



Review and Update of the Railway Development Strategy 2000

Strategic Environmental Assessment Executive Summary

Agreement No. CE 35/2010 (CE)



HIGHWAYS DEPARTMENT
RAILWAY DEVELOPMENT OFFICE

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ABBREVIATIONS

AQGs	Air Quality Guidelines
AQOs	Air Quality Objectives
C&D	Construction and Demolition
CO₂	Carbon Dioxide
CZ	Construction Zone
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance
EIAO-TM	Environmental Impact Assessment Ordinance - Technical Memorandum
EP	Environmental Permit
EPD	Environmental Protection Department
EPI	Environmental Performance Indicators
GHG	Green House Gas
GIS	Geographic Information System
LPG	Liquefied Petroleum Gas
NCO	Noise Control Ordinance
NO_x	Nitrous Oxide
NSRs	Noise Sensitive Receivers
PHI	Potentially Hazardous Installations
RAMSAR	Ramsar Convention on Wetland
RSP	Respirable Particulate Particles
SEA	Strategic Environmental Assessment
SOAI	Site of Archaeological Interest
SO₂	Sulphur Dioxide
SSSI	Site of Special Scientific Interest
VOC	Volatile Organic Compounds
WBA	Wetland Buffer Area
WCA	Wetland Conservation Area
WSRs	Water Sensitive Receivers

General

CEPA	Closer Economic Partnership Arrangement
HKBCF	Hong Kong Boundary Crossing Facility
HKIA	Hong Kong International Airport
HKSAR	Hong Kong Special Administration Region
HyD	Highways Department
HZMB	Hong Kong-Zhuhai-Macao Bridge
IVS	Individual Visit Scheme
KCRC	Kowloon-Canton Railway
LegCo	Legislative Council

MTR	Mass Transit Railway
MTRCL	MTR Corporation Limited
NDA	New Development Areas
NWNT	North West New Territories
NT	New Territories
PE	Public Engagement
PE1	Stage 1 Public Engagement Exercise
PE2	Stage 2 Public Engagement Exercise
PRD	Pearl River Delta
RDS	Railway Development Strategy
RDS-2000	Railway Development Strategy 2000
RDS-2	The Second Railway Development Study
RDS-2U	Review and Update of the Second Railway Development Study
SWNT	South West New Territories
WHO	World Health Organisation

Lines

EKL	East Kowloon Line
EWC	East West Corridor
ISL	Island Line
CTL	Kwun Tong Line
LMCSL	Lok Ma Chau Spur Line
MOL	Ma On Shan Line
NIL	North Island Line
NOL	Northern Link
SCL	Shatin to Central Link
SIL	South Island Line
SIL(E)	South Island Line (East)
SIL(W)	South Island Line (West)
SSWL	Siu Sai Wan Line
TCL	Tung Chung Line
TKL	Tseung Kwan O Line
TMTWL	Tuen Mun to Tsuen Wan Link
WEL	Hong Kong – Shenzhen Western Express Line
WIL	West Island Line
WRL	West Rail Line
XRL	Hong Kong Section of the Guangzhou-Shenzhen-Hong Kong Express Rail Link

Stations

ABE	Aberdeen Station
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CBN	Causeway Bay North Station
HKU	Hong Kong University
HSK	Hung Shui Kiu Station
KTU	Kwu Tung Station
POA	Po Lam Station
SMP	Sau Mau Ping Station
TCE	Tung Chung East Station
TCW	Tung Chung West Station
TMS	Tuen Mun South

1. INTRODUCTION

1.1 Background

- 1.1.1 In December 1994, the Government formulated the first Railway Development Strategy to provide a framework for planning the future expansion of Hong Kong's railway network. Based on the needs of different regions, a number of strategic ideas for railways were proposed in order to lay the cornerstone for Hong Kong's railway development.
- 1.1.2 The Railway Development Strategy 2000 (RDS-2000) was announced in May 2000, which defined the current phase of railway development for Hong Kong up to 2016 and set out the territory-wide railway development Strategy, to implement the policy of using railways as the backbone of our passenger transport system.
- 1.1.3 Following the completion of the RDS-2000, there have been some major changes in the planning circumstances in Hong Kong. At the same time, there have been increases in the cross-boundary travel demands resulting from closer economies and social activities between the Mainland and Hong Kong. In the past decade, with the implementation of the Mainland and Hong Kong Closer Economic Partnership Arrangement (CEPA) and the Individual Visit Scheme (IVS) for mainland residents, there has been an upsurge in the overall cross-boundary passenger demand and railway usage, and this is expected to continue. The development of the railway network in many Pearl River Delta (PRD) cities, and extensive coverage of the intercity and high speed railway network, will further promote intercity rail travel. There is a need to examine the cross-boundary railway planning framework to account for the strategic developments, sustainability of public transport and land use planning in Hong Kong, Shenzhen and nearby PRD cities.
- 1.1.4 For Hong Kong's domestic railway network, many District Councils and the public continue to make requests to expand the railway network to meet increasing public aspirations. Moreover, the Rail Merger in 2007 opened up new possibilities for integrating the railway networks of MTR Corporation Limited (MTRCL) and the former Kowloon Canton Railway Corporation (KCRC) to improve railway services for the travelling public.
- 1.1.5 Although many of the objectives of the Second Railway Development Strategy (RDS-2) remain valid, it is against this background that the Review and Update of the Second Railway Development Study (RDS-2U) was initiated and a comprehensive review and update of the RDS-2000 has now been undertaken. On the basis of the RDS-2000, the consultancy study examined the needs of the future railway network to fulfil the following objectives:
- To cover more areas and provide railway service to more people;
 - To enhance the accessibility and connectivity of major infrastructure and New Development Areas (NDAs);
 - To relieve bottlenecks of the railways and trunk roads;
 - To unleash the potential for developments and redevelopments along the railway corridors; and
 - To improve network robustness¹.

¹ Network robustness (or operational resilience) is the ability of the railway system to operate satisfactorily during unscheduled service disruptions on specific parts of the network. It can be achieved by providing operationally-independent rail route options so that if a train service of a particular route is delayed or unavailable, the affected passengers can take an alternative route and so reduce the impact caused by the initial incident.

- 1.1.6 In implementing any railway proposals consideration was given to:

- Minimising disruption to the existing network and impact on the local communities and the environment;
- Use of proven technology to deliver the desired results; and
- Be affordable and cost-effective.

1.2 Study Process

- 1.2.1 The technical study process has included extensive analysis of the latest planning data and forecasting information. The ways to provide railway service in future key development areas and to improve the service of the railway network in developed areas have been explored. Various conceptual railway schemes have been reviewed and rationalised, some of which had been proposed in the RDS-2000 and some by the Government or the public.
- 1.2.2 The study and consultation process have been conducted in two stages, with a view to recommending a new railway development strategy that is cost-effective in meeting the transport needs and supports the future development of Hong Kong in an environmentally friendly manner.

Stage 1 Study – Major Regional Corridors

- Conduct Passenger Transport Demand Forecasts:** The latest planning information has been examined to analyse the long-term local passenger transport demands and forecast major growth areas, having regard to the development potential and needs of various districts in Hong Kong.
- Review the Demands for Major Regional Railway Corridors Serving Key Development Areas:** On the basis of the above demand forecasts, a preliminary review of the demand for new major regional railway corridors in key future development areas was conducted to enhance railway coverage for associated areas and major infrastructure. Conceptual railway schemes were preliminarily assessed from different perspectives, such as engineering feasibility, environmental impact, operational considerations and service levels.

- 1.2.3 A three-month Stage 1 Public Engagement Exercise (PE1) was held from 20 April to 21 July 2012. The public was consulted on the preliminary ideas and conceptual schemes of the major regional railway corridors serving key future development areas. Analysis results on the major functions, planning considerations, traffic demand, as well as constraints from technical, environmental and other aspects were presented to allow early engagement of the public in the discussion and planning process.

Stage 2 Study – Network Integration and Local Enhancement Schemes

- 1.2.4 The Stage 2 studies focused on two key areas:-
- Optimisation and Integration of Railway Network:** The conceptual schemes of major regional railway corridors were optimised in view of the public comments collected in the PE1 exercise, and integrated into the existing railway network with adjustments where necessary, with a view to developing a holistic and more cost-effective railway development framework for Hong Kong; and

- (ii) **Study of Local Enhancement Schemes:** The patronage of the integrated railway network was forecast to assess potential bottleneck locations, with particular reference to the usage of the urban sections of the existing railway network. As the urban area has adopted a high development density with comprehensive railway coverage, the study mainly focused on local enhancement schemes such as: parallel lines to enhance network capacity; line extensions or spur lines; and new stations to increase the overall capacity of the railway network and reduce road-based feeder needs.
- 1.2.5 After completing the relevant studies, the public was further consulted on the local enhancement schemes. A three-month Stage 2 Public Engagement Exercise (PE2) was held from 21 February to 20 May 2013.
- 1.2.6 Following the completion of the public consultation, the public views at both stages were collated such that the planning of the major regional railway corridors and local enhancement schemes could be further optimised in a coordinated manner (with adjustments, additions and deletions where necessary).
- 1.2.7 The findings of RDS-2U are intended to provide a basis for the Government to prepare an updated Railway Development Strategy for the long-term railway development of Hong Kong.
- 1.3 Objectives of the Strategic Environmental Assessment (SEA)**
- 1.3.1 To achieve the above objectives, environmental considerations were included as an important element throughout the study process. Key objectives were to:
- Encourage integrated considerations of environmental factors together with other considerations in formulating the preferred railway network expansion plan;
 - Identify the environmentally preferred railway corridors and provide environmental inputs into the selection process;
 - Appraise potential environmental impacts and recommend broad environmental requirements for mitigation measures to avoid or minimise impacts, meeting environmental legislation and standards, and to demonstrate that the railway corridor/scheme would be feasible in environmental terms; and
 - Identify any environmental measures and follow up measures for the preferred railway network expansion plan.
- 1.3.2 In addition to assisting with the development of the preferred railway network expansion plan, the SEA Study Team also undertook a review of the current and future trends in air pollutants and the environmental benefits that may be gained from implementing more railway development.
- 1.4 Broad Methodology of the SEA**
- 1.4.1 RDS-2U comprised a number of study elements and represented the fundamental basis for determining the extent, location and timing of future railway development in Hong Kong.
- 1.4.2 The broad methodology of the SEA and its relationship with the wider RDS-2U Study is described briefly below. The integration of the SEA into the overall study process has ensured that a comprehensive assessment and evaluation of the future railway development and options has been achieved.
- 1.4.3 **Data Collection and Review** – Based on a desktop literature review, consultations and site visits, baseline conditions of the study area and environmentally sensitive receivers were identified. Potential environmental impacts were reviewed and significant environmental constraints to the proposed new railway schemes were identified early for considerations in the study. Based on the key constraints, a reference constraint map was prepared illustrating the opportunities and key issues, in the level of No-Go, Avoidance, No-impact or Acceptable with Mitigation. The absolute environmental constraints that were required to be considered at the earliest stage during corridor evaluation were those being statutorily protected. Other environmental issues were identified as requiring consideration during subsequent stages of the strategic development process.
- 1.4.4 **Options Evaluation and Design** – Following the environmental review, technical support was provided to the Study Team for example, advice on the scheme alignments to avoid key constraints, such as landfill sites, champion trees, Site of Special Scientific Interest (SSSI), Potential Hazardous Installations (PHI) and graded historic buildings/monuments or the need for environmental control measures such as noise barriers on viaducts. The aim of this assessment was not to provide a comprehensive evaluation of each of the corridors, but to identify any ‘fatal flaws’ that may exist. The Environmental Performance Indicators (EPIs) were used as criteria to evaluate the benefits / disbenefits of the proposed railway corridors and to assist in the selection process. In addition to the environmental inputs, the evaluation process also included transport assessment of the corridors, and consideration of the issues associated with planning, land-use, engineering and operation feasibility, etc.
- 1.4.5 **Preliminary Environmental Review** – Based on the recommended preliminary railway alignments, a preliminary environmental review was conducted to appraise potential environmental impacts and recommend broad environmental requirements for mitigation to avoid or minimise impacts, meet environmental legislation and standards, and to demonstrate that the new railway schemes would be feasible in environmental terms. The range of issues addressed within in the SEA included:
- Noise Impact;
 - Air Quality;
 - Water Quality;
 - Waste Management Implications;
 - Ecological and Fisheries Impact;
 - Landscape and Visual Impact;
 - Cultural Heritage Impact;
 - Landfill Gas Hazards;
 - Contaminated Land Issues; and
 - Potentially Hazard Installation (PHI) Hazards.
- 1.4.6 **Output and Findings** - The findings of the overall SEA Study are recorded in the **Final SEA Report**; and **Executive Summary** of which would appear in the wider RDS-2U Final Report.

