWF)). Instead of constructing a new STW within the Project Boundary, it is proposed to convey the sewage generated to a neighbouring government sewer that connects back to TPSTW located in Tai Po Industrial Estate (TPIE). Since TPSTW would have sufficient capacity to handle the additional 500m^3/day (see **Section 2**), the Project will not discharge any sewage to the marine water and it would not cause any adverse water quality and hence ecological and fishery impacts.

Recycling Surface Run-off during both Construction and Operational Phases

14.2.3.2 During the operational phase, the surface runoff from the turf area would inevitably contain certain amount of agrochemicals including fertilizers, pesticides, herbicides, etc. The concentration would generally be higher during the first flush but would decrease with increase rainfall duration/rate. Besides, higher rainfall density would also help dilute the concentration of agrochemicals as well.

14.2.3.3 Nevertheless, water storage tanks with a total capacity of 30,000m^3 have been proposed to intercept storm flow containing agrochemicals from the Project Site. The capacity of the water storage tanks have been determined based on historical rainfall data to ensure that the runoff from the majority of the rainfall events can be contained within the water storage tanks. Only during very heavy and prolonged rainfall events would the surface runoff be by-passed to Tolo Harbour from the water storage tanks (see **Section 2** for details).

14.2.3.4 The water storage tanks will also serve dual functions for both construction and operational phases. Apart from receiving the Project site runoff during operational phase, the water storage tanks also serve as part of the temporary drainage system during the construction phase to receive construction runoff. Temporary drainage system would be installed around the site perimeter to intercept all the construction runoff and divert to the water storage tanks which would enable sufficient sedimentation before the effluent is discharged to Tolo Harbour.

14.3 Environmental Designs Recommended to Minimise and Mitigate Environmental Impacts

- Minimization of ecological impacts to bird species of conservation interest;
- Optimal use of agrochemicals;
- Minimization of fresh water consumption;

- Minimization of potential impact of runoff bypass;
- Minimization of landscape and visual impact;
- Minimization of odour impact to the Project Site; and
- Optimize project design in other environmental aspects.

14.3.1 Minimization of Ecological Impacts to Bird Species of Conservation Interest

14.3.1.1 Site surveys have confirmed that the existing Shuen Wan Restored Landfill is night roost sites for two bird species of conservation interest, i.e. Collared Crow (CC) and Black Kite (BK).

Restriction of Works Hours

14.3.1.2 The construction methodology of the Project has been proactively adjusted to protect the night roosting site of Collared Crows and Black Kites by restricting the working hours for Area 3, the eastern portion of Area 2, and the ancillary facilities including the access road (see **Section 2** and **10** for more details).

Preservation of Major Tree Groups

14.3.1.3 Besides, the night roosting sites within the existing driving range is proposed to be preserved as much as practicable. For those roosting locations which could not be avoided, similar habitats will be re-provided in the design of the golf course. In contrary to typical golf course which would arrange the putting green and golf driving range immediately next to their ancillary facilities, the current layout has opted to locate the putting green and golf driving range further away from the ancillary facilities, by at least 250m in order to preserve the major tree group utilised as roosting site. The layout for the golf course has been substantially amended to relocate the putting green, and fairway, and replaced with driving range which would involve less earth works. The size of the driving range has also been proactively reduced from 25000m^2 to 20000m^2 to maximise the area size of this major tree group to be preserved.

14.3.1.4 Other than preserving the roosting site, advance enhancement planting would be implemented at the roost site. Whip planting will be conducted to replace those in poor conditions/collapsed to secure the conditions of the trees at the preserved area for night roost.

14.3.1.5 Besides, the direction of golf shots at the driving range has been duly considered from the ecological perspective. A typical arrangement is to have the golf shots directed to the south (i.e. facing the shoreline), so that the golf players can enjoy the sea view while playing (**Figure 2.2**). However, this arrangement may have certain impacts on the neighbouring CCs and BKs (e.g. physical disturbance). Hence, the current layout has strategically positioned the golf driving range in order to direct the golf shots towards the north. This would minimise the potential impacts on CCs and BKs, however, would compromise the view enjoyed by the users at the golf driving range.

