7. ENVIRONMENTAL ASSESSMENT OF THE SCHEMES WITHIN THE RAIL DEVELOPMENT PROPOSALS

7.1 Introduction

7.1.1 This chapter presents the findings of the environmental assessments undertaken for each of the Component Schemes and Stand Alone Schemes that make up the proposed network development options. Information is also presented for two of the Longer Term Schemes; the South Island Line (SIL) and the Shenzhen By-pass.

7.1.2 As outlined previously, the Component Schemes are centred around the FHC and generally provide relief to existing parts of the network. The degree of design advancement varies for each scheme. However, none of the alignments that were assessed are fixed and each is subject to alteration during the design development process.

7.1.3 At this strategic study level, the purpose of the assessment was to identify whether there were any potential 'strategic' environmental implications that would make the scheme under consideration 'unattractive' from an environmental perspective or would require particular attention during the future development of the scheme. It was not the intention of this assessment to undertake detailed evaluation to a level more commensurate with an EIA Study. Such detailed evaluations will need to be undertaken at a later phase of the development process for each of the routes once the design has been further progressed and the alignment is better defined.

7.1.4 As the detailed design of each of the Component Schemes within both rail development options have still to be developed, some of the schemes considered include minor alternative alignments possibilities. Whilst the alternatives alignments are not substantially different, each has been assessed.

7.1.5 The environmental benefits that may be accrued from the implementation of the Component Schemes are related principally to potential air quality benefits. The detailed assessment of such benefits on a scheme by scheme basis is outside the scope of a strategic study, nevertheless, whilst the generic environmental benefits of adopting rail in preference to equivalent road alternatives are presented in Section 3.2, a comparison of the cumulative air quality 'benefits' that may be derived from the implementation of the network development proposals is presented in Section 8.2.

7.2 Generic Construction and Operational Environmental Impacts

7.2.1 Before presenting the key findings of the assessments, it is considered worthwhile to present some generic discussion regarding the potential construction and operational impacts that could result from the rail developments. It should be noted that the information presented on this topic is only intended to give a broad overview of the generic impacts; the actual impacts will vary on a case by case basis depending upon the locality, construction method, and finalised operational details. A detailed evaluation of the impacts will be undertaken as part of any subsequent EIA Study that is undertaken before the schemes can be implemented.

Overview of Railway Construction Methods

7.2.2 All railway construction works, irrespective of the means by which they are undertaken, are likely to give rise to environmental impacts. However, the magnitude and severity of the impacts can vary significantly due to the chosen method of construction and the locality in which the works are undertaken.

7.2.3 As a broad principle, for subsurface railway construction, it can be assumed that the least environmental impacts are likely to result from bored tunnelling, whilst the greatest impacts are generally associated with cut and cover working.

7.2.4 At-grade or viaduct construction will also potentially give rise to impacts. The severity of these impacts would generally be considered to be less than cut and cover working, but greater than bored tunnelling. In comparison to cut and cover tunnelling methodologies, above ground construction methodologies can generally be completed in a shorter time frame (particularly if a viaduct structure is constructed using pre-cast sections). Consequently, due to the relatively rapid and transient nature of the works, the impacts in any one location are usually fairly short-lived.

7.2.5 In strategic terms, the impacts associated with any of the above mentioned construction methodologies are generally of a short duration, and they would not normally, therefore, be considered (in strategic terms) as representing an obstacle to the development of a railway; potential impacts and the range of options to minimise them are well established and can be specified in the subsequent EIA studies. Thus, to ensure that the impacts are reduced and that the statutory criteria are achieved, all practicable measures should be identified during the development phase, and appropriate mitigation measures should be developed and implemented.

7.2.6 By its nature, cut and cover tunnelling would be likely to result in adverse environmental impacts. In particular, noise, dust and visual impacts, would be likely during the site clearance, piling/diaphragm walling, excavation and spoil removal and station or tunnel construction works. Cut and cover working would also have the potential to affect major road junctions and possibly result in increased traffic congestion and associated air quality impacts.

7.2.7 Whilst the environmental impacts of bored tunnelling are likely to be less severe than cut and cover working, impacts can still result from ground treatment works that may be required, from the removal and subsequent re-use or disposal of tunnelling spoil, and the consequential increase in traffic on the local road network, which could result in both noise and air quality impacts. However, with careful work-shaft site selection and planning and enforcement of the lorry routes (where removal by water borne transport is not feasible), the magnitude of such impacts can be minimised.

7.2.8 Bored tunnelling works may also result in potential ground-borne noise and vibration impacts, however, these implications are normally short lived and only give rise to impacts to particularly sensitive receivers (e.g. historic buildings, recording studios, hospitals etc), which can be identified and suitably protected and/or forewarned, prior to the works commencing.