2. ENVIRONMENTAL BENEFITS OF RAILWAYS

2.1 Introduction

2.1.1 Railways have been vital in supporting the society, people's livelihood and economic development in Hong Kong over the past 30 years. Investing in the railway network will continue to yield environmental benefits to the community.

2.1.2 As part of RDS-2, an examination was undertaken of the environmental benefits that may be accrued from choosing rail-based over road-based forms of transportation. At the time, little research had been undertaken in Hong Kong or the PRD region on the quantifiable environmental benefits accruing from railways when compared with road-based systems. RDS-2 investigated the perceived advantages with a series of technical reviews and comparative assessment and provided an illustration of the environmental performance of railways versus road-based forms of transport.

2.1.3 The RDS-2 found that rail transport would be more efficient than road transport in terms of nitrogen oxides (NO_x), carbon dioxide (CO₂) and Respirable Suspended Particulates (RSP). On average NO_x emissions from road transport were found to be approximately 2.5 times greater than rail, while road emissions were of CO₂ and RSP emissions were found to be about 2 and 10 times greater than rail respectively.

2.1.4 Whilst this rail contribution was important, it was noted that through fuel and engine technology improvements, other changes, environmental policy objectives and more stringent emissions standards, these environmental benefits would reduce in future comparison between rail and road-based transport systems.

2.1.5 To this, RDS-2U undertook a review of the latest policy objectives, air pollutant trends and air quality initiatives to gauge the impact of the environmental benefits of constructing more railways, in particular to air pollutants and green house gas (GHG) emissions.

2.2 Review of the Historical Trends for GHG and Air Pollutants in Hong Kong

2.2.1 The historical trends of air pollutants and GHG in Hong Kong were reviewed and findings are summarised below:

- Emission burden trends² for NO_x, RSP and SO₂ from vehicles for road transportation mode has steadily decreased from 1997 to 2012. The main reasons for this are due to the advancement in vehicle technology and more stringent control measures.
- The emission burden trend³ for GHG from vehicles for road transportation mode has remained fairly flat which shows there have been limited changes in design or control measures for GHG from vehicular emission.
-

2.2.2 As reported by Environmental Protection Department (EPD), the 2012 emission inventory⁵ for Hong Kong in terms of NO_x, public electricity generation is the second highest (28% of total with 32,000 tonnes) while road transport is the third highest emission source (27% of total with 30,700 tonnes). In terms of RSP, similar trends were observed, with road transport contributing 20% of total (1,200 tonnes) and electricity generation contributing 16% (960 tonnes). In terms of SO₂, electricity generation is one of the dominant source (47%) while contribution from road transport was minimal (<1%).

2.3 Review of the Future Air Quality Policy/Initiatives affecting On-road Traffic Composition and Electricity Power Generation in Hong Kong

2.3.1 The future air quality policy/initiatives affecting on-road traffic composition and electricity power generation in Hong Kong were reviewed and summarised below:

- The World Health Organization (WHO) in October 2006 updated the Air Quality Guidelines (AQGs) to provide a scientific basis for supporting the development of air quality policies and management strategies in various parts of the world to protect human health.
- Legislative Council (LegCo) passed the new Air Pollution Control (Amendment) Bill 2013⁶ on 10 July 2013, setting new Air Quality Objectives (AQOs) to be enforced from 1 January 2014 with new AQO⁷ annual average criterion for NO₂ reduced from 80 ug/m³ to 40 ug/m³ and RSP reduced from 55 ug/m³ to 50 ug/m³.
- As the new AQOs are much more stringent, very drastic measures will need to be taken in Hong Kong and also in the PRD region over the long term to meet the new AQOs. It will require the extensive use of cleaner mass-transit systems, cleaner power generation technologies and fuels, and highly efficient energy saving technologies.
- A "Clean Air Plan" for Hong Kong (version March 2013)⁸ (Clean Air Plan) has been jointly developed by Environmental Bureau, Transport & Housing Bureau, Food & Health Bureau and Development Bureau. A set of air quality management system, has been defined. According the Clean Air Plan, the target is to achieve a NO_x reduction of 20-30% and RSP reduction of 15-40% as compared to emission inventory in Hong Kong by 2020.
- Owing to the uncertainty in future fuel technology the reduction targets proposed under the "Clean Air Plan" are only up to 2020.
- Government are considering major air control measures on road transportation and power generation including, phasing out pre-Euro IV diesel commercial vehicles, profits tax deduction for capital expenditure on environment-friendly vehicles and control of emission from power companies, etc.

2.3.2 The review supports the conclusion that the air quality benefits that maybe accrued from further railways development over road-based transport development would be less significant than in future as air pollution and GHG (for both on-road transport and electricity generation) emission rates would further reduce by 2031 (timeframe of RDS-2U) due to on-going improvements in fuel technology, more stringent environmental policy objectives and standards.

² Source of Reference: EPD web-site
http://www.epd.gov.hk/epd/english/environmentinhk/air/data/emission_inve.html#4
http://www.epd.gov.hk/epd/english/climate_change/files/HKGGHG_Trend_201304.pdf

³ Source of Reference: EPD web-site
http://www.epd.gov.hk/epd/english/environmentinhk/air/data/emission_inve.html#4
http://www.epd.gov.hk/epd/english/climate_change/files/HKGGHG_Trend_201304.pdf

⁴ Source: EPD web-site
http://www.epd.gov.hk/epd/english/environmentinhk/air/air_maincontent.html

⁵ Source of Reference: EPD web-site
http://www.epd.gov.hk/epd/sites/default/files/epd/english/environmentinhk/air/data/files/2012HKEIRReport_eng.pdf
⁶ <http://www.legco.gov.hk/yr12-13/english/counmtg/hansard/cm0710-translate-e.pdf>
⁷ <http://www.legco.gov.hk/yr12-13/english/hc/papers/hc0621cb1-1409-e.pdf>
⁸ Source: http://www.enb.gov.hk/en/files/New_Air_Plan_en.pdf

2.4 Other Environmental Benefits of Railways

2.4.1 Other environmental benefits associated with railways which have been documented in RDS-2 and other countries including the United Kingdom, Europe and the United States are highlighted below:

- **Sustainable development for a City** - Road-based public transport system will generally induce adverse implications on congestion, oil shortage, traffic accidents and air pollution. Railway development, in particular to underground railways allow for better land use planning and opportunities for better greening, outdoor environment and quality of life.
- **To cultivate a greener city⁹** - There is evidence showing compact and well-regulated cities with environmental friendly public transport systems use less energy and strongly influence energy consumption. Cities that are less dependent on motorised transport are not only more energy-efficient but contribute less to GHG emission.
- **Improve public health** – Improve public health (reduction in mortality and non-fatal health effects) through reduced vehicular emissions (i.e. NOx, Volatile Organic Compounds (VOC)) if electric railway system or electric on-road vehicle systems are adopted as the backbone of public transport system.
- **Saving energy** - Motorised urban transport accounts for a large share of energy consumption in Hong Kong. Information from “Hong Kong Energy End-user data 2012”, transportation counts for about 29% of the total energy consumption in 2010 (with the largest contributions from goods vehicle, bus, taxi, car, motorcycle and rail)¹⁰. Rail is relatively more energy efficient mode of transport compared to say petrol/diesel engines from vehicles and uses far less energy per passenger kilometre than road.
- **Less noise disturbance** – Road noise affects the quality of life of many people. The rail noise criteria at residential resources are more stringent than those for road traffic. Internationally, people are also generally find rail noise to be less intrusive than road noise¹¹. Also, rail noise in general is easier to mitigate by using noise enclosures or be located underground.
- **Space saving** - Rail infrastructure requires less land take than roads over equivalent capacity as rail makes more efficient use of space and this was found to result in a lower potential to affect environmental resources.
- **Reduced safety risks** – Supported by historical accidental data, rail travel offers significantly reduced levels of risk for the travelling public compared with road transport.
- **Relieve road congestion** - Railway can reduce the reliance of roads and reduce road congestion. Road users would benefit through savings in travelling time and fuel (due to idling).

⁹ Source: State of the World's Cities 2008/2009, Harmonious Cities, UN HABITAT
["http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=2562"](http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=2562).

¹⁰ Source: Table 30 of Hong Kong Energy End-use Data 2012, EMSD
["http://www.emsd.gov.hk/emsd/e_download/pee/HKEEUD2012.pdf"](http://www.emsd.gov.hk/emsd/e_download/pee/HKEEUD2012.pdf)

¹¹ http://www.uic.org/homepage/railways_and_the_environment09.pdf

3. DEVELOPMENT OF NEW RAILWAYS

3.1 Introduction

3.1.1 Since the 1970's, railway development has been instrumental in supporting land and economic development in Hong Kong. Although, the case for future generations of railway expansion would depend on a wide range of factors and policy directions of the Government, key factors remain unchanged but their relative importance may be different in the future according to the relative priorities of social, environment, economic and development; as well as the role of Hong Kong in connecting to Shenzhen, PRD and the Mainland.

3.1.2 Railways now accounts for around 40% of the travel in the public transport in the HKSAR and 60%¹² of cross-boundary passenger trips. They are a vital part of the HKSAR's transport network and essential in sustaining economic, social and land-use development. The importance of railways will increase in future with the continued growth of internal travel demands and increased economic ties and social interactions with the Mainland.