14.3.1.6 The construction phasing has been adjusted to re-provide roosting site in advanced. Heavy standard trees (or mature-size trees where possible) for Black Kite would be planted along the waterfront on both sides of the access road and on slopes along the road to re-provide roosting site at early stage of the construction phase. This will shorten the time between vegetation clearance and replanting, which is usually implemented upon completion of construction.

14.3.2 Optimal Use of Agrochemicals

14.3.2.1 Tolo Harbour has a very long retention time similar to that as Deep Bay. Given that the occurrence of red tides is highly related to the abundance of nutrient content and long retention time, the higher occurrence records of red tides in Tolo Harbour reveals the importance to have due consideration on the use of agrochemicals which includes fertilizer. To this end, **Section 2.7** presents an outline of the environmental conscious Turfgrass Management Plan which would be further optimised during the detailed design stage.

14.3.3 Minimisation of Fresh Water Consumption

14.3.3.1 According to the current golf course design, the average daily consumption of water during the operational phase for irrigation of green, tee, fairway, vegetation etc. would be approximately 1,800m^3/day (see Section **2.4**) during dry season. This water consumption would be relatively less during wet season. In order to fulfil the irrigation need and minimize such consumption for fresh water from Water Supplies Department (WSD), a number of options including seawater desalination, re-use of treated effluent from TPSTW, rainwater harvesting, grey water recycling, etc. have been exhaustively considered and it has been concluded that a combination of following method deems as the optimal scheme for irrigation purpose:

- Rainwater harvesting;
- Water extraction from existing open channel; and
- Freshwater supply from WSD as backup supply.

14.3.4 Minimisation of Potential Impact of Runoff Bypass

14.3.4.1 To reduce the water quality impact by the turf area runoff, special considerations have been formulated in designing the drainage system of the Project. In particular for the outfall location, it has been duly situated to allow an optimum distance from the adjacent water sensitive receivers and ecological resources. As such, potential water quality impact at receivers could be further minimised

14.3.5 Minimize Landscape and Visual Impact

14.3.5.1 Important trees identified within the Project Site has been duly considered and avoided as much as practicable, those could not be

avoided will be transplanted within the Project Site to reduce any potential impact. The Project minimizes the site formation works as far as possible to maintain the existing sloping profile of the site to some group of retain trees at their original ground level, especially those trees along the edge of the site, to maintain screening effect and buffer in the views of the adjoining visually sensitive receivers.

14.3.6 Minimize Odour Impact to the Project site

14.3.6.1 As discussed in **Section 2.4**, four odour sources including TPSTW, the committed food waste pre-treatment facilities (FWPF), an existing SPS which will be upgraded at Ting Kok Road and the proposed SPS within the Project Site, could have potential impact to the Project Site in operational phase. Quantitative assessment have demonstrated that the cumulative odour impacts within the Project Site would fully comply with the 5OU requirement. Nevertheless, the current golf course layout has proactively allowed for a buffer planting of approximately 20m wide between the TPSTW, the committed FWPF and the Project Site. This would help to create a more positive environment for the golfers at the western side of the golf course.

14.3.7 Optimization of Project Design in Other Environmental Aspects

14.3.7.1 Having considered the Project Site would be partially fall within the Consultation Zone (CZ) of Tai Po Gas Production Plant (TPGPP), the design of the Project has proactively avoided facilities that would be more densely populated (i.e. ancillary facilities) outside the CZ. The ancillary facilities would be located at the far southeast corner of the Project Site with more than 1200m separation from the TPGPP (See **Section 4** for details). Furthermore, population arrangements would be made within the Project Site that is partially encroaching to the CZ to minimise potential impacts on the hazards-to-life.

14.3.7.2 In order to avoid damaging the geomembrane in the capping layer, only a maximum of 300mm thick top soil would be excavated within the landfill area at the Project Site. Approximately 70% of the excavated top soil and almost all excavated inert materials would be reused on site for site formation and roadworks at the Project Site.

14.3.7.3 Due to extensive coverage of existing landfill gas and leachate extraction wells in the Project Site and consideration of safety of golfers, it is unavoidable that some of the extraction wells will be relocated to avoid conflict with the teeing ground and fairway. For any demolition, relocation, reprovision and modification works of the existing landfill facilities, the Project Proponent or the future golf course operator would hire a Specialist Contractor/Landfill Consultant who possesses experiences in local or overseas landfill design and engineering projects. By employing a Landfill Consultant for the design of landfill facilities and a Specialist Contractor to perform modification works, adverse impact from modification of landfill facilities can be minimised, provided that precautionary and protective measures are in place.

