

14. ENVIRONMENTAL OUTCOMES

14.1 Environmental Sensitive Areas Protected

- 14.1.1 A total of 300 domestic buildings, 26 schools, 1 hospital and 1 Homes for the Ages, population is approximate 119,000, are within the influence zone of the project boundary during the construction stage. The assessment predicates that 3 schools and 8 domestic buildings and 1 Home for the Ages, population is approximate 3,300, would only be affected by cumulative construction noise after implementation of mitigation measures such as the use of quiet plant, application of noise barrier and the adoption of regular noise monitoring during construction. Notwithstanding the above, the exceedances of the noise level are marginal. Therefore a substantial number of the population (population is approximate 115,700) will be protected during construction stage.
- 14.1.2 Further it is estimated that with 2 domestic buildings at Eastern Portal, 12 domestic buildings at Western Portal and 1 building along the adit with vertical shaft at W3 (population is approximate 5,400) would be subject to exceedance of the ground borne noise during the period 2300 to 0700. However, it has demonstrated that after restricting the TBM or blasting operation in non-restricted period for tunnel/adit section (i.e. 7:00 to 23:00), all the buildings will be protected during the construction stage.
- 14.1.3 With appropriate mitigation measures and precautions in place, the adjacent sensitive receivers, water bodies, habitats and historical buildings/structures will be protected during both construction and operation of the project. Table 14.1 summarises the respective impacts and the corresponding measures taken to mitigate the impacts

Table 14.1 Summary of Mitigation Measures to be Implemented During the Construction and Operation Stages of the Project

Types of Impact	Affected Location	Mitigation Measures
Loss of woodland /shrubland	Eastern Portal, Western Portal and all intakes	<ul style="list-style-type: none"> - Minimise the land intake by adoption of environmental friendly design and construction method - Reservation of existing woodland, shrubland and stream as far as possible. - Good site practice - On-site compensatory planting
Loss of Stream habitat	Eastern Portal, Western Portal and all intakes	<ul style="list-style-type: none"> - Provision of temporary by-pass for water flow during construction. - Section of temporary loss to be reinstated after construction.
	Eastern Portal	<ul style="list-style-type: none"> - Provision of low flow channel and step chute inside the stilling basin structure to maintain existing aquatic habitats.
	Eastern Portal, Intakes PFLR1(P) , W12(P) and P5(P) , MB16, E5(B)(P) and TP789(P)	<ul style="list-style-type: none"> - Survey of the site and translocation of frogs including Hong Kong Cascade Frogs and Lesser Spiny Frogs
Air borne noise impact	All construction sites	<ul style="list-style-type: none"> - Use of quiet plant
	Intakes W5(P) and W8	<ul style="list-style-type: none"> - Use of cantilevered-type noise barriers when noise level exceeds the limit
	Eastern Portal, intakes E7(P), WO(P), E5(A)(P), GL1(P), MB16, P5(P), W10 and W12	<ul style="list-style-type: none"> - Use of movable barrier when noise level exceeds the limit
	Eastern Portal	<ul style="list-style-type: none"> - Use of full noise barrier enclosure at mud pit area - Use of partial enclosure at loading and unloading bays
	BR7(P), E7(P), E5(A)(P), W5(P), W8 and W12	<ul style="list-style-type: none"> - Pre-drilling followed by chemical splitting to replace use of excavator mounted breaker
	Eastern Portal, DG1(P), E7(P), RR1, W0(P), W5(P) and W8	<ul style="list-style-type: none"> - No construction activity is recommended during the examination period.
Ground borne noise impact	Eastern Portal, Western Portal	<ul style="list-style-type: none"> - Limit the TBM operation time
	Horizontal adit with vertical shafts W3 and W5	<ul style="list-style-type: none"> - Restriction of rock breaking operation if the measured noise levels exceeds the limit.
Construction dust impact	All locations	<ul style="list-style-type: none"> - Adoption of good housekeeping and effective dust suppression measures.
	Western Portal	<ul style="list-style-type: none"> - Delivery of excavated spoil by barge to avoid land transport