3.2 Findings and Direction for Updating the Railway Development Strategy

3.2.1 The review of the domestic and international context covered the changes in the land use and planning parameters, cross-boundary traffic demand, and transport demand forecasts for the long-term in Hong Kong. In broad terms, upon completion of the committed railway projects, it was considered that the railway network will be largely adequate to meet the potential additional demand in the short to medium term in respect of:

3.2.2 **Coverage:** The coverage of the existing and committed railway network will be largely extensive, providing railway services to most of the existing major residential and commercial areas. Most people will be able to use the railway service by accessing the railway stations on foot or by using short feeder service. As there is limited room for significant coverage expansion due to spatial constraints in the urban area, the extension of existing lines and adding new stations will help to improve railway service in some areas not currently served by rail;

3.2.3 **Connectivity:** The connectivity of railway lines in the urban area (Kowloon and Hong Kong Island) is already quite extensive. The railway lines connect various destinations, allowing inter-regional trips to be made without significant detours. The emphasis in these areas will be on relieving currently congested sections of the railway network. By comparison, future developments areas such as northern Lantau, North West New Territories (NWNT) and North East New Territories (NENT) are of much larger scale which will create opportunities for improvement in rail connectivity in the eastern and western part of Hong Kong, such as connecting the NWNT and NENT (with higher population growth) and improving rail connectivity in northern Lantau (with higher employment growth); and

3.2.4 **Capacity:** The overall capacity of the railway network will increase significantly upon completion of the committed railway projects, which should be sufficient to meet the transport demand in the short to medium term. However, bottleneck situations may arise in some urban sections of the railway network in the peak hours.

3.3 Stage 1 Study Findings - Major Regional Corridors considered in RDS-2U

3.3.1 The Stage 1 of the Study found that there was reasonable demand for major regional railway corridors in the western NT, mainly to link up the western NT, northern NT, and the boundary

and facilities such as the Hong Kong-Zhuhai-Macao Bridge (HZMB) and Hong Kong International Airport (HKIA), etc. The review of the major railway corridors identified the following preliminary ideas and conceptual schemes considered to be worthy of further discussion in the public engagement exercise (refer to **Figure 3.1**):

- The development of the Northern Link (NOL) corridor to serve the new NDAs, cross-boundary travel and east-west movements in the railway network;
- A new east-west rail corridor through NWNT to South West New Territories (SWNT) in the form of the Tuen Mun to Tsuen Wan Link (TMTWL);
- Expansion of the cross-boundary services from north Lantau and NWNT to western Shenzhen to support the major growth poles such as Qianhai on the western PRD, Hong Kong's own airport expansion plan and the new Hong Kong Boundary Crossing Facility (HKBCF) in the form of the Hong Kong-Shenzhen Western Express Line (WEL);
- Improved rail connectivity between NWNT and north Lantau, possibly combined with the WEL and linked to the existing rail system such as the East West Corridor¹³ (EWC) and Tung Chung Line (TCL);



Figure 3.1 Major Regional Corridors proposed in Stage 1 of the Study

3.3.2 Apart from the planning for new major regional railway corridors, there was also a need to improve and optimise the existing railway network with smaller-scale projects to improve coverage of existing railway lines, support new development areas and provide relief to bottlenecks in the existing railway network. These smaller projects were considered to further facilitate use of Hong Kong's railway.

¹² The rail share percentage was estimated based on the Statistics in the Monthly Traffic and Transport Digest (excluding ferry transport) in November 2013.

¹³ East-West Corridor (EWC) – is formed by the WRL, Tai Wai to Hung Hom Section of the SCL and Ma On Shan Line (MOL).

3.4 Stage 2 Study Findings - Local Enhancement Schemes considered in RDS-2U

3.4.1 The local enhancement schemes would focus on the committed network by improving connectivity, fill in gaps in the current network with no rail coverage, and provide relief to line sections in the network which are forecast to be under pressure in the long term.

3.4.2 The review of the local enhancement schemes identified the following preliminary ideas and conceptual schemes considered to be worthy of further discussion in the public engagement exercise (refer to **Figure 3.2**):

- North Island Line (NIL) corridor along the north shore of Hong Kong Island to improve network linkage, relieve the pressure on the Island Line (ISL) and serve the Central and Wanchai waterfront;
- The continued development of the South Island Line (SIL) corridor to reach large residential catchments in Aberdeen and Wah Fu. The South Island Line (West) (SIL(W)) would provide additional passenger transport capacity along the Pokfulam transport corridor to help to relieve the existing transport constraint related to the development potential along the Pokfulam area; and
- Line extensions and new stations to serve existing and planned development centres along or adjacent to existing railway lines that are worthy of consideration as smaller scale railway projects:
 - Tung Chung West (TCW) Extension;
 - Tuen Mun South (TMS) Extension;
 - Siu Sai Wan Line (SSWL);
 - Kwu Tung (KTU) station; and
 - Hung Shui Kiu (HSK) station.



Figure 3.2 Local Enhancement Schemes proposed in Stage 2 of the Study

3.5 Public Views

3.5.1 The basis of sustainable development is to balance environmental, social, and economic objectives, and the interests of different areas of society. It is therefore important to build consensus in the community in order to take forward railway development.

3.5.2 In view of the importance and far reaching implications of the Railway Development Strategy (RDS) proposals, a two stage Public Engagement (PE) exercise was conducted to seek the general public's perceptions on the railway proposals, to obtain their views, and to raise consciousness and the level of understanding on the broader implications of the railway schemes. The first stage PE1 focused on three major regional railway corridors (i.e. WEL, NOL and TMTWL) and took place between April and July 2012. The second stage PE2, carried out from February to May 2013, focused on optimisation and integration of the railway network and local enhancement schemes (i.e. NIL, SSWL, SIL(W), TMS Extension, HSK station, TCW Extension, and KTU station). A public survey was also carried out in September 2011.

3.5.3 In the course of the consultation, comments were gathered during some forty meetings and forums held with the general public and various committees and organizations, including the Railway Sub-committee of the LegCo Transport Panel, District Councils, political parties, and focus groups. In addition, over 11,600 written submissions were received through various channels, including the study website, post, email and fax. We also received many verbal comments at the aforementioned public forums, focus group meetings, and through the hotline.

3.5.4 While the railway proposals were generally welcomed by the public, there were mixed reviews on specific projects. Many looked forward to an early implementation programme. The majority agreed that land use and transport should be planned in an integrated manner and that the railways should continue to serve as the backbone of the public transportation system in Hong Kong, with feeder services helping to increase usage of the railway lines.

3.5.5 During the PE, many suggestions for changes or additions to the ten proposed railway schemes were received from the public. These suggestions were subject to further study to determine how they could best be integrated into the railway development strategy.

3.6 Schemes forming the Railway Network Expansion Plan

3.6.1 Drawing from the public views collected in Stage 1 and Stage 2 of the PE exercise, further assessments were conducted on the railway proposals, such that the planning of the major regional and local enhancement corridors can be further optimised in a coordinated manner in order to provide recommendations on the future railway development.

3.6.2 The recommended railway network expansion plan has taken into account the railway proposals and the results of the public consultation exercise. Account has been taken of a wide range of issues including transport needs, land use planning and environmental, operational and sustainable aspects to recommend the various components of the network.

3.6.3 The projects identified in the railway network expansion plan for implementation are proposed as they are needed to serve committed and new developments, provide relief to critical transport corridors, bring economic benefits and are environmentally friendly. These rail projects include (refer to **Figure 3.3**):

(a) **Northern Link (NOL) and Kwu Tung (KTU) Station** - a major regional corridor formed by linking West Rail to the Lok Ma Chau Spur Line (LMCSL) with a new station at Kwu Tung.

(b) **Line Extensions and New Stations**

- **Hung Shui Kiu (HSK) Station** - a new station on the West Rail Line (WRL)(future EWC) between the existing stations at Tin Shui Wai and Siu Hong.
- **Tung Chung West (TCW) Extension** - formed by extending the existing TCL westward with a new station at Tung Chung West.
- **Tuen Mun South (TMS) Extension** - formed by extending the existing WRL (future EWC) from Tuen Mun to Tuen Mun South area.

(c) **East Kowloon Line (EKL)** - a new corridor running in the northern Kwun Tong area connecting to the Kwun Tong Line (KTL), Tseung Kwan O Line (TKL) and Shatin to Central Link (SCL);

(d) **South Island Line (West) (SIL(W))** - a new corridor linking the South Island Line (East) (SIL(E)) with the West Island Line (WIL)/ISL; and

(e) **North Island Line (NIL)** - a new rail corridor on the north shore of Hong Kong Island formed by the extension of the existing TCL and Tseung Kwan O Line (TKL).

3.6.4 **Table 3.1** provides a brief summary of the functions of the proposed railway schemes listed above.



Figure 3.3 Hong Kong's Railway Development Plan for 2031

3.6.5 Although the RDS-2U Study was tasked to review and update the RDS-2000 to 2031, there is a growing need for Hong Kong to look beyond HK2030 to sustain the steady supply of land in order to meet the severe housing shortage problem which has escalated in tandem with the continued population growth and a number of changing circumstances after completion of the HK2030 study. As the increasing population would induce further demand on the transport network, it will be necessary to closely monitor the long term demand and regularly review the implementation window of the recommended railway schemes and to gauge whether there is a need to implement new transport infrastructure or improvement works to meet the transport demand beyond the time frame of the RDS-2U Study.

3.6.6 The justification, location, timing and financing details of any new lines and additional rail stations will be subject to more detailed studies as part of local or regional planning studies and project feasibility studies.

Table 3.1 Summary of the Functions of the Railway Schemes

Package	Summary
NOL and KTU Station	The NOL will enhance east-west connectivity and facilitate cross-boundary movements; improve network robustness and serve the Kwu Tung North NDAs in the NT. Land reserve and design provisions should be made for intermediate stations along its alignment to serve the potential developments, and bifurcation between the KSR station and the LMC BCP station. Flexibility should also be retained for extending the NOL to serve the potential developments in future taking into account the policy initiatives of developing NT North to include a new town and employment clusters which are under study.
HSK Station	The station will support and tie in with the development pace of the Hung Shui Kiu NDA.
TCW Extension	The timing of this line extension will tie in with the development pace of the Tung Chung area. (Subject to the findings of the Tung Chung New Town Extension Study, it may be possible to add a TCE station to tie in with the development of the Tung Chung East area).
TMS Extension	The TMS Extension will enhance the connectivity of the Tuen Mun South area and facilitate residents there to access the West Rail more conveniently and further promote the use of rail as the main mode of travel.
EKL	The line will provide additional transport capacity for the north Kwun Tong area and improve network robustness. There is a need to overcome technical challenges arising from the hilly environment at the detailed planning stage.
SIL(W)	The line will provide additional transport capacity to the western part of Hong Kong Island, help to serve any increase in public transport demand resulting from public housing and other developments in future, and improve network robustness.
NIL	The NIL will help to relieve the ISL and improve rail access to the north shore of Hong Kong Island. The implementation will depend on the performance of the ISL and the changes in travel pattern upon the progressive completion of the committed railway and other projects.

3.7 Other Railway Proposals

- 3.7.1 A number of other railway proposals were consulted in the two stages of public engagement exercise but are not recommended in the Railway Development Expansion Plan due to present uncertainty or constraints regarding these schemes. It would be pre-mature to set target time frame for their implementation. These schemes are highlighted in **Table 3.2**.

