This report is prepared by Hyder-Mott Connell Joint Venture for information and discussion purposes. The findings and recommendations do not necessarily represent the views of the HKSARG.
1. Introduction

1.1 Background

1.1.1 The HK2030: Planning Vision and Strategy (Main Study) is a strategic planning study tasked with preparing a strategic land use planning framework for Hong Kong for a period of 30 years. It will address ‘how much, what type and where land for development should be provided’.

1.1.2 The Government is committed to supporting and promoting sustainable development and to this end major policy and strategy initiatives must undergo a sustainability assessment. Under the overall goal of adhering to the principle of sustainable development, a planning objective of the HK2030 Study is to provide a good quality living environment. To achieve this, we need to strike a balance in the demand for, and supply of, environmental resources and a Strategic Environmental Assessment (SEA) is being undertaken as an integral part of the HK2030 Study.

1.1.3 To put the SEA into context, it is important to note that the Main Study involves four key stages of work viz:

Stage 1: Agenda Setting, Baseline Review and Identification of Key Issues
Stage 2: Examination of Key Issues
Stage 3: Formulation and Evaluation of Scenarios and Options
Stage 4: Formulation of Development Strategies and Response Plans

1.1.4 The SEA is being integrated with the Main Study by providing environmental input at all stages. This includes strategic environmental information and suggestions to help facilitate the formulation, development and identification of development options that would be likely to meet the requirements for environmentally sustainable development. The scope of the SEA is focussed on those environmentally related issues which have potential to significantly affect land use strategies.

1.1.5 The main deliverables of the SEA Study have so far been an Inception Report and the Initial Assessment Report (IAR). The IAR was prepared under Tasks 1 - 3 of the SEA Study Brief and reviewed Baseline Conditions, discussed Environmental Capital Stock and Carrying Capacity, identified Environmental Target areas as well as listing Environmental Constraints, Opportunities and Key Issues.
1.2 Purpose of Report and Objectives

1.2.1 This Key Issues Report is the 3rd major deliverable of the SEA Study and has been prepared in accordance with the requirements of the Study Brief. The issues have been identified from a combination of:

- discussions with the Main Study Team
- items raised in the SEA Study Brief
- comments raised during HK2030 Study’s public consultation
- comments from Environmental Study Management Group representatives including the HK2030 Study Advisors
- those identified in the Initial Assessment Report

This Key Issues Report examines these issues (and other major environmental land use related concerns) in greater detail. However, a prime focus has been those issues which have a significant land use implication.

1.2.2 The Key Issues include both local and regional issues that could have major implications for the Hong Kong environment and influence strategic land use. The factors which will potentially have a significant effect on Hong Kong’s environmental resources include:

- Pearl River Delta (PRD) Regional Development
- Population Growth and Dynamics
- Economic Transformation
- Infrastructure and Transportation Development
- Environmental Concerns and Aspirations

1.2.3 These Key Issues and Influencing Factors are discussed below and this discussion is followed by the examination of relevant environmental aspects.

1.2.4 The objectives of this Report are to examine the identified issues to facilitate their consideration during the development of options and help to ensure that they would be given due weight and attention in the Main Study deliberations and that they would influence the Development Options and the eventual Development Strategy appropriately.

1.2.5 It should be noted that there would have a wide range of issues that are considered important by many people and the provision (or upgrading) of associated infrastructure and/or facilities would be necessary to prevent these issues causing social and possibly environmental problems (and their satisfactory resolution would be expected in a World Class City). However, many of these issues may not be fundamentally strategic in nature or related to land use planning and are therefore not to be considered in the context of the SEA Study and in this Report. An example of such issues is the provision of utilities and services in cables and pipelines.
2. Influencing Factors and Key Issues

2.1 PRD Regional Developments

2.1.1 The Guangdong Provincial Government defines the PRD as a region of 10 district level cities (including Guangzhou, Zhuhai, Shenzhen, Jiangmen, Foshan, Zhaoqing, Huizhou, Dongguan, Zhongshan and Qingyuan) and 21 county (Xian) level cities and hsiens under its jurisdiction.

2.1.2 Hong Kong is now economically and socially an inseparable part of the PRD. We rely on this region for the supply of most of our water and food and many Hong Kong residents either originally came from or have close family ties with the region.

2.1.3 To foster further economic and social interactions between these two places, measures to increase the capacity of existing boundary control points are being implemented and additional transport links will shortly be constructed. In addition, various ideas are being investigated, such as a possible road link to the west bank of the PRD, the possibility of linking our railway network with that of the PRD, the possibility of opening up the Frontier Closed Area for development and utilising the land resources in the Mainland, and, in the long term, a possible ‘eastern corridor’ connecting Hong Kong with eastern Shenzhen and Guangdong Province.

2.1.4 Economically, since the adoption of the Open Door Policy in 1978, the trade between Hong Kong and the Mainland has been growing by an average of some 24% per annum. About 80% of the total cargoes in the Southern China region are shipped through Hong Kong. This significant growth seems destined to continue into the foreseeable future. More recently we have seen a growing trend of Hong Kong people travelling across the boundary for shopping, leisure and work and even some buying properties there. This trend of closer socio-economic integration appears inevitable and irreversible.

2.1.5 Pollution, however, shows no respect for administrative boundaries and Hong Kong’s environment is also influenced by developments in the PRD. For example, the ambient air quality and water quality are influenced by pollutants that are blown/flowed down from the PRD and in the case of air quality much further afield.

2.1.6 In addition Hong Kong’s environment will be affected by impacts associated with the development of new cross-boundary infrastructure/facilities. Examples would be the construction and operation of new road and rail infrastructure such as the Hong Kong - Shenzhen Western Corridor and the Lok Ma Chau Spur Line. These involve significant land use implications including large areas of direct landtake for the full road or rail corridor and also a wide range of environmental impacts to the adjacent land.

2.1.7 An important consideration for such major infrastructure is that the choice of location, route and horizontal and vertical alignments etc., are critical issues which may be restricted or determined by external factors (such as the location/position of the connecting infrastructure on the other side of the boundary). It is significant that some of the connection points of the cross-boundary links are within the northwestern New Territories where ecologically sensitive areas such as wetlands and fishponds are located. This can have significant and specific land use implications and also lead to sterilisation of land and/or isolation of land pockets.
2.1.8 A further issue of concern is the large number of trips made by heavy vehicles/container trucks to and from the PRD and the associated emissions. According to the Mainland’s prevailing customs regulations, a container is treated as a dutiable commodity instead of transportation tool. This results in most containers carrying imports into Guangdong being returned empty over the boundary and vice versa. Should there be a change in the Mainland’s customs policy, the container vehicle fleet could be rationalised with reduced number of container trips, resulting in significant reduction of vehicular emissions, alleviating the air quality problem and at the same time traffic noise problems could also be lessened.