7.2.9 When compared to cut and cover tunnelling, the adoption of a viaduct construction methodology, particularly that which utilises pre-cast elements, could result in a shortened construction period. It also avoids the need to undertake major 'heavy' engineering techniques such as the excavation of large station or tunnel boxes. The utilisation of the pre-cast elements enables a major aspect of the engineering works (ie the construction of the elements) to be undertaken at designated worksites which, where possible, should be less sensitive locations away from key sensitive receivers. Whilst impacts can result from the transportation of the pre-cast units to site (usually by road) such impacts can potentially be overcome by 'delivering' the pre-cast elements to the site by means of a system whereby the units are transported along the alignment using a temporary rail track and special rolling stock mounted with cranes.

7.2.10 Wherever practicable, efforts should be made to incorporate environmental factors into the selection and development of the construction methodology. Such aspects could include using bored tunnel (wherever practicable), reducing the extent of cut and cover working, giving sensitive consideration to the locations of worksite and workshafts, using pre-cast construction methodologies etc. However, even with the inclusion of such measures, environmental impacts may occur from the construction phase. Specific mitigation measures for these remaining impacts can be developed during the EIA stage, drawing upon established sources of such advice, for example, a range of dust control measures are defined in the Air Pollution (Construction Dust) Regulations. These include measures such as damping down haul roads, sheeting over dusty materials, using wheel washes at site exits etc. The implementation of these measures provides a proven means of effectively controlling dust levels.

7.2.11 Construction noise impacts can also be mitigated through developing site specific control measures. Depending upon the severity of the predicted impacts, a package of mitigation measures can be developed from the following:

- ensuring the implementation of good site practice (eg switching off plant when it is not in use, siting plant away from sensitive receivers or behind earth bunds/site offices etc);
- using of quiet plant;
- using temporary noise barriers or enclosures either around specific items of plant or possibly over the whole worksite;
- limiting the number of items of construction plant operating on site;
- prohibiting the occurrence of simultaneously noisy construction activities on site; and
- restricting the 'on-time' of certain items of plant.

7.2.12 The above mitigation methods have been successfully used in Hong Kong to reduce construction noise impacts. If construction noise impacts cannot be controlled by design developments (eg reducing the extent of cut and cover or using bored tunnelling methods), it is envisaged that these same mitigation measures would provide an effective means of controlling noise from the rail related construction works.

7.2.13 A range of mitigation measures are also available to control construction related water, waste and visual impacts. The details of these mitigation measures will need to be developed in relation to the specific site locations. Experience from past EIA's and on-site monitoring has demonstrated that such potential impacts can be effectively mitigated against.

7.2.14 To ensure that the proposed mitigation measures are effective, it will be necessary to develop an Environmental Monitoring and Audit system. The programme of physical monitoring (typically in relation to air, noise and water quality) and regular auditing should ensure that each of the prescribed mitigation measures are fully and effectively implemented, in a timely manner, and that any breaches of the actions or limit levels are quickly identified and rectified, thereby optimising compliance with the statutory criteria.

Generic Operational Phase Impacts from Underground Railways

7.2.15 Locating railways underground clearly presents a means of practically eliminating operational impacts (such as noise and visual) during the operational lifetime of the Project. Noise and visual impacts would normally be confined to those associated with the operation of the depots and ventilation shafts. Potential impacts from appropriately designed ventilation shafts would be anticipated to be minimal. Whilst the operation of railway depots presents a greater potential for impacts (eg noise, water from for example train washes, waste etc), recent experience has demonstrated that such impacts can be effectively mitigated against through the implementation of standard mitigation measures.

7.2.16 For example, recent examples of depots in Hong Kong (eg at Tai Wai, Tsuen Wan etc) have had, or will have, major residential/commercial developments constructed above them. As such, the depots are generally fully enclosed and noise is thus effectively mitigated. Where noise from the operations of the depot has been predicted to result in potential impacts, these have been controlled through the use of noise barriers, or by operational controls such as requiring that train air conditioning units are switched off within the depot area.

7.2.17 If the depot were to include a train wash, there may be the potential for water quality impacts if the waste water is not adequately treated. However, experience has shown that appropriate mitigation measures (such as the use of bio-degradable detergents and the recycling and treatment of the waste water), can adequately control such water quality impacts.

Generic Operational Phase Impacts from Above-ground Railways

7.2.18 Above ground railways have the potential, particularly within an urban environment, to give rise to environmental impacts; notably noise and visual impacts. The permanent landtake can also result in potential landscape, heritage and ecological impacts.