14.3.7.4 Excavation has been avoided as far as possible. By placing buildings, access road, water storage tanks, ancillary facilities outside the waste boundary where the landfill capping layer has been installed, deep excavation and heavy construction atop the waste boundary can be avoided. For any inevitable excavation on the existing landfill capping layer, a method statement should be submitted to EPD for approval before the works commence. The method statement should assess the risk of excavation based upon the excavation depth, equipment, extent and types of landfill capping system underneath. Excavation works on the existing landfill capping layer will only be performed in accordance with the approved method statement by the Specialist Contractor.

14.4 Summary of Key Environmental Problems Avoided and Sensitive Areas Protected

14.4.1.1 **Section 14.2** and **Section 14.3** have summarised the key approaches adopted in the current proposal to avoid current proposed layout to avoid, minimise and mitigate environmental impacts. Some of these approaches have contributed to avoid a number of environmental issues and to protect a number of environmentally sensitive areas. The following table presents the key environmental problems that have been avoided and any sensitive areas protected by these approaches.

Table 14.1 Key environmental problems avoided and sensitive areas protected

Design Approach	**Key Environmental Problems Avoided, Sensitive Areas Protected & Environmental Outcomes Achieved**
Avoidance of Marine Works (**Section 14.2.2**)	• Adverse direct impacts on marine ecology and fisheries would be avoided
Avoidance of Effluent Discharge into Tolo Harbour (**Section 14.2.3**)	• Adverse indirect impacts on marine ecology and fisheries would be avoided
Minimization of ecological impacts to bird species of conservation interest (**Section 14.3.1**)	• Adverse direct impact (i.e. permanent habitat loss) to bird species of conservation interest would be minimised
Optimal Use of Agrochemicals **(Section 14.3.2**)	• Minimise chances of inducing red tides and protect nearby water quality and hence ecological and fisheries resources
Minimization of Fresh Water Consumption **(Section 14.3.3**)	• Minimise freshwater demand on public utilities

Design Approach	Key Environmental Problems Avoided, Sensitive Areas Protected & Environmental Outcomes Achieved
Minimization of Potential Impact of Runoff Bypass **(Section 14.3.4**)	• Minimise potential impact to nearby water sensitive receivers, and minimise potential ecological and fisheries impact
Minimization of landscape and visual impacts **(Section 14.3.5**)	• Minimise the changes in level of the Project to reduce visual intrusion and protect important tree species onsite
Minimize Odour Impact to the Project site **(Section 14.3.6**)	• Minimise potential odour nuisance to future golf course users
Optimisation of Project Design in Other Environmental Aspects **(Section 14.3.7**)	• Minimise potential impact in the aspect of hazard-to-life, waste management and landfill gas.

14.5 Estimated Population Protected from Various Environmental Impacts

14.5.1.1 The Project has been carefully designed to protect the populations from various environmental impacts. The protected populations include the following:

- Future staff / visitor at the ancillary facilities of the Project would be avoided from the 1000m Consultation Zone (CZ) of Tai Po Gas Production Plant;
- Existing sensitive receivers such as residential premises in Fortune Garden, Casa Marina, etc. would be protected from fixed noise impact by applying acoustic treatment to future fixed noise source (i.e. Pumps, chiller, etc.).

14.6 Environmental Benefits of Environmental Protection Measures Recommended

14.6.1.1 In addition, mitigation measures have been recommended to further reduce the environmental impacts due to construction and operation of the Project. Key recommended mitigation measures and their associated benefits are summarised in **Table 14.2** below.