2.1.9 In addition, the open storage of empty containers, mostly in the rural land area of the New Territories, has caused nuisance and environmental problems. One possible outcome of a change in the Mainland’s customs policy could be a shift of empty container depots to Guangdong, thus reducing the demand for land for container storage within the Territory.

2.1.10 One important aspect of PRD development (and how this might affect Hong Kong) is that there is no joint planning of development (nature, rate, location etc.) between Hong Kong and the PRD. However, the setting up of various liaison groups, for example the Hong Kong-Guangdong Environmental Protection Liaison Group, has pointed to a positive direction of mutual co-operation.

2.2 Population Growth and Dynamics

2.2.1 The current population of Hong Kong is about 6.8 million people and historically the population has increased by about 1 million people per decade.

2.2.2 In the last TDSR, the significant population growth was expected to continue with population forecasts of about 8.1 million by 2011. However, current information (including the Hong Kong 2001 Census) indicates that the rate of growth has slowed down and it is projected that a population size of about 8.1 million will not be reached until much later.

2.2.3 This slower population growth rate is a critical factor in land use planning and would significantly reduce the land requirements, major infrastructure planning and associated environmental impacts in general.

2.2.4 The population of Hong Kong is becoming more mobile as a result of our increasing socio-economic integration with the Mainland. Increasingly more people are travelling out of the SAR, primarily to the Mainland, and are doing so more frequently. The most significant feature of such a trend is the extended duration of their absence. More and more people are spending a substantial proportion of their time outside of Hong Kong.

2.2.5 The needs and expectations regarding provision of facilities for such a mobile population may well be quite different from those of the population who reside in Hong Kong on a more permanent basis. The size and growth rate of this so called mobile population will be important factors in developing planning strategies particularly over such a long time span as up to the year 2030.
2.2.6 The PRD currently has a population (including transients) of around 30 million. From 1982 to 1996, the average annual population increase was 2.79%, corresponding to an annual increase in population of over 400,000. [1] These increases have also had an effect on the distribution of population density. Historically the periphery of the PRD area had a much lower population density than the inner area, but the growth in areas such as Zhuhai, Shenzhen, Bao'an, Zengcheng, Sanshui and Doumen has increased densities in the outlying areas. The population growth in Shenzhen has some significance to Hong Kong due to its adjacent position.

2.2.7 The actual population increase per annum shows that the east bank of the PRD is growing more rapidly than the west bank. The Shenzhen SEZ has benefited greatly from foreign investment, most notably from Hong Kong, and the abundant employment opportunities there have attracted large number of migrants and also temporary populations. As the Shenzhen SEZ has grown and developed, the surrounding cities/counties, notably Dongguan and Bao'an, have shared in the increase. Significant development has also occurred on the west bank; but greater proximity to Hong Kong and more efficient transportation links on the east side have allowed it to develop more rapidly.

2.2.8 The significance of this population growth and dynamics to the HK2030 SEA study include:

- high population growth rates in the PRD will lead to increased generation of pollution (such as sewage, air pollutants, water pollutants etc.) which may have environmental impacts on the HKSAR;
- higher PRD population and greater mobility will require increased transportation facilities and other facilities required by the visitors while in Hong Kong;
- land in Hong Kong will become even more scarce as the population increases and the existing high population densities will remain or even increase making it even more difficult to address environmental impacts and pollution problems than at present; and
- the lower predicted population growth rate for Hong Kong in the next several decades will however reduce the land requirement when compared with that predicted under the last TDSR. As development pressure to meet the growing population needs will be comparatively lower than previously anticipated, the associated impacts and pollution problems will also be less than previously expected.

2.3 Economic Transformation

2.3.1 Significant economic linkages have developed between the PRD and Hong Kong since 1978. These have resulted from a number of factors including:

- the relocation of predominantly light manufacturing activities from Hong Kong to the PRD where labour and land have been considerably cheaper
- high levels of capital investment from Hong Kong into the PRD
- an increase in the trading activity between the PRD and Hong Kong (as trading and related services have become a larger and dominant share of the Hong Kong economy)
2.3.2 The key drivers behind the relocation of manufacturing industries from Hong Kong to the PRD region have been the comparatively lower labour and rental/land costs offered in the latter. Moreover, other factors such as the designation of the Shenzhen SEZ to attract foreign investment, the proximity of the PRD to Hong Kong combined with the well-developed transport infrastructure has made it easier for Hong Kong manufacturers to relocate to this region. However, the general trend has been to relocate low technology, labour intensive manufacturing processes to the PRD, whilst keeping high value-added processes in Hong Kong.

2.3.3 As a result, the PRD region has experienced significant economic growth in this period, shifting from a predominantly agricultural area to a manufacturing one concentrating on textiles, food processing, footwear and electronic assembly activities. The strength of this growth can be seen in the annual GDP growth rates which were some 14% to 16% between 1978 and 1994.

2.3.4 Up until about 1996, industrial growth in the PRD has centred on low technology labour intensive industries, however, advanced technologies are predicted to grow at a rapid rate over the course of China’s Tenth Five Year Plan (2001 to 2006). Future growth industries include automobile manufacture, petrochemicals and steel in addition to advanced sectors such as biotechnology and information technology. It is expected that by 2005, in Guangdong Province the new and high technology output would occupy about 20% of the total Industrial Output [1].

2.3.5 Historically, agriculture has been the dominant land use in the PRD with intensive grain cropping predominating. In 1982, over 25% of the inner PRD was cultivated land. But since 1996, the PRD region as a whole had lost one third of its farmland to urban encroachment, infrastructure development and serviced or semi-serviced land, with the inner delta seeing the most significant losses.

2.3.6 In response to the increasing urbanisation of the PRD, difficulties with coordination of planning and environmental degradation, in 1988 the Construction Commission of Guangdong Province commissioned a study known as the PRD Urban System Plan (USP) to coordinate the development and modernisation of the province. The plan focused on two aspects: merging cities and countryside into an organic whole and sustainable development.