Table 3.2 Summary of the Other Railway Proposals

Rail Scheme	Summary
Hong Kong-Shenzhen Western Express Line (WEL)	The WEL scheme could be revisited if there are significant increases in cross-boundary traffic and significant changes in the relevant development parameters. Currently the scheme does not perform well in either economic or financial terms and is extremely costly compared to the other rail proposals in the updated railway network expansion plan.
The Coastal Railway Between Tuen Mun to Tsuen Wan (Tuen Mun to Tsuen Wan Link) (TMTWL)	This railway line could be considered for the long term, subject to any major changes in population along the coastal areas between Tuen Mun and Tsuen Wan. The transport assessment found that the proposed extension of the existing WRL to Tuen Mun South would be a more cost-effective proposal to provide railway services to this populated area. For Tuen Mun residents, the relative travel time advantages of using the TMTWL over West Rail would be limited, as interchange to other railway lines would still be required in the Tsuen Wan area for onward train journeys to other areas in Hong Kong. Additionally, road-based public transport already provides an efficient service along the Tuen Mun to Tsuen Wan corridor, which will further improve after the completion of the improvement works on Tuen Mun Road. Unless there are new land use and development opportunities emerging along the coastal area between Tuen Mun and Tsuen Wan, the TMTWL would not be cost-effective due to its limited patronage and high project costs.
Siu Sai Wan Line(SSWL)	The study found the best scheme to serve the Siu Sai Wan residents is the extension of the ISL. This was also the views of many local residents. The route of the "Extension" scheme is currently constrained or blocked by several buildings and the implementation of this option could be reconsidered when these constraints are removed through future redevelopment of the surrounding buildings.

4. ENVIRONMENTAL ASSESSMENT OF THE RAILWAY SCHEMES FORMING THE UPDATED RAIL DEVELOPMENT PLAN

4.1 Introduction

4.1.1 The core work of the SEA was to assist in the selection of the railway proposals for the updated railway development strategy.

4.1.2 At this strategic level, the purpose of the assessment was to identify whether there were any potential “strategic” environmental implications that would make the scheme unattractive from an environmental perspective or would require particular attention during the future development of the railway. It was not the intention of the SEA to undertake detailed evaluation to a level commensurate with an EIA study. The railway lines indicated in this summary are considered as preliminary “corridors” and are by no means fixed. In case any railway project is to be taken forward for implementation, there will be detailed design and planning for the individual project (including public consultation), and the impact of such railway on a social, environmental, economic and other aspects will be assessed.

4.2 Influence of Strategic Environmental Considerations

4.2.1 In forming the railway network expansion plan, it was necessary to strike a balance between environmental considerations and other considerations to overcome the competing demands of various stakeholders and disciplines within the railway development process.

4.2.2 Through the SEA process, the environmental inputs have been integrated into the formulation of various railway lines and, through the application of strategic impact assessment, potential environmental constraints have been avoided for the current Hong Kong environmental legislation and baseline environmental conditions.

4.2.3 Through the assessment exercises (using evaluation criteria on transport planning, engineering, planning, land-use, environment, cost-effectiveness and other criteria) it has allowed the selection of the better performing railway lines for inclusion in the railway network expansion plan.

4.2.4 The rail corridors were first evaluated individually using, where appropriate, the broad methodologies defined in the EPIs. The results of the evaluation of the individual rail schemes and the cumulative environmental implications of the combined network expansion are summarised in the follow chapters.

4.2.5 Public views and the key suggestions gathered from the PE exercise have also been considered before finalisation of the preferred schemes forming the railway network expansion plan.

4.3 Scheme Assessment

4.3.1 Each scheme was evaluated for conflicts with the mapped environmental constraints, and any schemes that were seen as having fatal flaws by impacting upon statutorily protected resources were rejected. All other schemes were retained for further development and environmental evaluation.

4.3.2 The environmental consideration comprised an environmental assessment of the strategic construction and operational impacts of each of the schemes.

4.3.3 The majority of the schemes are assumed to be constructed and operated predominately underground. This greatly reduced the potential environmental impact of each scheme since the affected environmental resources are largely located on the surface. The predicted impacts from each scheme were therefore reduced substantially from similar above-ground alternatives.

4.3.4 At this strategic study level, the purpose of the assessment was not to quantify or evaluate the magnitude of these impacts, but 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 if the scheme is progressed to the next stage of design. As the detailed design of each scheme has still to be developed, some schemes may have alternative alignments that could be assessed in the design stage of the project.

4.3.5 Overall, each of the railway schemes is likely to give rise to a degree of environmental impacts during either the construction or operational phases. However, in strategic terms, none of the schemes is considered likely to give rise to insurmountable environmental impacts since established means are available which can be developed during the design stages of the project. A summary of the key findings for each of the railway schemes is given in **Table 4.1**. The environmental constraint map for each rail corridor/scheme is shown in the figure list below.

- **NOL and KTU Station** – (refer to **Figure 4.1**)
- **HSK Station** – (refer to **Figure 4.2**)
- **TCW Extension** – (refer to **Figure 4.3**)
- **TMS Extension** – (refer to **Figure 4.4**)
- **EKL** – (refer to **Figure 4.5**)
- **SIL(W)** – (refer to **Figure 4.6**)
- **NIL** – (refer to **Figure 4.7**)

Table 4.1 Summary of Key Findings of the Individual Corridors and Schemes

Issues/ Corridor	Railway	NOL and Kwu Tung Station	HSK Station	TCW Extension	TMS Extension	EKL	SIL(W)	NIL
GHG		Annual Changes in the order of: • -28,000 ~ -43,000 tonnes	Annual Changes: • minimal	Annual Changes in the order of: • -19,000 tonnes	Annual Changes: • minimal	Annual Changes in the order of: • -19,000 tonnes	Annual Changes in the order of: • -19,000 tonnes	Annual Changes in the order of: • -16,000 tonnes
Noise		Underground with above-ground sections • Percentage of Exposed Track: ~64%; • Max Rail Noise Impact (Unmitigated): 43-65dB(A)	Above-ground • Percentage of new Exposed Track: 0%; • Max Rail Noise Impact (Unmitigated): 0dB(A); (Remark: HSK station built on existing West Rail)	Underground • Percentage of Exposed Track: 0%; • Max Rail Noise Impact (Unmitigated): 0dB(A)	Above-ground • Percentage of Exposed Track: 100%; • Max Rail Noise Impact (Unmitigated): 55-68dB(A) on open section	Underground • Percentage of Exposed Track: 0%; • Max Rail Noise Impact (Unmitigated): 0dB(A)	Underground with above-ground sections • Percentage of Exposed Track up to an order of 9%; • Max Rail Noise Impact (Unmitigated): 31-68dB(A)	Underground • Percentage of Exposed Track: 0%; • Max Rail Noise Impact (Unmitigated): 0dB(A)
Ecology		WCA and WBA • Potential loss and indirect disturbance to fishpond/wetlands • Potential foraging grounds for migratory and wintering waterbirds as well as ardeids nesting in the Deep Bay area • Potential barrier effect to bird flight paths at Kam Tin, Ngau Tam Mei and areas between Mai Po and Hoo Hok Wai • Potential impact on Conservation Areas in Yuen Long and Lok Ma Chau • Areas with High Ecological Value Habitats ~ 4.4 ha	--	• Potential impact on the river mouth (artificial drainage channel) of Tung Chung Bay.	• Potential impact on egret foraging ground in Tuen Mun Nullah	• Potential impact at over-run of POA is located in areas with Mixed Shrubland • Areas with High Ecological Value Habitats < 900 m ²	• Egret nesting ground in Wong Chuk Hang Nullah • Potential ecological impact to the habitats in Wong Chuk Hang Nullah • Areas with High Ecological Value Habitats ~ 1.0 ha	--
Water Quality		• Key WSRs in the vicinity include the Shenzhen River, Kam Tin River, fish ponds and compensatory wetland habitats in the northern NT	• Site Runoff	• Site Runoff into Tung Chung Bay	• Site Runoff into Tuen Mun River Channel	• Site Runoff	• Site Runoff into Wong Chuk Hang Nullah	• Site Runoff
Waste Management [1]		• C&D waste generated about 340,000 m ³	--	• C&D waste generated about 270, 000m ³	--	• C&D waste generated about 1,290,000 m ³	• C&D waste generated about 1,080,000 m ³	• C&D waste generated about 720,000 m ³
Hazard to Life		• Au Tau Water Treatment Works	--	--	• Estate LPG store of Exxon Mobil HK Ltd. in Tuen Mun Area 44	--	--	--
Landfill Gas		--	--	--	--	• Underground corridor passes within CZs of : ➢ Ma Yau Tong Central closed landfill site, ➢ Ngan Chi Wan closed landfill, ➢ Jordan Valley closed landfill and ➢ Ma Yau Tong West closed landfill	--	--

Issues/ Corridor	Railway	NOL and Kwu Tung Station	HSK Station	TCW Extension	TMS Extension	EKL	SIL(W)	NIL
Contaminated Land		<ul style="list-style-type: none"> Potential land contaminated sites: <ul style="list-style-type: none"> ➢ along the corridor at Kam Tin, Ngau Tam Mei and San Tin 	<ul style="list-style-type: none"> Land contamination to be handled by HSK NDA project 	--	--	<ul style="list-style-type: none"> Potential land contaminated sites: <ul style="list-style-type: none"> ➢ Petrol refilling station near POA station and SMP station 	<ul style="list-style-type: none"> Potential land contaminated sites: <ul style="list-style-type: none"> ➢ Petrol refilling station near ABE station 	<ul style="list-style-type: none"> Potential land contaminated sites: <ul style="list-style-type: none"> ➢ Petrol refilling stations near CBN station
Cultural Heritage		--	--	<ul style="list-style-type: none"> Potential conflict with historical and cultural resources <ul style="list-style-type: none"> ➢ Ma Wan Chung SOAI 	--	--	<ul style="list-style-type: none"> Potential conflict with historical and cultural resources <ul style="list-style-type: none"> ➢ Old Block of Holy Spirit Seminary in Wong Chuk Hang ➢ Fung Ping Shan Building of the Hong Kong University ➢ Exterior of the Main Building and Hung Hing Ying Building of the HKU ➢ King's College, Lo Pan Temple ➢ Kong Sin Wan Kiln SOAI 	<ul style="list-style-type: none"> Potential conflict with historical and cultural resources <ul style="list-style-type: none"> ➢ Hong Kong City Hall ➢ Tin Hau Temple in Causeway Bay
Significant Concerns on Landscape Resources & Visual Impacts		<ul style="list-style-type: none"> Visual impacts from ventilation shafts and station entrances Visual impacts from viaducts Areas of landscape areas with "High" or "High (Qualified)" value that need compensation <ul style="list-style-type: none"> ➢ 2 km length of viaduct in Lok Ma Chau ➢ 700m length near Cheung Chun San Tsuen in Kam Tin 	<ul style="list-style-type: none"> Visual impacts from ventilation shafts and station entrances 	<ul style="list-style-type: none"> Visual impacts from ventilation shafts and station entrances Station will fall into an area with "High" or "High (Qualified)" value that need compensation 	<ul style="list-style-type: none"> Visual impacts from ventilation shafts and station entrances Visual impacts from new elevated viaducts and station 	<ul style="list-style-type: none"> Visual impacts from ventilation shafts and station entrances Overrun at POA falls in landscape area with "High" and "High (Qualified)" value that need compensation; 	<ul style="list-style-type: none"> Visual impacts from ventilation shafts and station entrances Visual impacts from viaducts at Wong Chuk Hang and Cyberport 	<ul style="list-style-type: none"> Visual impacts from ventilation shafts and station entrances Registered old and valuable tree along the NIL Temporary loss of amenity areas, i.e. Green carpet CBN station falls in landscape area with "High" value that need compensation, i.e. Victoria Park

Remarks:

[1] The construction & demolition materials contained in the table are estimated based on the best available information.