Table 14.2 Key recommended mitigation measures and their associated benefits

Aspect	Key recommended mitigation measures and their associated benefits
Air quality	• Implementing relevant control measures as required in the Air Pollution Control (Construction Dust) Regulation to minimise dust generation. • Erect a 3m hoarding at the northern boundary of the Project Site. • Watering once per hour on exposed worksites and haul road. • Deodourising units of 99.5% removal efficiency should be provided to the proposed SPS.
Hazard to Life	• No mitigation measures would be required.
Noise	• Adoption of good site practices including use of temporary noise barrier and using quality powered mechanical equipment (QPME) to reduce construction noise emissions at the source. • Mechanical plants should be enclosed inside a building structure to mitigate impacts from fixed noise sources. • Installation of silencer/ acoustic enclosure/ acoustic louver for the exhaust of ventilation system to reduce impacts of fixed noise sources. • Installation of absorptive noise barrier (with density of absorption material of 48kg/m^3) for the aerator which would duly shield the engine and other noisy parts of the aerator as far as practicable.
Water Quality	• Adopting good site practices in accordance to Practice Note for Professional Persons on Construction Site Drainage, Environmental Protection Department, 1994 (ProPECC PN 1/94) to avoid potential adverse water quality impacts from construction site runoff. • Minimise emergency bypass to neighbouring water bodies to avoid impacts on water quality. • Install and maintain roadside gullies and oil / grease interceptors for removal of pollutants from storm water. • Dual power supply and standby pump will be provided to cater for emergency situations at the proposed SPS. Sewage could also be tankered away if the above measures were failed to implement during emergency situations.
Waste Management	• Good waste management and control practices to avoid generation of excessive amount of waste materials. • Good site practices to alleviate impacts related to waste management such as dust, odour and noise. • Implementation of a trip-ticket system promulgated under DEVB TC(W) No. 6/2010 to monitor off-site delivery of surplus inert C&D materials and to control fly tipping. • 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 to avoid potential hazard and land/ water pollution due to malpractice or chemical leakage/ spillage. • Employ reputable licensed waste collectors for disposal of general refuse to prevent potential nuisance caused by mistreating general refuse, such as windblown, vermin, water pollution and visual impact.

Aspect	Key recommended mitigation measures and their associated benefits
Land contamination	• Project Proponent (PP) is recommended to conduct further land contamination assessment at the storage/ workshop area at later stage of the Project after the area within the boundary of the Project and the works of the Project is handed over to the PP. Further land contamination assessment should include site re-appraisal, submission of Land Contamination Review (LCR) or Contamination Assessment Plan (CAP), Site Investigation (SI) and submission of Contamination Assessment Report (CAR), if necessary. If land contamination is confirmed, a Remediation Action Plan (RAP) should be submitted to formulate viable remedial measures. Possible remediation methods include air sparging, biopile, stabilisation / solidification, thermal desorption, etc. The contaminated land should then be remediated according to the approved RAP, and a Remediation Report (RR) should be submitted to demonstrate the land has been remediated adequately. • All pesticides used on the golf course must be registered under the Pesticides Ordinance and be used by person with valid Pesticides Permit. • In case of any chemical spillage, the operator should follow the instruction of the labels and take precautionary measures before handling the spillage. In incidents where the spillage may result in significant contamination of an area or risk of pollution, EPD should be informed immediately. • An Environmental Conscious Turfgrass Management Plan (TMP) which would provide details on the application, handling and storage of agrochemicals as well as measures to be carried out in the occurrence of chemical spillage will be prepared by the future operator and submitted to EPD as one of the EP conditions. • The current land use of golf course will not be changed under current arrangement. In the unlikely event that the proposed golf course is decommissioned in future, the Project Proponent will conduct contamination testing to identify and delineate any contamination that may have occurred and, if necessary, propose remediation action to be taken, subject to the agreement of relevant authorities.
Landfill Gas Hazards	• Mitigation measures such as provision of mechanical ventilation system, wind scoops, compacted high density concrete and gas-proof membrane, ventilation by natural air movement, and good site management should be implemented in which high and medium-risk targets would be present and wherever practicable to reduce the hazards to sensitive targets to acceptable levels, in accordance with Landfill Gas Hazard Assessment Guidance Note (EPD/TR8/97). • Entry safety procedures should be followed by the maintenance staff working in confined spaces in accordance with Factories and Industrial Undertakings (F&IU) (Confined Spaces) Regulation. • For any modification of existing landfill facilities, including landfill gas management system, leachate management system and landfill capping layer, Design Plan/Works Plan should be submitted to EPD for approval before commencement of works. The modified facilities should only be carried out by Specialist Contractor/Landfill Consultant to ensure the landfill and its restoration facilities would not be affected due to the implementation of the Project.