2.3.7 In the last 10-15 years, Hong Kong's economy has changed from manufacturing and property based to predominantly a service economy. This trend is unlikely to be reversed and the Hong Kong service sector, particularly the travel and tourism industry, is more important than ever.

2.3.8 For years, Hong Kong has maintained the prominent status of being the most frequented destination in Asia. Industry success can be attributed to many factors including the chance for overseas visitors to encounter a culture that embodies both Eastern and Western traditions, a wide variety of top end hotels, culinary delights, quality sale goods, an efficient transportation system, spectacular skyline and the list continues. Yet visitors are concerned about the quality of the environment at the destinations they visit. Unlike most other industries, the travel and tourism industry depends to a significant extent for its success on the quality of the environment. Not only does this include the environment inside establishments that cater to overseas visitors but everything that a visitor is likely to encounter. Therefore, although travel and tourism industry members are not predominantly responsible for creating environmental problems such as air, waste and noise pollution encountered in Hong Kong, ultimately these problems can divert tourists to visit other less polluted destinations.
2.3.9 Hong Kong is perceived by most to be a modern, exciting and culturally enriched city. It is in the best interest of industry members and Hong Kong as a whole to sustain this image. Traditionally, efforts have focused on enhancing economic growth within the industry. However, it is increasingly recognised that the travel and tourism industry is greatly dependent on the quality of a destination's characteristics that include environmental, social and cultural components. Therefore, Hong Kong's many special features need to be protected and enhanced.

2.4 Infrastructure and Transportation Development

2.4.1 Hong Kong is a small region with a high population density and limited available usable land. Its layout including islands, peninsulas and hilly topography has made the provision of infrastructure in general and transportation infrastructure in particular a challenging task. The location and distribution of infrastructures are limited by the natural features, conservation areas and the residential, commercial and industrial developments.

2.4.2 The nature of infrastructural developments ranging from sewerage and water treatment plants, waste treatment and disposal facilities to roads/expressways, railways, bridges, ports and ferry piers etc. means that they create significant impacts to nearby environmentally sensitive receivers.

2.4.3 The further provision of infrastructure to improve current levels and to meet growth in population and increased transportation demands will inevitably exacerbate there impacts and it will therefore be an important consideration in any development strategy and will greatly affect its land use provision and its environmental sustainability.

2.4.4 According to the Port Cargo Forecast 2000/01 and the Port Development Strategy Review 2001, there is a need for further development of container port facilities. The location of these facilities will have significant direct landtake implications (including waterfront land usage), related major land use implications for port back-up, container storage areas and associated road/rail services.

2.4.5 By examining the strategic transport planning studies over the last decade, it is noticeable that the environmental assessment aspects have progressively received greater attention and the recent studies have included a level of assessment which is commensurate with the significance of the land use and environmental issues involved.

2.4.6 The first Railway Development Study conducted in 1993 involved an assessment of proposed alternative railway development strategies for both freight and passenger traffic. Over 90 railway schemes were considered and it only involved a simple environmental appraisal of alternative strategies and ‘broad brush’ noise modelling.

2.4.7 The Freight Transport Study undertaken in 1994 included an SEA of the freight transport strategy for Hong Kong. Two future growth scenarios up to 2011 were made to predict traffic flow. Environmental considerations factored into the main recommendations included overnight parking, container storage and cross border freight issues as well as environmental follow up actions such as the need to tighten the control on vehicle emissions.
2.4.8 The Third Comprehensive Transport Study (CTS-3) completed in 1999 considered four population/traffic growth scenarios with a range of rail, road and traffic management strategic options. Some 99 main computer model runs (with associated environmental components) were conducted for strategy development. The key environmental issues were noise, air quality and ecology. The SEA also examined the environmental constraints on further strategic transport developments to identify where strategic transport development should be avoided.

2.4.9 The Second Railway Development Study (RDS-2) completed in 2000 aimed to develop a preferred rail network that is ‘environmentally acceptable’. To achieve this objective, environmental considerations were included as an important element in all the stages of the study. More than 60 links and alternatives were evaluated. The key environmental considerations were to:

- integrate environmental considerations in development, refinement and selection of strategy;
- promote rail instead of road transportation to reduce potential air and noise problems; and
- eliminate environmentally unacceptable alternatives.

**Implications for HK2030 Study**

2.4.10 As noted above, the extent and detail of environmental consideration in the strategic and planning studies for infrastructure development has increased over the last 10 - 20 years. It is important that this trend is maintained in this HK2030 Study.

2.4.11 In regard to environmental aspects of transportation infrastructure, one of the Government’s stated objectives for better environmental protection is that “transport infrastructure and related services will be provided in an environmentally acceptable manner to ensure the sustainable development of Hong Kong”. [2]

2.4.12 In consideration of new transportation infrastructure, the environmental preference for rail has been clearly identified. For example a review to determine the scope of environmental benefits of implementing rail in preference to road schemes was undertaken as part of the RDS-2 [3] and concluded that the environmental benefits in terms of air pollution, noise control and landtake implications were substantial. Moreover, additional road schemes are likely to be still required as part of an integrated transport system. However, economic/financial and social concerns should also be taken into account in the consideration of new projects.

2.4.13 In addition, the RDS-2 included a principle that for new railway development, consideration of an underground railway option should be the ‘base case’ and other options such as at-grade or elevated should only be considered after the underground option has been explored.
2.5 Environmental Concerns and Aspirations

**Introduction**

2.5.1 There has been a significant growth in public and other stakeholders' environmental awareness across the world over the last few decades. This has been particularly the case in developed countries. Hong Kong has experienced a similar growth in awareness but this has mainly occurred in the last 10-15 years.

2.5.2 This increased awareness is important in that in conjunction with other factors and events it has led to increased environmental concerns and in some cases heightened expectancy and aspirations in terms of better environmental quality by the public. In turn this has, via various mechanisms, led to greater requirements on organisations, Government and private sector companies to improve environmental performance. Some other factors are discussed below.