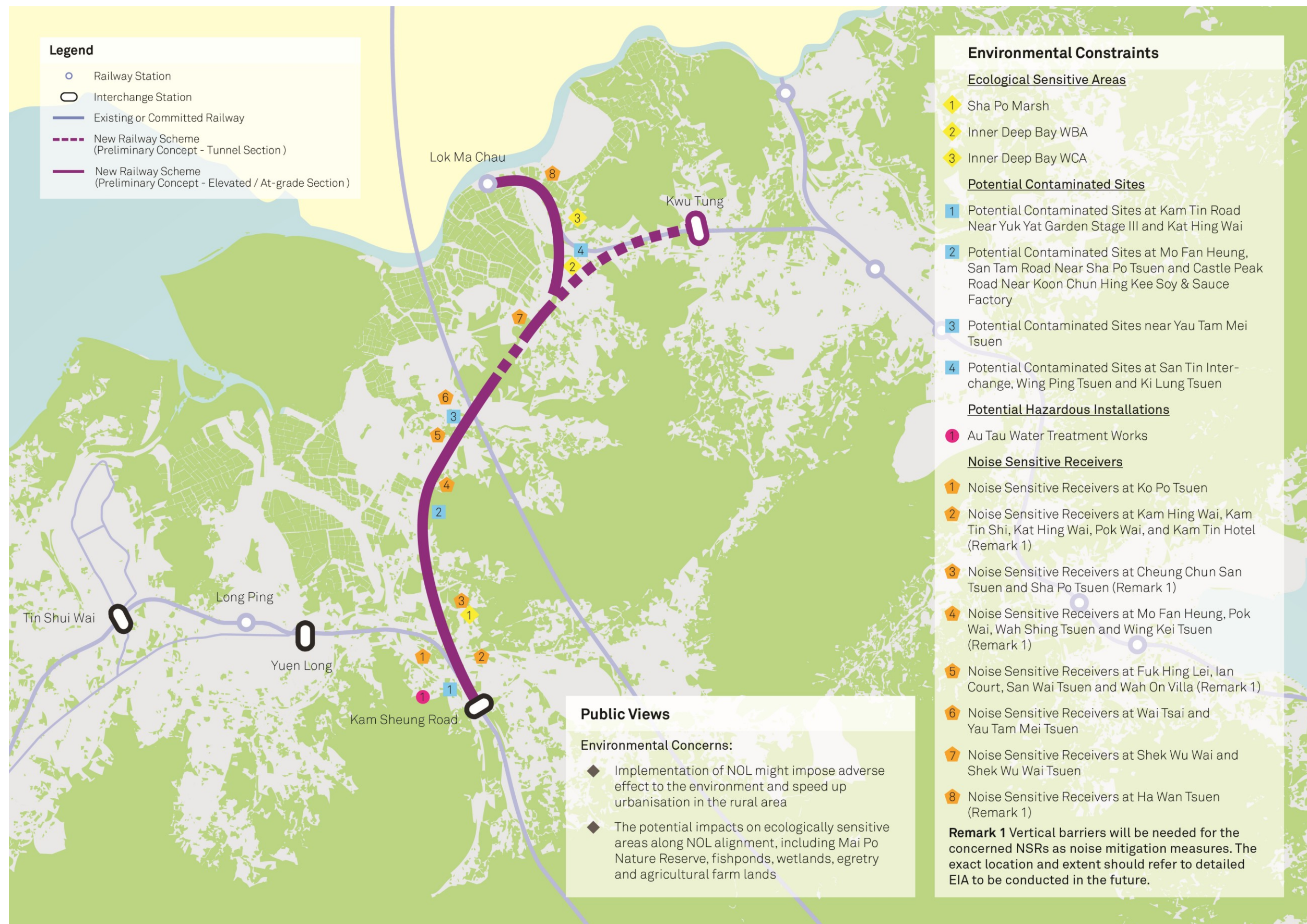


Figure 4.1 Environmental Constraints Map for Northern Link and Kwu Tung Station

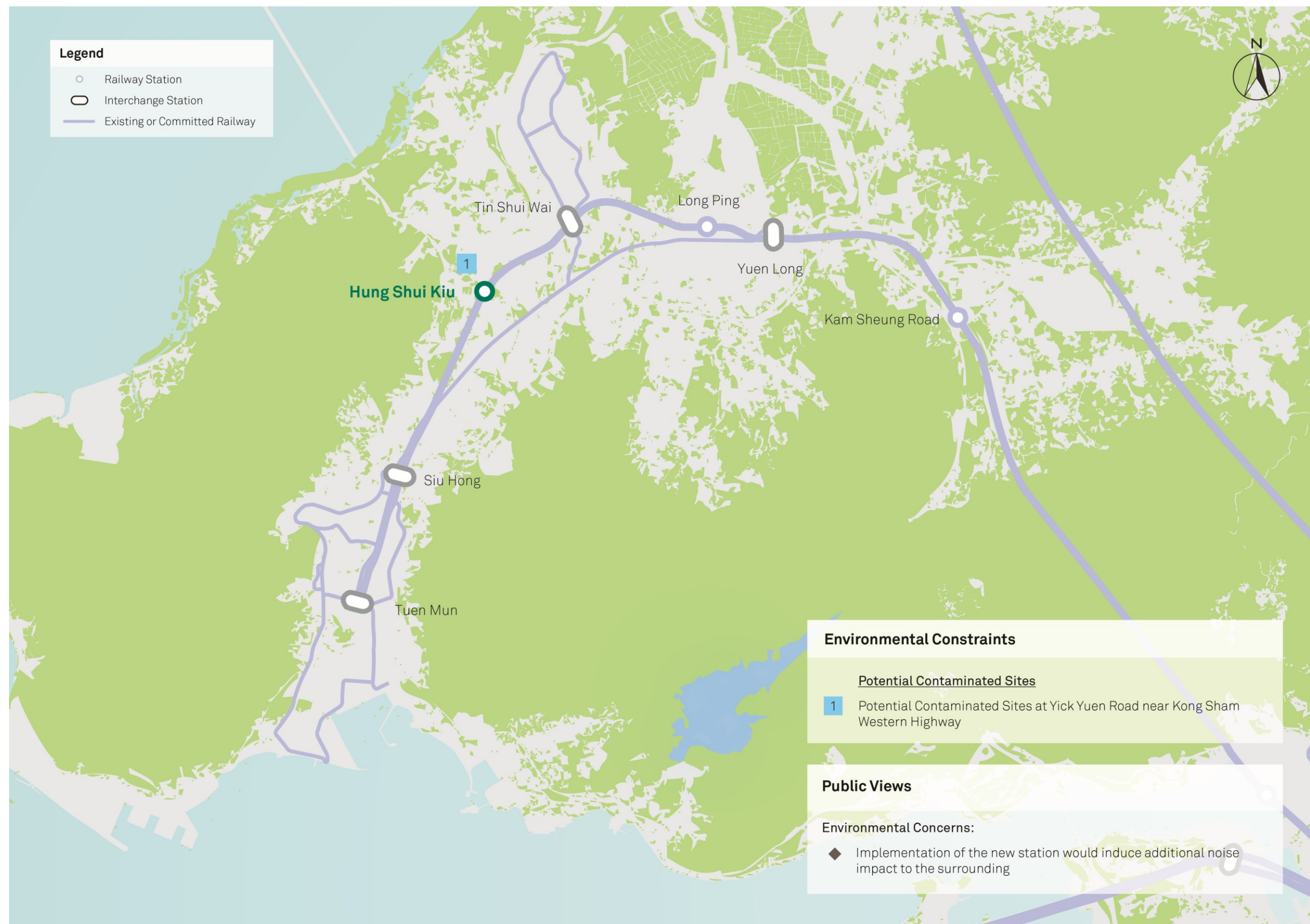


Figure 4.2 Environmental Constraints Map for Hung Shui Kiu Station

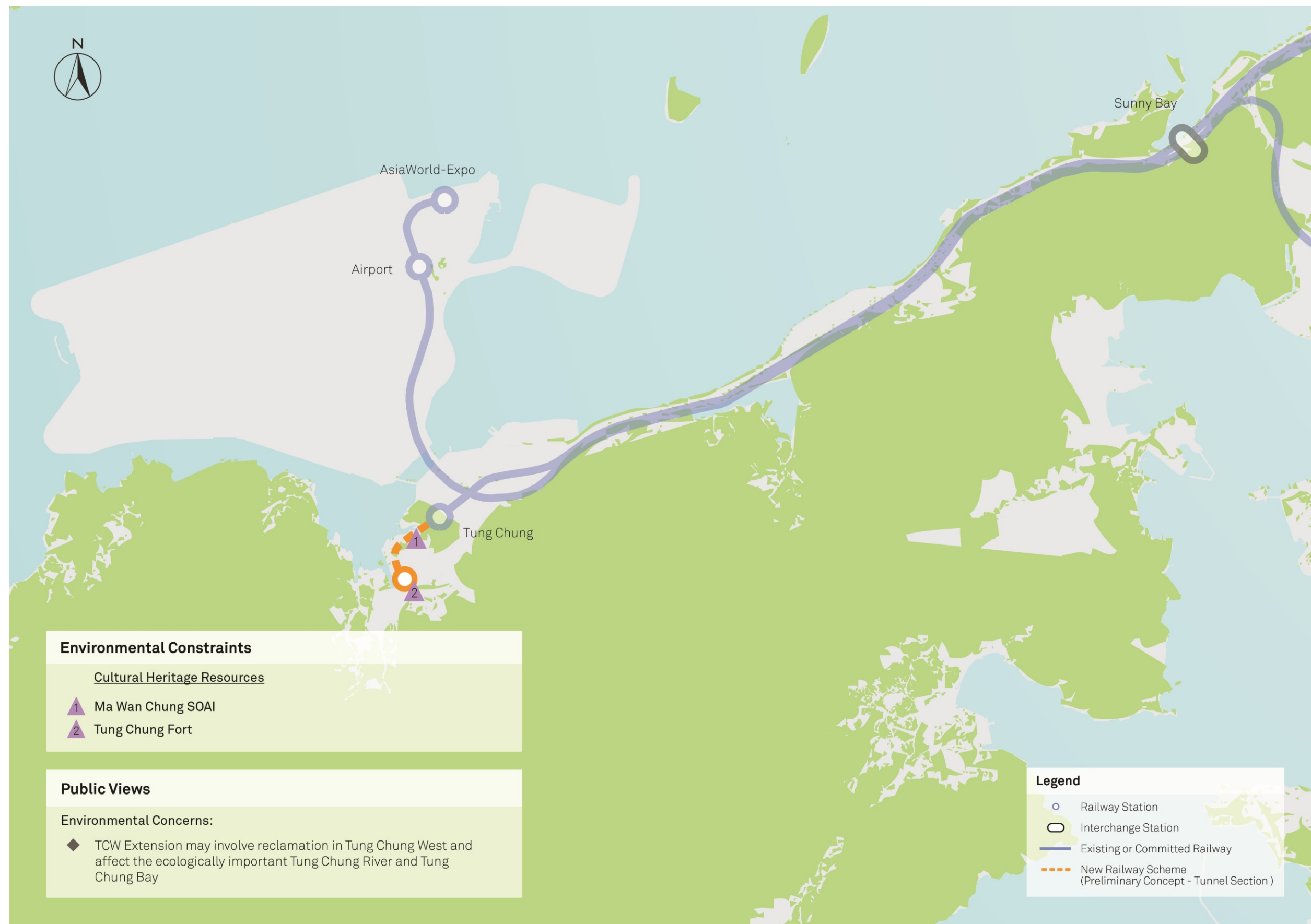


Figure 4.3 Environmental Constraints Map for Tung Chung West Extension

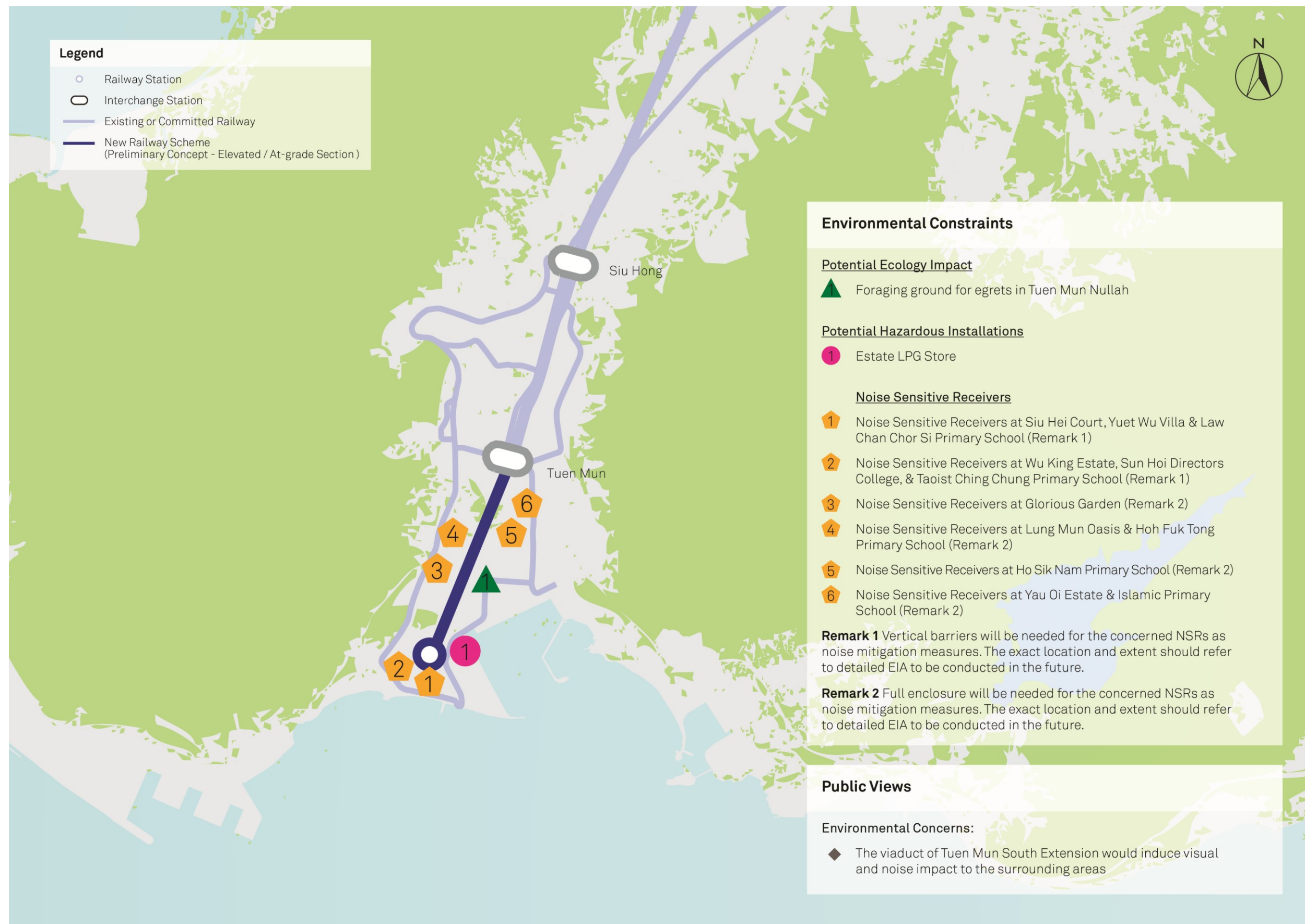


Figure 4.4 Environmental Constraints Map for Tuen Mun South Extension



Figure 4.5 Environmental Constraints Map for East Kowloon Line



Figure 4.6 Environmental Constraints Map for South Island Line (West)

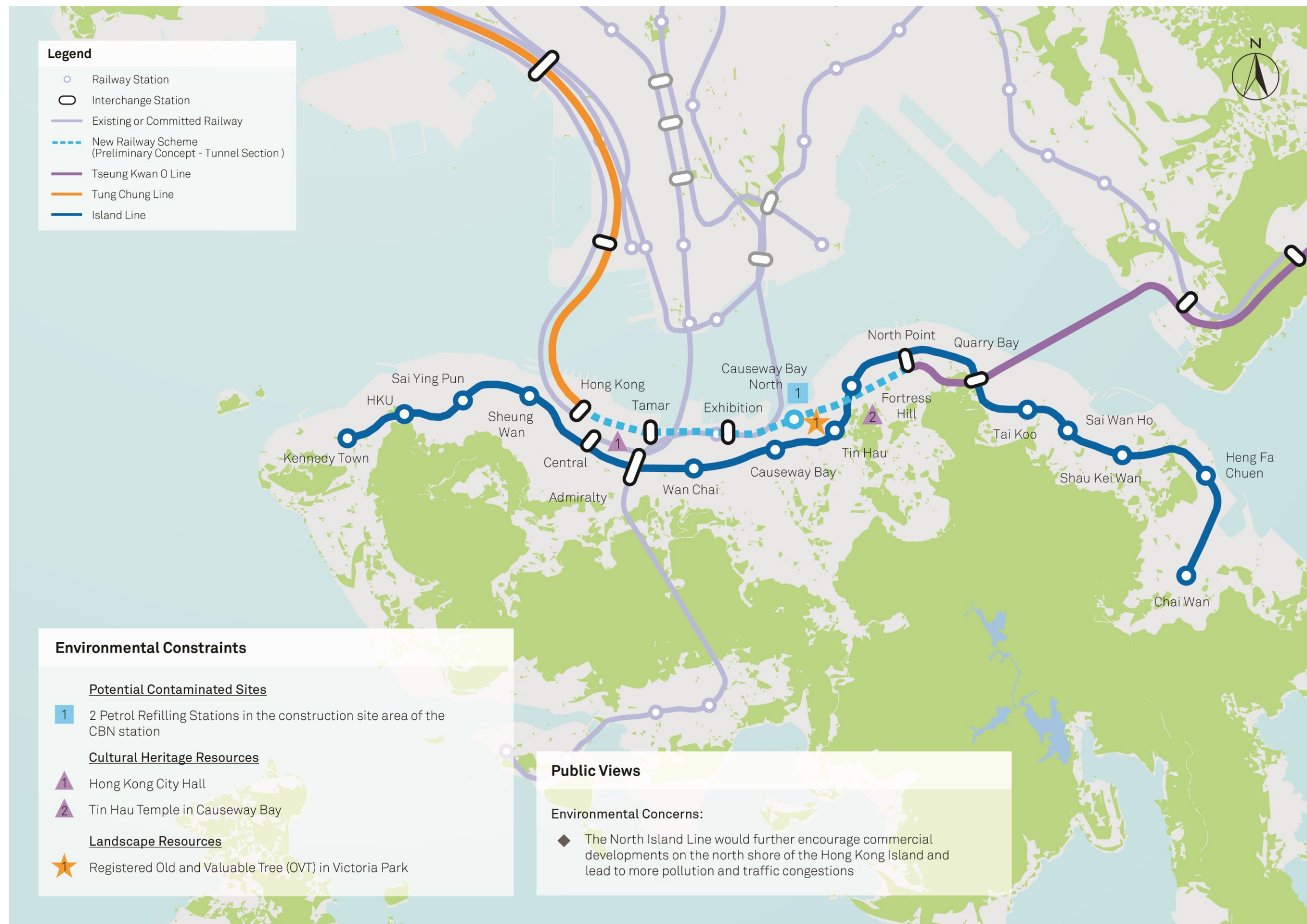


Figure 4.7 Environmental Constraints Map for North Island Line

5. CUMULATIVE IMPACTS OF THE PROPOSED RAIL DEVELOPMENT PROPOSALS

5.1 Introduction

5.1.1 To provide an indication of the potential cumulative environmental impacts that would result from the implementation of the railway development proposals, assessments were undertaken based, where appropriately on the methodologies presented in the Final SEA Report. The findings are summarised below.

5.2 Cumulative Air Quality Impacts

5.2.1 An evaluation was undertaken to assess the air quality benefits that may be accrued from the implementation of the railway proposals.

5.2.2 Transport forecasting data generated by the main study was used to quantify and compare the potential air quality “benefits” that may be obtained from a reduction in the road traffic brought about by the implementation of the railway network expansion plan. It involved determining the likely reduction in vehicle kilometers, for the year 2031 and using this data together with emission factors to determine the quantities of the NO_x, RSP and CO₂ that may be ‘saved’ due to the implementation of the railway proposals.

5.2.3 The assessment concluded that the railway network could reduce roadside emissions of all four of the concerned air pollutants. In general, the annual emission savings are in the order of some 190 tonnes of NO_x and 143,000 tonnes of GHG. The savings accrued are relatively small (about 2%-4%) compared to the base case on-road emissions. The main reasons for these small savings have been explained in **Chapter 2**.

5.2.4 As there are many uncertainties in the future energy requirements such as fuel, plant types and the proportion of low-carbon/renewable energy used for power generation, estimating the CO₂ emissions that may be associated with the electricity power generation for the proposed railway network in 2031 is extremely difficult. At the same time, the power company may also carry out greening such as tree planting to off-set part of the CO₂ generation.

5.2.5 In terms of air pollutants, the best practicable means is to reduce emissions at source, and at the same time enhance the operational efficiency of the power plants and the combustion and generation efficiencies. Emissions caps will likely be set under the renewal conditions; and power companies will need to actively consider adopting the most effective economic tools (including emissions trading) to achieve the emission reduction targets.