Aspect	Key recommended mitigation measures and their associated benefits
Ecology	• Tree groups used by Collared Crows and Black Kites night roosting sites within the Project Site is preserved as much as practicable, including tree groups more frequently used as night roosts. • Protective fencing without foundations to be erected surrounding the major preserved tree group. • Also preserving other tree groups such as those along the western boundary of the Project Site • Direction of golf shots at the driving range has been revised to reduce disturbance to the preserve night roost of Collared Crows and Black Kites. • Extensive new tree planting is proposed and the new tree groups will cover about 10 ha. The new trees will be planted in patches or several rows, to allow the future tree groups suitable for bird roosting. Heavy standard trees (or mature-size trees where possible) will be included in the planting list to facilitate the establishment of new tree groups as early as possible. Heavy standard trees will be planted along the waterfront on both sides of the access road and on slopes along the road to re-provide roosting site for Black Kite at early stage of the construction phase, • Phasing of construction programme to allow the planting of new tree groups, with the function of roosting site reprovision, to be conducted at early stage. Upon completion of site formation at each phase, landscape planting will be implemented immediately before the beginning of next phase such that new tree groups aiming for roosting site provision will be planted before site clearance in the next phase, to shorten the time between vegetation clearance and replanting. • Planting of whip to replace those trees in poor conditions/collapsed to secure the conditions of the trees at the preserved area as night roost of Collared Crows and Black Kites. • Restricting the working hours of construction plants in Area 3 of the Construction Programme (i.e. the southern part of the Project Site, near the major preserved tree group), the ancillary facilities (including part of the water storage tanks and traffic along the existing access road), and the eastern part of Area 2 (near other preserved tree groups), to protect the preserved night roosting sites of Collared Crows and Black Kites. • Primarily designed for the operational phase storage of surface runoff from the Project Site to minimize bypass during raining, these water storage tanks, once any of them are constructed, would also serve to temporarily store site runoff during construction phase. • Good site practices in accordance to Practice Note for Professional Persons on Construction Site Drainage, Environmental Protection Department, 1994 (ProPECC PN 1/94) should be implemented to avoid potential adverse water quality impacts. • During operational phase, a collection system conveying the runoff to the water storage tanks will be installed. The surface runoff from turfgrass and landscaped areas will be collected by surface channels and diverted to the proposed water storage tanks (with a total volume of 30,000 m^3), especially the first flush runoff from turf area after

Aspect	Key recommended mitigation measures and their associated benefits
	raining, to prevent the discharge of residual agrochemicals into Tolo Harbour and to minimize the runoff bypass. • The future TMP will set out the management practices which could significantly reduce the amount of agrochemical application and thus the residual agrochemicals. • Prevent emergency bypass to neighbouring water bodies through design of the SPS to avoid impacts on marine ecology and fisheries resources.
Fisheries	• Primarily designed for the operational phase storage of surface runoff from the Project Site to minimize the bypass during raining, these water storage tanks, once any of them are constructed, would also serve to temporarily store site runoff during construction phase. • Good site practices in accordance to Practice Note for Professional Persons on Construction Site Drainage, Environmental Protection Department, 1994 (ProPECC PN 1/94) should be implemented to avoid potential adverse water quality impacts. • During operational phase, a collection system conveying the runoff to the water storage tanks will be installed. The surface runoff from turfgrass and landscaped areas will be collected by surface channels and diverted to the proposed water storage tanks (with a total volume of 30,000 m^3), especially the first flush runoff from turf area after raining, to prevent the discharge of residual agrochemicals into Tolo Harbour and to minimize runoff bypass. • The future TMP will set out the management practices which could significantly reduce the amount of agrochemical application and thus the residual agrochemicals. • Prevent emergency bypass to neighbouring water bodies through design of the SPS to avoid impacts on marine ecology and fisheries.
Landscape and Visual	• Provide temporary landscape on temporary construction. • Optimisation of construction areas to ensure that the landscape and visual impacts arising from the construction activities are minimised. • Provide landscape treatments to the affected trees (such as tree transplantation and compensatory planting) to mitigate adverse landscape impacts. • Compensatory planting for felled trees would be provided. Trees unavoidably affected by the construction of associated utilities would be transplanted where practical. Transplantation would be conducted in accordance with DEVB TCW No.7/2015.