2.5.3 **Pollution Incidents** - Other significant events have been the occurrence of a series of major pollution incidents around the world and the often costly and difficult clean up operations that followed. These incidents received a high level of media interest and coverage and increased public concerns. Examples of such incidents include:

- **Seveso (Italy 1976)** - An explosion and fire at a chemical plant leading to dioxin contamination of the local area.
- **Bhopal (India 1980)** - An explosion at a Union Carbide manufacturing plant leading to significant chemical exposure to the local population.
- **Chernobyl (the then USSR 1984)** - A nuclear plant accident causing radioactive contamination of the local area and elevated radiation levels in Europe and in many countries worldwide.
- **Sandoz (Basle – Switzerland 1986)** - A chemical warehouse fire leading to toxic chemicals being flushed into the Rhine and causing environmental damage.
- **Exxon Valdez (1989)** - An oil tanker accident leading to crude oil spillage in the pristine environment of the Arctic.

2.5.4 **Access to Information** - A further contributor to environmental awareness and concerns has been the growth in the environmental journalism field that has both helped create and also responded to growing environmental awareness. There has been much greater access to environmental information due to greater public consultation and the advent of corporate (and Government) environmental reporting. The availability and common usage of the World Wide Web has also made information more easily available.

2.5.5 **Political Recognition** - The popularity and increased influence of the non-governmental bodies and so called 'Green Groups' such as Green Peace, World Wide Fund for Nature, Friends of the Earth, Action Asia etc. have had effects on increasing environmental awareness at both political and grass roots levels. In addition political success of environmental orientated political groups such as the Green Party in Germany during the 1980s and the fact that many main stream political parties now have an environmental post and spokesperson etc., have raised environmental awareness and the environment is also now accepted as a main item on business agendas.
Precautionary Principle - A principle for guiding human activities, to prevent harm to the environment and to human health, has emerged during the past 10-20 years. It is called the "principle of precautionary action" or the "precautionary principle" [47] for short. The most broadly accepted definition of the precautionary principle is Principle #15 of the June, 1992, Declaration of the Rio Conference on Environment and Development (The Earth Summit):

"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

Some international examples of the application of a Precautionary Principle which would be relevant to Hong Kong are given in The Precautionary Principle In Action - A Handbook [48].

There include the actions of the International Joint Commission, a 100 year old bi-national (between Canada and the United States) body formed to protect water quality in the Great Lakes. The IJC noted damage caused by persistent and bioaccumulative substances in the Great Lakes and that attempts to control them using the concept of assimilative capacity had failed. The IJC issued a call to phase out all persistent toxic substances in the Great Lake Ecosystem and stated:

"Such a strategy should recognize that all persistent toxic substances are dangerous to the environment, deleterious to the human condition, and can no longer be tolerated in the ecosystem, whether or not unassailable scientific proof of acute or chronic damage is universally accepted."

The principle is also mentioned in the conclusions of the first (European) North Sea Conference in 1984, and the second North Sea Conference Ministerial Declaration states in 1987:

"Accepting that, in order to protect the North Sea from possible damaging effects of the most dangerous substances, a precautionary approach is necessary which may require action to control inputs of such substances even before a causal link has been established by absolutely clear evidence."

Moreover, the principle is mentioned in a number of other regional and global treaties, conventions and declarations, for instance the Bergen Declaration, the Rio Declaration, the Montreal Protocol, the Biological Diversity Convention and the Climate Convention. In addition, article 130R of the Maastricht Treaty emphasises that EU environmental policy is based on the precautionary principle:

"Community policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Community. It shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source, and the polluter should pay."

The benefits of this approach include the fact that it involves prevention rather than cure and provides a contingency or safety margin to areas such as exposure to toxic chemicals. The difficulties are that it can be hard to justify in quantitative terms.
2.5.11 **Sustainable Development** – Sustainable Development is a common goal being pursued in many countries. Knowledge of what Sustainable Development is and its importance is growing all the time. This growth in awareness leads to a desire by many stakeholders to see implementation of appropriate measures which are consistent with sustainable development principles.

**Agenda 21**

2.5.12 Agenda 21 is a comprehensive programme of action adopted by 182 governments at the United Nations Conference on Environment and Development (UNCED), the Earth summit [45]. It provides a blueprint for securing the sustainable future of the planet, from now into the twenty-first century. It is the first document of its kind to achieve widespread international agreement, reflecting a global consensus and political commitment at the highest level.

2.5.13 The Agenda is grouped around a series of themes, comprising 40 chapters and 115 separate programme areas, each of which represents an important dimension of an overall strategy for global transition to more sustainable development practices. The chapters build up a comprehensive list of actions. These actions address the issues of environmental protection and human development in an integrated manner and include incentives and concrete measures to reduce the inequalities between rich and poor nations, stimulate the economies of developing countries, eliminate poverty, reduce use of earth's natural resources, and reduce the unsustainable rates of population growth that threaten both development and the environment.

2.5.14 The broad programme of action was adopted by all 182 countries attending the meeting. While not legally binding, Agenda 21 has moral and practical forces as it was negotiated and agreed by Government representatives.

2.5.15 Agenda 21 has been taken up by countries, (who have produced a National Agenda 21 Report) and industries such as the Travel and Tourism Industry (who have also produced an Agenda 21 Report) [45]. Many cities have also formulated their own Local Agenda 21 to take on board actions appropriate to their local circumstances.

**Local Situation**

2.5.16 Hong Kong has mirrored the developments of awareness and concerns in the rest of the world. It has a growing environmental related industry (for example in environmental consultancy, mitigation design and manufacture and construction), has active chapters of the main Green Groups (and some of its own such as the Conservancy Association and the Green Lantau Association), has created environmental institutes (such as the Hong Kong Institute of Environmental Impact Assessment) and has environmental Diploma, Bachelor's Degree and Master's Degree courses at local universities as well as environmental courses in schools. Hong Kong also has comprehensive environmental protection measures and pollution control legislation backed up by strong enforcement and complaints mechanisms administered by the Environmental Protection Department.

2.5.17 Further significant local developments which have raised environmental knowledge and awareness include the inclusion of environmentally friendly measures in major planning and development studies and increased (and now statutory requirement for) public consultation of EIA Study Reports and the requirement for Government Departments to prepare environmental reports.
2.5.18 This has focussed attention on Government’s plans and proposals and the transparency of the Environmental Impact Assessment Ordinance (EIAO) process means that the public has a greater say in the development process than before. For HK2030 Study, the extensive programme of public consultation will enable the public’s views to be addressed and integrated into the planning process where appropriate.

2.5.19 **Aspirations** - Heightened awareness of environmental issues and concerns regarding possible deleterious effects on health and to the environment will often lead to a greater desire and even expectancy for a better quality environment from many levels of society including the general public. This is particularly evident with the growing affluence of the local community, hence increasing attention on issues such as quality of life (including environment). Key events occurred in Hong Kong that received a high level of media interest and coverage and increased public concerns include the outbreak of SARS and Avian Flu, public sentiment to further reclaiming the Harbour, air pollution problems, red tides and Lantau and Sai Kung Stream events, etc.