7.2.19 Whilst it is has been demonstrated recently (for example with the Ma On Shan Railway) that, with careful planning, design and the adoption of the appropriate mitigation measures, noise and visual impacts can be mitigated to within the required criteria, it is acknowledge that they cannot be totally eliminated.

7.2.20 Operational phase air quality impacts would be expected to be minimal, and no specific mitigation measures would be expected. Similarly, the operational water quality impacts would not be expected to be significant, and such potential impacts can generally be controlled through the adoption of standard water quality mitigation measures (e.g. development of an adequate surface water drainage system with the incorporation of sediment tanks and oil interceptors).

7.2.21 Hazards could be related to the presence and operation of above ground rail related infrastructure that is located within the Consultation Zones of PHIs. Whilst the magnitude of the potential hazard implications will be related to many factors including the proximity to the PHI and the operations of the PHI, it is recommended that, wherever practicable, stations, railway lines and ventilation shafts should not be located in close proximity to PHI's.

7.2.22 Whilst above ground railways will give rise to visual impacts, the magnitude of such impacts will be related to the locality and, for example, the extent of noise barriers and/or enclosures. However, the magnitude of such impacts can be minimised through the implementation of mitigation measures including;

- careful detailing of the external appearance of all above-ground structures;
- the avoidance of high safety fences along the railway;
- the implementation of extensive tree and shrub planting along the alignment beneath and alongside the viaduct; and
- the use of climbing plants to soften the appearance of viaduct columns.

7.2.23 The principal environmental impact from above ground railways is air borne noise (although ground borne can be a contributory factor). A range of mitigation measures are available to control such operational noise impacts. The measures range from those which can be incorporated into the planning and design of the railway and surrounding buildings, (e.g. integrating the railway, or a station, into a development, or using podium structures or non-noise sensitive buildings to provide screening) to those measures which can be employed when a railway is introduced into an already urbanised area (e.g. noise barriers/enclosures). Further discussion regarding mitigation measures that can be employed to control operational noise impacts are presented in Section 8.7.

7.2.24 With the adoption, where necessary, of appropriate mitigation, as commonly employed on other types of project which require 'landtake', an above ground railway would not normally be expected to give rise to residual impacts in relation to water quality, waste management, ecology, heritage or land contamination.

Environmentally Preferred Option

7.2.25 Whilst, from an environmental standpoint, an underground rail alignment constructed using a bored tunnelling methodology will, in most cases, present the most environmentally preferred option, it is not feasible to always develop or construct a railway underground. The factors that need to be considered when formulating a decision on whether to construct 'bored tunnelled railways' include:

- engineering feasibility - related to ground conditions, tunnel depth, existing structures etc;

- cost of both construction and operation - including greater cost to provide additional personnel to man underground stations and additional air conditioning and lighting costs;
- results of economic evaluation, including any loss or savings in land premium cost due to the above ground or underground options;
- construction and operational safety implications; and
- construction duration.

7.3 Strategic Environmental Assessment of the Component Schemes

7.3.1 Having provided a broad overview of the generic environmental impacts that may be associated with the construction and operation of railways, the following sections highlight the key strategic findings of the environmental assessments that were undertaken for each of the Component Schemes within the proposed rail development options.

7.3.2 As the environmental assessments have been undertaken on schemes that have been developed as part of a strategic study, they cannot be considered as representing definitive alignments. Each of the schemes will be subject to further development before they can be implemented, and as such, the final optimised alignment and construction methodology may differ from that assumed at the time of undertaking the assessments. Consequently, in addition to presenting the key strategic impacts, the indicative alignment details and preliminary construction methodologies that have been assumed to undertake these assessments are also outlined for each of the schemes.

North Island Line

Description and Assumed Construction Methodology

7.3.3 The NIL is proposed to connect the existing Hong Kong station (HOK) with Fortress Hill (FOH), via the new Tamar (TAM) and the HK Convention & Exhibition Centre (EXH). Two alignment options have been proposed, with Option 1 being a route outside reclamation (ie an 'inland' option), and Option 2 requiring the implementation of the Phase III Central Reclamation in the vicinity of TAM Station and the Wanchai Phase II reclamation in the vicinity of EXH Station for it to be feasible.

7.3.4 The preliminary design information indicates that the NIL will be constructed entirely underground, using a combination of cut and cover, soft and rock bored tunnelling techniques. As the alignment will be entirely underground, the potential for operational impacts is considered to be minimal. The magnitude and extent of any construction phase impacts will be dependant upon the exact construction methodology that is employed (details of which has still to be finalised). However, such impacts are likely to be relatively short lived, and therefore unlikely to present insurmountable strategic impacts. Nevertheless, where impacts are envisaged, these are discussed below.