5.2.6 As would be expected, any air quality benefits accrued from implementing the railway development proposals could be maximised through the introduction of more “environmentally friendly” fuel sources, plant types, and by advances in power generation technology. Furthermore, it is considered that developments in the rail industry (using more energy efficient rolling stock and the use of platform screen doors) would help to reduce their future electricity requirements thereby leading to lower emissions.

5.2.7 It should be noted that the assessment of the cumulative air quality impacts is based on a number of assumptions and as a result, the findings should only be intended to provide a ‘strategic level’ indication of the potential air quality benefits that could be achieved from implementing the railway development proposals.

5.3 Cumulative Ecology and Fishery Impacts

5.3.1 As the majority of the railway development proposals are to be located underground within an urban environment, the potential for ecological impacts is generally low. However, losses to sensitive ecological habitats or other resources could occur from the implementation of the NOL, TMS Extension, TCW Extension, EKL and SIL(W) (refer to **Table 4.1**) as they are located in more rural environment in the NT or close to ecological habitats.

5.3.2 The assessment have so far determined that, of most significance, the currently proposed above ground alignments would affect some high ecological value habitats including a rough order of 4.1 hectares (ha) of natural woodland (<0.1% of Hong Kong’s overall resource), 0.6 ha of wetlands (including marsh areas) (or <0.2%) and 0.9 ha of natural watercourse (or <0.2%).

5.3.3 With reference to the Annex 16 of Environmental Impact Assessment Ordinance – Technical Memorandum (EIAO-TM), avoidance, minimisation and compensation approach has been adopted. The preliminary railway alignments have generally, where practical avoided important sensitive ecological habitats and country parks during the scheme’s development process.

5.3.4 The loss of any aquaculture site from development is undesirable from an inland fisheries perspective and detailed evaluation will need to be assessed at the EIA stage with reference to EIAO-TM Annexes 9 and 17 when more detailed information is available such that mitigation measures can be developed or considering alternative alignment to keep the fishery loss as low as reasonably practicable. Suitable compensation shall also be allowed in the engineering design (no net loss in fishery value); in particular at WCA.

5.3.5 In developing the design, reference should be made to the Town Planning Board Guideline No. 12B, where planning approval from the Town Planning Board is required and justification for “no net loss in wetland” is necessary.

5.3.6 Nevertheless, the rail development proposals will be subject to more development at the design stage of the project, alternative alignment options will be investigated to avoid or reduce potential impacts to important ecological areas. In the event that the railway scheme will result in compensatory areas, the affected habitats will be fully assessed and mitigation will be proposed, commensurate with the significance and exact area.

5.4 Cumulative Water Quality Impacts

5.4.1 Potential water quality impacts from the implementation of railway schemes are likely to come from dredging and filling activities; surface run-off and drainage generated from the construction site during the construction phase.

5.4.2 Key Water Sensitive Receivers (WSRs) have been identified for a number of railway schemes. The NOL alignment (refer to **Figure 4.1**) runs close to the Shenzhen River, Kam Tin River, fish ponds and compensatory wetland habitats in the northern NT. Other railway schemes such as the TMS Extension (refer to **Figure 4.4**) run along the Tung Mun River Channel, while the SIL(W) (refer to **Figure 4.6**) runs along the Nullah in Aberdeen on its approach to Wong Chuk Hang. The TCW station (refer to **Figure 4.3**) and the extension run along the coast line in Tung Chung Bay.

5.4.3 Mitigation practices in Hong Kong are well established and have been successfully implemented on many infrastructure projects to reduce water quality impacts. With proper consideration at the design stage of the project and on-site monitoring during the construction phase, water quality impacts can be effectively mitigated against.

5.5 Cumulative Waste Impacts

- 5.5.1 Environmental impacts associated with construction waste include, construction and demolition (C&D) materials; inert excavated materials from tunnelling; chemical waste and general refuse.
- 5.5.2 At strategic level, the estimation of C&D waste generation is generally considered from the construction phase through tunnelling activities and construction of underground stations. As such, waste management is mainly related to underground schemes. Based on the cumulative assessment of the railway development proposals, there will be around 3,700,000 cu metres of generated C&D material (refer **Table 4.1**).
- 5.5.3 With reference to the NOL, the alignment corridor will encroach on the Inner Deep Bay Wetland Conservation Area (WCA) and Wetland Buffer Area (WBA), and as these areas are largely occupied by commercial fishponds and filled fishponds, large amount of pond mud could potentially be dredged during the construction phase. Proper waste treatment and handling of the dredged mud will therefore need to be implemented and any illegal disposal at the WCA and WBA would be strictly prohibited.
- 5.5.4 As waste management practices are generally well established in Hong Kong and with proper implementation of the waste management practices (3-Rs) during the construction phase, there would unlikely be any waste related regulatory non-compliance and/or unacceptable environmental impacts arising from the handling, storage, transport and disposal of construction waste.

5.6 Cumulative Cultural Heritage Impacts

- 5.6.1 Potential impacts to cultural heritage resources are generally low as the majority of the railway schemes are to be located underground. However, impacts will arise, especially from above ground construction works associated with station construction or above ground structures such as viaducts, ventilation buildings or tunnel portals, etc.
- 5.6.2 The railway schemes were assessed to determine their proximity to cultural heritage resources (refer **Table 4.1**). Ten heritage sites have been identified within 50 m of the currently assumed alignments and only one of the schemes is currently assumed to be above ground. Consequently, it is not envisaged that there will be any insurmountable impacts to cultural heritage resources from the implementation of the railway development proposals.

5.7 Cumulative Contaminated Land Impacts

- 5.7.1 Contaminated land generally refers to land which has been polluted by hazardous substances as a result of industrial operations carried out on site over the years. These contaminants, if present, may pose hazardous risks and could cause potential adverse effects to construction workers during construction and users during operation.
- 5.7.2 With reference to the railway schemes, the NOL (refer to **Figure 4.1**) would encroach into a number of potential land contaminated sites. Other schemes such as the NIL and SIL(W) have some at grade works close to petrol stations (refer **Table 4.1**).
- 5.7.3 At strategic level it is not possible to identify the magnitude of these impacts and it will be necessary to conduct ground investigation works at the EIA stage to determine appropriate soil treatment or disposal for these schemes.

5.8 Cumulative Landscape and Visual Impacts

- 5.8.1 Generally, above ground railways, entrances and ancillary railway facilities such as ventilation buildings have the potential to give rise to noise, visual and landscape impacts.
- 5.8.2 Railway alignments may encroach into key landscape resources areas, such as champion trees, greenbelt and country park areas. To minimise direct impacts, key areas of landscape resources have been mapped with reference to the Landscape Character Map of Hong Kong (published by Planning Department 2005) and generally avoided during the development of the railway alignment.
- 5.8.3 The landscape value has been categorised as “High”, “High (Qualified)”, “Moderate” and “Low”. **Table 4.1** provides a summary of the potential cumulative landscape and visual resources estimated with the use of the Geographic Information System (GIS) database.
- 5.8.4 As mentioned above, visual impacts generally come from the construction works and above ground railways and structures. In the past, it has been demonstrated (for example on the LMCSL and the Ma On Shan Line (MOL)) that, with careful planning, design and the adoption of the appropriate mitigation measures, visual and land impacts can be mitigated to within the required criteria.

5.9 Cumulative Hazard Impacts

- 5.9.1 To provide an indication of the potential cumulative hazard implications, an assessment was undertaken to determine the length of track and number of stations within the Consultation Zones (CZ) of the PHI.
- 5.9.2 With the assumed railway alignments, it was found that two of the elevated schemes, NOL and TMS Extension would be located within the CZs of PHIs. The total length of above ground track within the CZs was found to be about 1,500 m. In comparison to the total length of proposed new railway proposals (i.e. approximately 35 km) the potential length of above ground track within the CZs is comparatively small. Upon further review, the alignment of the two schemes is generally located quite far from the hazard source (refer to **Table 4.1**) and no insurmountable impacts would be anticipated. Nevertheless as is standard practice, hazard assessments will be required at the EIA stage to assess the hazard implications, and, where applicable, develop and specify suitable mitigation measures.

5.10 Cumulative Landfill Gas Impacts

- 5.10.1 With reference to the rail development proposals, only the EKL corridor (refer to **Figure 4.5**) is located within the CZs of landfill sites. Three sections of the railway (length of about 2.2 km) would be located within the CZs of Ma Yau Tong Central Closed Landfill site, Ngan Chi Wan Closed Landfill, Jordan Valley Closed Landfill and Ma Yau Tong West Closed Landfill in the Kwun Tong area. In view of the close proximity of the railway tunnel to the closed landfills, it is recommended to further investigate any potential gas hazard to the construction and operation of the railway in the design stage.
- 5.10.2 If the railway scheme is taken forward, alternative alignments can be investigated at the design stage of the project and if found necessary, special engineering measures can be incorporated into the design, precautionary measures can be implemented in the construction and operational phase to ensure that the planned railway development is safe.
- 5.10.3 A landfill gas hazard assessment will be a requirement at the EIA stage with the consideration of the latest design information.

5.11 Cumulative Noise Impacts

5.11.1 With the majority of the railway schemes proposed to be located underground, the potential for operational noise impacts is low. Generally, railways give rise to two different types of noise source, air-borne and fixed noise.

Air borne Noise

5.11.2 The principal air-borne noise impact comes from above ground railways through the propulsion system, wheel/rail interaction and roof-mounted air-conditioning system (although ground borne noise can be a contributory factor). Mitigation of noisy operational impacts from above ground railways been implemented successfully in past railway projects including the MOL and LMCSL. Furthermore, there are a wide variety of measures that are available from those which can be incorporated into the design of the railway (i.e. integrating the railway/station into a development, or use of podium structures or non-noise sensitive buildings to provide screening), to those which can be employed when a railway is introduced into an urbanised area (i.e. noise barriers/enclosures).

5.11.3 The assessment has found that the elevated railway schemes such as the NOL, TMS Extension and some sections of the SIL(W) would likely require direct (at source) mitigation measures to be developed.

Fixed Noise Source

5.11.4 Fixed noise source comes from ventilation shaft / ventilation buildings and is a noise issue in particular, in the rural area with low ambient noise level. Best practices as recommended in the EPD's "Good Practices on Ventilation System Noise Control"¹⁴ is to adopt practicable and effective mitigation measures during design stage of the project in order to minimise potential noise impact to nearby Noise Sensitive Receivers (NSRs). Some best practices are highlighted below:

- Use of quieter plant;
- Locate fixed plant/louver away from NSRs, locate fixed plant in walled plant rooms or in specially designed enclosures, or locate noisy machines in a basement or a completely separate building;
- Where possible, integrate large ventilation building into nearby hills or building structures (e.g. merge with stations, commercial buildings, etc) – improve screening and visual effect;
- Use of top-vent design and small directivities effect directly facing NSRs. Use of green wall/planting to improve the visual effect of vent buildings;
- Install direct noise mitigation measures including silencers, acoustic louvers and acoustic enclosure; and
- Develop and implement a regularly scheduled plant maintenance programme.

5.11.5 If a rail depot is required, this rail facility should be located away from the NSRs and where appropriate adopt suitable mitigation measures (such as noise decking/ semi / full-enclosures) to minimise noise impact (or cumulative noise contribution) to the existing or nearby NSRs.