**HK2030 Context**

2.5.20 The growth in the public and other stakeholders’ environmental awareness, sensitivity and expectancy has implications for the Main Study in general and the SEA in particular. A desire for a higher quality of life needs to be recognised and could be considered as a ‘driver’ to promote options which are environmentally favourable.

2.5.21 Current expectations are that the limits set in regulations and legislative standards should be met on a territory wide basis as a minimum and that these might not be stringent enough at present in any case. There is also a view that even more stringent requirements for environmental standards and performance will be the norm in the future. This view is based on many factors such as the historical trend for increasing stringency, expectations that international countries (particularly those with world class cities) will raise their standards over the next 3 decades.

2.5.22 The consequence of this is that in order to achieve public acceptance and approval the HK2030 Study will need to demonstrate that environmental issues have been fully considered, given due weight in any decisions, integrated into Development Options and Strategies and that the eventual strategy is flexible enough to enable future improvements and stricter requirements to be incorporated.

2.5.23 For the HK2030 Study it is apparent that the general public will expect a better living environment, cleaner air, less congestion, less noise generated by traffic, more recreational facilities, no or at least minimised interfaces with those undesirable uses (PHIs, waste facilities etc.). How to deliver these expectations is a key challenge. The public fora and debates are helpful in identifying the concerns and challenges of planning and can lead to integration of public suggestions, at a macro level, into the process. Many of the issues raised at such events however are for the micro planning rather than strategic level - it is nevertheless useful to build in innovative ideas at an early stage to prevent potential damage to the environment. Application of a Precautionary Principle would give the benefit of any doubt to the environment in appropriate circumstances.
3. Environmental Aspects and Key Issues

3.1 Introduction

3.1.1 The influencing factors discussed in Section 2 are likely to have a major impact on environmental conditions in future. The critical problems facing Hong Kong’s environment and the major issues of concern expressed by the general public include those pertaining to pollution problems as well as the adverse impacts of urban expansion on our natural environment and valuable heritage and landscape resources.

3.2 Ecological Conservation

3.2.1 The Second Review of the White Paper "Pollution in Hong Kong - A Time to Act" [43] published in 1993 states the objectives for nature conservation are:
- protecting the existing conservation sites;
- identifying new areas for conservation; and
- compensating for areas which merit conservation but are unavoidably lost to essential development projects.

3.2.2 In relation to the planning process, implementation of this policy occurs via two existing mechanisms. Ecologically important sites are conserved through statutory designation/zonings such as Country Parks, SSSIs, Marine Reserves and Parks, Special Areas, Conservation Areas, Green Belts etc., or through consideration of planning applications (Section 16 and Rezoning Requests) on a case by case basis. Avoidance, minimization and compensation for potential ecological impacts or loss are dealt with in Environmental Reviews, Assessments and Controls undertaken in the planning application or via the EIAO and its associated Technical Memorandum.

3.2.3 The latest review of the policy (4th Review) published in 1998 [44] states that "our conservation policy should strike a balance between the need for development and the needs of the natural environment, to ensure that development is sustainable". Further actions listed in this latest review include:
- to continue to participate actively in international fora with a view to fostering regional co-operation in fisheries management and conservation;
- to formulate a fisheries conservation strategy;
- to invest some $100 million over five years on the development of artificial reefs at marine parks and at sites of special importance to local fisheries;
- to increase penalties for conducting destructive fishing practices;
- to better understand local biota through surveys on biodiversity of corals and reef fish and study on the Chinese White Dolphin;
- to enhance conservation management of the Mai Po/Inner Deep Bay Ramsar site; and
• to identify more sites for designation as country parks, marine parks and marine reserves.

3.2.4 It is considered that any future blueprint for environmental improvement should be compliant with Agenda 21 [45] as this provides the policy framework for global sustainable development. Chapters 10 on Land Resources and 15 on Biological Diversity of Agenda 21 are particularly relevant to ecological conservation.

3.2.5 The key issues regarding ecological conservation include:
• identifying conservation measures for different ecologically important sites and the level of protection required for the ecological resources;
• determining the prioritisation of the protection;
• protecting privately owned land with ecological importance (although it should be appreciated that this only represents a small percentage of the total); and
• recognising the dichotomy of the urban development versus nature conservation and developing mechanisms to overcome such dichotomy.

3.2.6 The Government is currently reviewing the nature conservation policy which is expected to be released for public consultation within this year.

3.3 Cultural Heritage Conservation

Introduction

3.3.1 Our cultural heritage resource is a strength and provides many opportunities but, at the same time, it is a strength under threat. There is no doubt that in many cases heritage resources have been seen as constraints on development. It is imperative that, in planning for the future, heritage should be viewed as an affordable constraint that can be easily and profitably transformed into an opportunity with expert input and guidance.

HK2030 Context

3.3.2 A number of issues can be identified arising from the present approach to heritage conservation within the planning process. They include the following:

3.3.3 The lack of a broad policy framework for heritage conservation handicaps the attempts to integrate heritage conservation into Hong Kong’s future planning strategy. Current policies exist only as in-house tools, for example within the AMO, PlanD and the URA. In addition, there is no effective mechanism to enforce heritage conservation other than statutory declared monuments; and no government organisation has sufficient statutory and hierarchical authority to effectively plan, oversee and carry out heritage conservation work.

3.3.4 At present, selected sites of heritage value are highlighted in the Explanatory Statements attached to town plans. They are meant to assist in understanding of the plan and to reflect planning intention. However, identification of heritage resources is not exhaustive and no specific zoning yet exists tailored for heritage needs.
3.3.5 Another major issue is that current conservation mechanisms are only applied to individual historical buildings or sites. A new policy framework will be needed to ensure a holistic approach for area-wide preservation. In terms of land use planning, a new designation of *Special Design Area* (proposed in previous consideration of amendments to the Town Planning Ordinance) could be effective for conservation of urban assemblages with historical buildings set in an area of local character. However, additional zoning tools are required for the conservation of heritage resources and adequate information should be attached to the zoning to reflect the respective character of the resources: for example, sites of archaeological value, areas of rural character and traditional landscape value and remnants of early industries. Such zoning should ensure that development of any kind requires permission of a designated authority and/or the Town Planning Board. It should also emphasize that preservation and on-going conservation of such heritage sites is a priority objective.