Types of Impact	Affected Location	Mitigation Measures
Water quality impact	All locations	- Adoption of good housekeeping and site management practices to control site run-off, spillage of chemical, on-site effluent generation.
	Western Portal	- Erection of silt curtain in the waters during construction of the temporary berth, placing of rock armour panel at the seabed and outfall structure - All construction for the basin shall be carried out inside the temporary cofferdam which is a temporary watertight enclosure to prevent dispersion of sediment. - The Western Portal is designed with provision of stilling basin and armour rock panels on the seabed. Such provisions will reduce the flow discharge velocity from outlet and hence the disturbance to seabed.
	At all intakes	- Bar screens are provided to screen off large stone, tree branches and other debris - Sand trap at the bottom of the intake drop shaft to retain coarser particles/ sand
	Main tunnel and adits	- Regular cleansing to remove debris, sand and leaves prior to onset of heavy rainstorm - Deployment of marine vessel to collect floating debris/leaves on an as-needed basis
Waste generation	All locations	- By implementation of waste management plan through good site practices for the achievement of waste minimization at source, waste recycle and reuse.
Cultural heritage impact	Eastern Portal and Intake W3	- Condition of condition survey to the historical buildings (Haw Par Mansion near Eastern Portal) and former explosive magazine of the former Victoria Barrack (near Intake W3) - Provision of a buffer zone between the work site and the respective buildings.
Landscape and Visual impacts	All locations	- Preservation of the existing landscape and visual resources as much as possible by minimising the land intake - To provide compensatory planting and design the landscape design to blend in the surrounding environment. - Erection of decorative hoarding around the works site during construction - To arrange landscaping works and reinstatement works immediately after completion of the civil works.

14.2 Environmental Friendly Designs and Problems Avoided

- 14.2.1 The principle of design of the proposed works is to avoid environmental impacts as far as practical. The minimisation will be the key design principle only when avoidance is not possible. Bearing this in mind, the tunnel alignment for this project is selected with the shortest tunnel length. The benefit of the design is to reduce the volume of spoil/excavated material to be generated as far as possible. Since the tunnel is designed to have life span of 120 years and have minimum operation and maintenance requirements, it will turn to be an environmental advantage.
- 14.2.2 The location of the intake structures, tunnel portals and outfall locations are mainly in disturbed areas which have lower ecological value such that lesser habitats and vegetation will be affected and hence the least environmental impacts will be generated.
- 14.2.3 Some environmental friendly designs have been incorporated into the drainage system to mitigate potential impact to the surrounding environmental. These include provision of low flow channel, basin and step chute within the diversion structure at Eastern Portal to maintain existing aquatic habitats as far as possible. The expansion section of the stilling basin at Western Portal will attenuate the flow velocity significantly and hence to prevent scouring and erosion of seabed. In addition, the protection of the seabed at the immediate downstream of the outfall will be enhanced by placement of rock armours over the seabed.
- 14.2.4 At the locations of intakes points and tunnel portal, the areas will be landscaped such as to blend it into the surrounding environments. Most of the structures are either be constructed underground or screened by planting, reducing the visual impact to the nearby sensitive receivers. For those intakes structures located inside existing sitting out or garden areas, the area on the top of the structure will be designed for the use of the public as far as possible such that loss of amenity areas will be minimal.

14.3 Environmental Benefit of the Project

- 14.3.1 The primary objective of the proposed drainage tunnel is to improve the flood protection level for the low lying areas on Northern Hong Kong Island without any significant additional improvement works to the existing drainage system in highly busy districts like Sai Ying Pun, Sheung Wan, Central, Admiralty, Wanchai and Causeway Bay.
- 14.3.2 The drainage tunnel will convey the uphill runoff via its intake structures and adit system for disposal into the sea off the western coast of Hong Kong Island, alleviating the flooding problems on Northern Hong Kong Island. With the proposed system, the flood protection level of trunk drains will be improved to a 50-year return period. It will minimise the requirement of extensive pipe laying works in the highly congested urban areas with heavy traffic and congested underground utilities, and hence prevents associated environmental impacts arisen from those works.