5.11.6 Through careful planning, design and the adoption of the appropriate noise mitigation measures, it is considered that noise and visual impacts can be mitigated to within the required criteria for the above ground railway schemes. Furthermore, the Noise Control

Ordinance (NCO) defines absolute performance limits for controlling operational railway noise and if impacts are envisaged, direct (at source) mitigation measures can be developed to meet the noise standard to ensure noise is controlled to within the required noise criteria.

5.12 Summary

5.12.1 The assessment of the cumulative impacts has provided an indication of the potential impacts that may arise through the implementation of the railway development proposals. With the proposed majority of the schemes to be located underground, the potential for environmental impacts has been greatly reduced. The environmental impacts that have been identified need to be carried forward and addressed at the next stage of scheme development to ensure that, environmentally, the resulting railway network performs at least as predicted in the SEA.

¹⁴ http://www.epd.gov.hk/epd/english/environmentinhk/noise/help_corner/files/Vent_sys_E-06.pdf

6. THE WAY FORWARD AND FUTURE ENVIRONMENTAL REQUIREMENTS

6.1 Strategic Environmental Monitoring & Auditing

- 6.1.1 One of the objectives of the environmental component of RDS-2U was to assist in the formation of the development options, and to ensure, as far as possible within the constraints of the available design information, the environmental impacts were avoided, minimised or, successfully mitigated against.
- 6.1.2 The key findings of the environmental assessment undertaken of the railway schemes are highlighted in the previous chapters. Whilst potential environmental impacts are identified at the construction or operation phases for each of the railway schemes, the assessment concluded that none of the railway schemes would result in insurmountable impacts and it was considered that such impacts could be mitigated to acceptable limits during design stages of the project.
- 6.1.3 It is not the purpose of the SEA, nor is it possible with current design information to specify precise details of such mitigation measures. However, it is considered that the key potential impacts that have been identified can be carried forward into the development process and successfully addressed within the appropriate stage of the scheme's development (refer to **Table 6.1**). Many of the identified potential impacts or "local" implications of the scheme will need to be further evaluated before mitigation measures can be fully developed. It is assumed that this will be undertaken during the project environmental studies (refer to **Table 6.2**) that accompany the design stage of the project and ultimately at the EIA stage.
- 6.1.4 It should also be noted that the implementation of any new railway proposals in Hong Kong will constitute a designated project under Section 2 of the EIAO. As such, an EIA will be required to be undertaken and an Environmental Permit (EP) granted before construction of any of those schemes can commence.

Table 6.1 Key Potential Environmental Impacts encountered by each Railway Corridor/Scheme

Potential Impact / Scheme	NOL	NIL	KTU Station	HSK Station	TCW Extension	TMS Extension	SIL(W)	EKL
Issue 1: Noise, dust and traffic impacts from cut-and-cover works	✓	✓	✓	✓	✓		✓	✓
Issue 2: Noise, dust and traffic impacts at shaft/worksite locations from bored tunnelling operations	✓	✓			✓		✓	✓
Issue 3: Water quality impacts to identified key WSRs ¹	✓							
Issue 4: Ecological impacts to important ecological habitats	✓ ²					✓ ³	✓ ⁴	✓
Issue 5: Fisheries impacts	✓							
Issue 6: Operational noise impact	✓			✓		✓	✓	
Issue 7: Alignment falls within the CZ of PHI	✓ ⁵					✓ ⁶		
Issue 8: Potential for encountering contaminated land	✓ ⁷						✓ ⁸	✓
Issue 9: Visual impacts from above-ground structures	✓	✓	✓	✓	✓	✓	✓	✓
Issue 10: Temporary loss of amenity sites		✓ ⁹						
Issue 11: Potential impacts to heritage sites		✓ ¹⁰			✓ ¹¹		✓ ¹²	
Issue 12: Potential Landfill Gas Hazard								✓ ¹³

Remarks:

- [1] General site runoff is expected for construction sites in all schemes.
- [2] Important ecological habitats potentially affected by NOL include Inner Deep Bay WBA and WCA, a number of fish ponds, compensatory wetland and major rivers.
- [3] Foraging ground potentially affected by TMS extension include the Tuen Mun Nullah.
- [4] Important ecological habitats potentially affected by SIL(W) include the Wong Chuk Hang Nullah.
- [5] NOL will encroach on CZ of Au Tau Water Treatment Works
- [6] TMS Extension will encroach on CZ of the estate LPG store of Exxon Mobil HK Ltd. in Tuen Mun Area 44.
- [7] Potential contaminated land encountered by NOL includes sites along the alignment/works area at Kam Tin, Ngau Tam Mei and San Tin.
- [8] Potential contaminated land encountered by SIL(W) includes a petrol refilling station near cut-and-cover station at Aberdeen.
- [9] Amenity sites being temporary loss by the implementation of NOL including Wan Chai Sports Ground and the proposed waterfront promenade.
- [10] Heritage sites to be potentially affected by NIL include Hong Kong City Hall and Tin Hau Temple in Causeway Bay.
- [11] Heritage sites to be potentially affected by TCW Extension include Ma Wan Chung SOAI.
- [12] Heritage sites to be potentially affected by SIL(W) include Old Block of Holy Spirit Seminary in Wong Chuk Hang, Fung Ping Shan Building of the Hong Kong University, Lo Pan Temple, King's College, the exterior of the Main Building of the Hong Kong University, the exterior of Hung Hing Ying Building of the Hong Kong University; and Kong Sin Wan Kiln SOAI.
- [13] Ma Yau Tong Central closed landfill, Ngan Chi Wan closed landfill Jordan Valley closed landfill and Ma Yau Tong West closed landfill would potentially affect EKL.

Table 6.2 Proposed timing for further consideration of Key Potential Environmental Impacts

Potential Impact	Action Required	Implementation Stage	Implementation Agent
Noise			
Noise, dust and traffic impacts from cut-and-cover works	Determine if requirement or extent of cut-and-cover working can be reduced.	Design	Design Engineers
	Evaluate construction phase impacts and propose appropriate mitigation and monitoring if required.	EIA	EIA Consultant
Noise, dust and traffic impacts at shaft/worksites locations from bored tunnelling operations	Include environmental considerations in the selection of shaft / worksite locations.	Design	Design Engineers
	Evaluate environmental impacts from use of shafts / worksites and, if required, develop appropriate mitigation measures and monitoring requirements.	EIA	EIA Consultant
Operational noise impact	Incorporate operational noise considerations into the development of the alignment.	Design	Design Engineers
	Evaluate operational noise impacts and specify mitigation and monitoring as required.	EIA	EIA Consultant
Water Quality			
Water quality impacts to identified key WSRs including a number of fish ponds, compensatory wetland and major rivers	Ensure the alignment is designed such that the impacts to the identified WSRs are minimised.	Design	Design Engineers
	Evaluate potential water quality impacts and propose appropriate mitigation and monitoring if required.	EIA	EIA Consultant
Ecological and Fisheries			
Ecological and fisheries impacts to important ecological habitats	Ensure the alignment is designed such that the impacts to the identified ecological and fisheries resources are minimised.	Design	Design Engineers
	Evaluate potential ecological and fisheries impacts and propose appropriate mitigation and monitoring if required.	EIA	EIA Consultant
PHI			
The alignment falls within the CZ of PHI	Undertake hazard assessment and proposed appropriate mitigation if required.	Design / EIA	Design Engineers / EIA Consultant
Contaminated Land			
Potential for encountering contaminated land	Evaluate potential contamination impact and propose appropriate mitigation and monitoring if required.	EIA	EIA Consultant
Visual and Landscape			
Visual impacts from above-ground structures	Consider visual impact issues during the development of the alignment.	Design	Design Engineers
	Evaluate visual impacts and specify mitigation and monitoring if required.	EIA	EIA Consultant
Temporary loss of amenity sites	Determine whether the impacts to amenity resources can be minimised, and if necessary, identify alternative locations for reprovisioning.	Design	Design Engineers
Cultural Heritage			
Potential impacts to heritage sites	Give due consideration to potential construction and operational phase impacts to the identified heritage resources and develop construction methodology and alignment such that the potential for these impacts are minimised.	Design	Design Engineers
	Evaluate potential impacts to the identified heritage resources and proposed appropriate mitigation and monitoring if necessary.	EIA	EIA Consultant
Landfill Gas Hazard			
Potential Landfill gas impacts	Give due consideration to potential construction and operational phase impacts/risk induced from the identified closed landfill sites. Develop construction methodology/precautionary measures and alignment such that the potential for these impacts is minimised.	Design	Design Engineers (Particular for EKL)
	Evaluate potential landfill gas risk and proposed appropriate mitigation and monitoring if necessary.	EIA	EIA Consultant

7. CONCLUSIONS AND RECOMMENDATIONS

- 7.1.1 The work undertaken as part of the SEA has assisted in the development of the proposed railway network expansion plan. The key environmental issues, including noise impact, air quality, water quality, waste management implications, ecological and fisheries impact, landscape and visual impact, cultural heritage impact, contaminated land issues, and potentially hazardous installation hazards, have been addressed in the SEA.
- 7.1.2 Strategic level environmental assessments were undertaken for each of the railway schemes and the railway network expansion plan. With the majority of the railway schemes proposed to be constructed underground, the potential for environmental impact has been greatly reduced. None of the proposed railway schemes would result in any insurmountable impacts during construction or operation phases. Whilst potential environmental impacts were identified for the implementation of each of the railway scheme, it was envisaged that the magnitude of such impacts could be reduced during the design stage of the project and suitable measures could be developed to limit these impacts to acceptable levels. To ensure that the potential impacts that have been identified are carried forward and addressed throughout the schemes development process, follow-up actions have been recommended in such a manner that they can be successfully addressed within the appropriate stage of the scheme's development.
- 7.1.3 The review of the environmental benefits of railway development have shown that air quality benefits would be less in future (as compared to the RDS-2) due to more stringent AQOs and advanced on-road transportation systems, including electric cars and buses, would be introduced in the long-term when the technology becomes mature and cost effective.
- 7.1.4 Nevertheless, railways development can save land, minimise the reliance on road travel and reduce the use of energy. One further advantage, railways can also help curb roadside pollutant emissions. With the implementation of the railway proposals, the rail share in the public transport system would rise to some 45% to 50% of the total number of trips by 2031, and a reduction in road-based transport is expected. This would translate to environmental benefits amounting to a reduction in roadside air pollutants by some 190 tonnes of NOx per year and 143,000 tonnes of GHG per year, i.e. reduction of about 2%-4% of the roadside air pollutants and green house gases per year. At the same time, the relief to road congestion can benefit the overall productivity and competitiveness of Hong Kong.
- 7.1.5 In short, the SEA has demonstrated there are environmental advantages by building the aggregate schemes which make up the railway network expansion plan and the SEA has clearly established on the whole, railways make significant contributions to improving the environment in Hong Kong.
- 7.1.6 The further decision to build individual railway projects will depend on the outcome of detailed engineering, environmental and financial studies relating to these projects. Further public consultation will also be undertaken prior to the implementation of any new railway projects.