3.3.6 The effectiveness of such planning tools will be dependent on whether a comprehensive inventory of heritage resources is available, and the identification and prioritisation of these resources will be problematic which means addressing such issues as what to conserve.

3.3.7 There is hence a need for a clear statement of what constitutes the heritage to be conserved. Many types of valuable heritage resources are not included in present working definitions. Heritage may be defined to include more than outstanding historical buildings and archaeological sites; resources as varied as assemblages of minor village structures; rural landscapes modified by centuries of human activities; and urban neighbourhoods housing traditional crafts and enterprises in early to mid 20th century buildings may constitute heritage that are deserving conservation.

3.3.8 A large majority of heritage resources in Hong Kong, both built heritage and archaeological sites, have not been ranked in terms of their significance. This means that the degree to which a resource poses a constraint on planning decisions is not clear. At present, as each individual case arises, it is necessary to liaise with the AMO to clarify their position on preservation, removal, reuse etc. Moreover, the lack of official recognition may lead to many valuable historical or cultural sites/buildings in private hands being left in a state of deterioration due to inadequate maintenance.

3.3.9 The Government is currently reviewing the policy and framework on heritage conservation.

3.3.10 Upon determining the value of resources and their priorities, there is a need for proposing sustainable development indicators to measure the loss and gain of heritage capital due to the following reasons:

- The CASET indicators of heritage sustainability as developed for SUSDEV 21 could benefit from further expansion; the current indicators only include two categories of cultural heritage: archaeological sites and historical buildings and structures. Additional heritage resources of local importance might also include cultural landscape features such as fung shui woodlands and ponds, traditional field patterns, pre-war clan graves, boulder paths and terraces; and remnants of early industries such as sauce and oil factories, salt pans and oyster cultivation.

- The CASET indicators which only show the number of recorded sites are unable to reflect the nature of the sites, their rarity, typicality, condition, the quality of their surroundings, public accessibility and other important criteria.
3.3.11 The need for a focussed policy for cultural heritage tourism arises from the following factors:

- One of the planning objectives of HK2030 Study is to promote tourism to ensure that Hong Kong will continue to be the major tourist destination in the region. Heritage is seen as a source of potential tourist attractions. It must be acknowledged, however, that cultural heritage is a valuable but often fragile tourism resource and that it requires special treatment within Hong Kong’s broad tourism strategy.

- Many heritage resources with display and re-use potential have not been recognised. The adaptive re-use of cultural heritage should focus on promotion of cultural heritage tourism and re-use of preserved heritage resources under urban renewal and new development for recreation, community, educational or tourism purposes. The concept of brownfield sites can also be applied in heritage conservation to tackle the current problems in adaptive re-use of heritage resources.

- A policy is needed which makes reference to many successful international heritage tourism schemes and adapted to local circumstances. For example, including heritage tourism in planning schemes for the harbour along the lines of successful programmes in Sydney, Vancouver and Barcelona; maximising historical neighbourhoods which retain isolated historical buildings in updated community contexts, within new Special Design Areas, as seen in New York, Berlin and Shanghai; and turning old industrial complexes into vital and interesting cultural heritage centres like living history farms in the USA, mining centres in Burra, South Australia and pottery works in Stoke on Trent, UK.

3.4 Landscape Planning and Conservation

3.4.1 Conserving the natural landscape is one of the key planning objectives of HK2030 so as to provide a quality living environment for Hong Kong. Only one-fifth of Hong Kong’s total land has been developed, with the remainder as undeveloped countryside. Hong Kong’s countryside comprises regionally important landscape resources, such as secondary woodland, shrubland, grassland, mangrove, farmland, streams and ponds etc. It also provides recreational, educational and eco-tourism opportunities. However, due to the growing population, new town development and new infrastructure projects, this remaining countryside is under pressure.

3.4.2 Key observations are:

- conflicts between urban development and conservation of natural landscape resources;
- limited integration between built-up area with natural landscape;
- insufficient provision of urban landscape enhancement; and
- lack of efficient landscape conservation mechanisms.
Integrated Urban and Rural Environments

3.4.3 According to the Draft Technical Report No. 1 of the “Study on Landscape Value Mapping of Hong Kong” (ongoing) prepared by the Consultants of the Planning Department, Hong Kong’s landscape character can be generally divided into three types of regional landscape character types (LCTs): “Countryside”, “Development” and “Coasts”. Within the “Development” LCT, two sub-regional LCTs have been identified, namely “Urban Fringe” and “Rural Fringe”. These particular areas are the interface between the urban and rural LCTs and where the pressure for urban development is affecting landscapes with conservation and heritage value.

3.4.4 Most of the urban fringes have a low landscape quality, usually owing to non-compliant land uses. Temporary container storage, warehouses and workshops are often found adjacent to filled fishponds and agricultural lands particularly near Yuen Long, Kam Tin, Tai Po and Fanling. In terms of landscape quality, these temporary uses are leading to the fragmentation and degradation of the rural fringe scenic qualities and also disturb those landscape resources with high heritage and natural conservation value.

3.4.5 In provision of the cross-boundary infrastructure and the local transportation needs, numerous infrastructure projects are being planned and implemented. They have significant landscape and visual impacts upon the existing landscape character. Bridges, highways, junctions, viaducts and associated slope works are built through Hong Kong’s countryside and along the coastlines. There are mechanisms that analyse the acceptability of the development to the existing environment under the EIARO and ACABAS, however it is often difficult to determine the level of impact or acceptability, while such developments are typically function-driven projects. There is also a problem of how urban structures integrate with the natural landscape. The Study on Landscape Value Mapping of Hong Kong should be able to provide clearer yardsticks and principles for better integration.

Provision of Landscape Enhancement

3.4.6 In provision of landscape planning guidelines, Chapter 10 (Conservation) of the HKPSG has provided a comprehensive treatment of the conservation of natural landscapes and habitats as well as historic buildings, archaeological sites and other antiquities. It suggests that conservation not only applies to individual items but also their wider urban and rural setting. The environment of historical buildings should be integrated with the surrounding developments through sensitive design. Furthermore, Chapter 4 of the HKPSG has recently been expanded to incorporate planning guidelines on greening and retitled to “Recreation, Open Space & Greening”. It is stipulated that concerted efforts should be made to incorporate as many greening opportunities as possible during the early stage of planning new development / redevelopment areas and infrastructure projects.

3.4.7 Although there are comprehensive landscape planning guidelines, fragmentation of urban landscape character frequently occurs owing to implementation problems and insufficient communication between different conservation authorities.

Landscape Conservation Strategy

3.4.8 Many worldwide landscape conservation strategies have been made to protect or enhance landscape resources. For example, London is formulating a new biodiversity strategy to integrate natural and urban areas for the benefit of local residents and wildlife.
3.4.9 Examples of international Landscape Conservation Strategies and their key objectives are listed below:

<table>
<thead>
<tr>
<th>Title</th>
<th>Objectives</th>
</tr>
</thead>
</table>
| *Pan-European Biological and Landscape Diversity Strategy (1995)*   | • Conservation, enhancement and restoration of key ecosystems, habitats, species and landscape features through the creation and effective management of the Pan-European Ecological Network.  
• Sustainable management and use of the positive potential of Europe's biological and landscape diversity through making optimum use of the social and economic opportunities on a national and regional level.  
• Integration of biological and landscape diversity conservation and sustainable use objectives into all sectors managing or affecting such diversity. Improved information on and awareness of biological and landscape diversity issues, and increased public participation in actions to conserve and enhance such diversity.  
• Improved understanding of the state of Europe's biological and landscape diversity and the processes that render them sustainable.  
• Assurance of adequate financial means to implement the Strategy. |
| *Benelux Convention on Nature Conservation and Landscape Protection (8 June 1982)* | • To preserve nature, natural areas and the landscapes, especially in boundary regions. |

3.4.10 Common objectives of these landscape conservation strategies listed above are:

• the conservation of landscape features; and
• the sustainable use of landscape resources.

3.4.11 In Hong Kong, a number of Government departments are involved in one way or another in landscape aspects. Without an effective mechanism to co-ordinate all the efforts from the public sector as well as private sector in improving the quality of our living environment, the outcome could be seen as piecemeal.

**Landscape Conservation Policy / Management**

3.4.12 In many countries, as in Hong Kong, landscapes are also protected by a land use planning system. However, the land use planning system does not cover all areas or govern all activities which potentially influence or damage landscape values and visual qualities.

3.4.13 In addition to the land use planning control, the Environmental Impact Assessment Ordinance provides legislative tools to require certain proposed developments to follow statutory EIA process before approval is given for their construction and operation. Landscape impact would be one of the environmental aspects for consideration under the EIAO.
3.4.14 However, the current policies tend to be made only for preventing any adverse impacts on landscape values. No policy has been formulated to encourage development which is of benefit to the existing landscape values. An international example of this is in New Zealand where relief on land tax is successfully encouraging those developments which are beneficial to the landscape. Similar policies or ‘drivers’ may be considered for Hong Kong.

3.5 Air Quality

Introduction

3.5.1 The general perception of Hong Kong people is that air quality is a key environmental issue. The introduction of the Air Pollution Index (API) has given the general public access to statistics which indicate the quality of the air at various locations around Hong Kong on an hourly basis. This information has been taken by researchers and journalists and translated into statistics or trends showing the relationship between health and air quality (from numbers of hospital admissions etc.).

3.5.2 The reasons for the perceived deterioration in air quality may be related to emissions from trans-boundary sources (industrial pollution and vehicle emissions, etc.) as well as locally from vehicle emissions (NOx and RSP) and construction works (TSP/RSP). The recently published PRD Air Quality Study also identified power stations as being a major contributor to poor regional air quality (along with vehicles and industrial sources).

Health Effects of Air Pollution in Hong Kong

3.5.3 Since the late 1980s, a number of studies have been carried out by different research groups on the air pollution and health problems in Hong Kong.

3.5.4 A study concluded that significant associations were found between hospital admissions for all respiratory diseases, all cardiovascular diseases, and chronic obstructive pulmonary diseases and heart failure in 1994-5.1

3.5.5 Another study was carried out to assess the effects of four air pollutants on daily death counts between 1995-1997 for all non-accidental causes, cardiovascular and respiratory diseases.2 During the cool season, all oxidant pollutants (NO2, SO2 and ozone) were associated with all daily mortality outcomes in a dose-dependent manner, with the exception of SO2 on respiratory mortality. PM10 was marginally related to respiratory mortality but not for other outcomes.

3.5.6 Table 3.1 shows the percentage increase in adverse health effects with each 10 μg/m³ increase in PM10 level. The magnitude of increase in health care utilisation in Hong Kong for each 10 μg/m³ increase in PM10 is similar to those reported in other countries.
Table 3.1 Percentage Increase in Adverse Health Effect with Each 10 μg/m³ Increase in PM$_{10}$

<table>
<thead>
<tr>
<th>Health effect</th>
<th>% increase in various studies</th>
<th>% increase in Hong Kong</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory symptoms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td>1.2</td>
<td>NA</td>
</tr>
<tr>
<td>LRT symptoms</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>URT symptoms</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Asthma attack</td>
<td>3.0</td>
<td>NA</td>
</tr>
<tr>
<td>Bronchodilator use</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>Health care utilization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All respiratory disease admissions</td>
<td>0.8</td>
<td>1.6</td>
</tr>
<tr>
<td>Asthma admissions</td>
<td>1.9</td>
<td>1.5</td>
</tr>
<tr>
<td>A and E visits for asthma</td>
<td>1.0</td>
<td>NA</td>
</tr>
<tr>
<td>Cardiovascular admission</td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td>Mortality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total mortality</td>
<td>1.0</td>
<td>2</td>
</tr>
<tr>
<td>Respiratory mortality</td>
<td>3.4</td>
<td>5</td>
</tr>
<tr>
<td>Cardiovascular mortality</td>
<td>1.4</td>
<td>2</td>
</tr>
</tbody>
</table>

LRT = lower respiratory tract; URT = upper respiratory tract; A and E = Accident and Emergency.
NA = Not Available.

Mortality refers to loss of life expectancy due to exposure to air pollution.


Industrial Emissions

3.5.7 Air pollution problems in Hong Kong have changed as its economy has changed. In the 1980s, the biggest concern was sulphur dioxide from factory chimneys, which were often located near residential buildings. Regulations introduced in 1990 to reduce sulphur content in fuel, combined with a reduction in industrial activity, resulted in a dramatic overnight plunge in sulphur dioxide levels which can be shown in the monitoring results presented by EPD. [8]

Ozone Emission

3.5.8 Concentrations of ozone are on a steadily increasing trend. Average concentrations have increased by 44% since 1991. To reduce ozone and photochemical smog, it is necessary to reduce the emissions of NOx and VOC both in Hong Kong and Guangdong. [6]

Greenhouse Gas Emission

3.5.9 In 1994, a reduction in greenhouse gases (GHG) was observed as a result of the commissioning of the Daya Bay Power Station. The use of natural gas for electricity generation in the Black Point Power Station and the migration of manufacturing industries out of Hong Kong have further reduced the emissions since 1996. However, in view of the expanding population and growing economic activities, it was projected that the GHG emissions would increase again from 2000 onward upon the projected increases in energy consumption through demand for power generation and increased total transport. This needs to be carefully considered in the overall context of the air quality issues.
3.5.10 Importantly from a global perspective is the release of carbon dioxide, methane and nitrous and other GHG as emissions from power production. Their accumulation in the atmosphere contributes to the greenhouse effect and poses a threat to the functioning of natural systems in the future. Estimates indicate that if energy consumption continues to increase at the existing levels, projected GHG emissions for year 2010 are expected to increase by 40% from 2000 level.

**Power Plant Emission**

3.5.11 Fossil fuel combustion, particularly coal and oil fractions, results in the release of particulates, sulphur, nitrogen and carbon dioxide. Combustion of diesel and coal contributes to ground-level ozone due to emissions of NOx. Ozone in particular decreases lung function, and can increase the susceptibility of vegetation to disease, insect attack and other pollutants.

3.5.12 Power plants are the dominant source types for SO$_2$ and NO$_2$. Power plant emissions which are expected to support increases in population and economic growth, are projected to increase up to 43% for SO$_2$ and 78% for NO$_2$ between 1997 to 2015 according to the Study of Air Quality in the Pearl River Delta Region [41].

3.5.13 Coal combustion waste (CCW) is largely made up of ash and other unburned materials. Further combustion wastes are generated by other processes necessary to operate power plants, including cleaning the steam boilers. Most of these other wastes are liquid and are mixed with the solid ash wastes for disposal. In addition, air pollution control devices installed to reduce SO$_2$ create large volumes of solid waste. This waste requires disposal, unless it can be used in construction to make materials such as cement, wallboard or as fill.

**Vehicle Emissions**

3.5.14 In the 1990s, vehicle emissions were highlighted as the key concern, reflecting the move away from manufacturing to a service economy. More vehicles were road based, especially diesel vehicles which include everything from taxis and vans to buses and heavy trucks. With the mix of rail and road based transport strategies, some improvements can still be made in air quality.

3.5.15 In 2000, 60% of total vehicle kilometres travelled in Hong Kong were undertaken by diesel vehicles. Diesel vehicles emit RSP and NO$_2$ which are linked to health problems and smog. Levels of these pollutants increased during the last decade and in some places exceeded the relevant air quality objectives under the Air Pollution Control Ordinance. [8] Vehicle emissions has caused street level pollution particularly at the narrow streets in the dense urban areas (canyon effect).

3.5.16 To tackle the problem, the Government has been implementing a comprehensive programme to reduce motor vehicle emissions through the introduction of stringent vehicle emission and fuel standards, retrofitting in-use diesel vehicles with particulate removal devices, enforcing and promoting better vehicle maintenance, and replacing in-use diesel vehicles with cleaner alternatives where practicable. These measures have taken effect in improving street level air quality but further actions will need to be taken to improve the ambient air quality. Aggressive measures to combat smog were introduced in 2000, which included reduction in the reliance on diesel, by converting to LPG. From 2001 all new taxis must run on LPG, and diesel taxis are to be completely phased out in five years. There are also on the spot fines for smoky vehicles. This has improved the quality of the air in
urban areas, however, air quality remains variable.

3.5.17 The issue of increased cross-boundary traffic flows as discussed in Section 2 above will also be a major concern.

Marine Vessel Emission

3.5.18 Marine vessel emissions are not significant contributors in the transportation sector. Based on the CTS-3’s estimation and the Hong Kong Port Cargo Forecast, the activities of marine traffic, except for domestic ferry, are expected to grow by 47-151% in the period from 1997-2015 while the domestic ferry contribution is predicted to decrease by 15%.

Regional Pollutant Emissions

3.5.19 According to the Study of Air Quality in the PRD Region, a regional air quality problem exists and air quality in the region will deteriorate due to the increase of electricity generation, industrial emissions and motor vehicle activities, unless additional improvement measures are implemented. The emissions of regional pollutants are expected to increase from 1997 to 2015, unless additional improvement measures are implemented, by 25% to 53% even with many control measures currently committed to by both the Guangdong Government and the HKSAR Government. In order to improve regional air quality from existing levels, it is necessary to implement additional control measures with a view to reducing emissions from major polluting sources in the PRD region including the energy sector, industries, motor vehicles and VOC containing consumer products. It is expected that, with the implementation of a combination of control measures, the current air quality objectives could be largely met by 2010 at the earliest. In addition, a Regional Air Quality Management Plan is recommended to be developed and implemented under a joint cooperative effort between both governments to ensure continued improvement in regional air quality.

Aspirations for Higher Standards

3.5.20 It is noted that pollution problems from motor vehicles have been reduced significantly in recent years as a result of the Government’s effort to control emissions. Nonetheless, there would exist a need to further tighten the air quality standards taking into account international standards and the community’s aspirations for better health and well-being.

3.6 Noise

Introduction

3.6.1 Noise pollution has long been a problem in Hong Kong. According to EPD’s estimates, about one million of the population are exposed to excessive noise levels, and it is mainly due to traffic noise from existing roads. Relocating the Hong Kong International Airport relieved some 380,000 people from the aircraft noise nuisance. The SUSDEV21 Study revealed that approximately 435,000 people have been living within 300m of existing cargo handling areas, industrial areas, and transport terminals, according to six different survey activities conducted for the Study. Among them, about 60,000 people would be exposed to a higher cumulative noise level due to the presence of other nearby sources. A Consultancy Study on Monitoring of Non-transport Related Noise Pollution has been recently commissioned in order to update the database on non-transport related noise.
condition in Hong Kong.

**Transportation Noise**

3.6.2 With the rapid economic development of the PRD and the Mainland’s entry to the WTO, a further boost in the already increasing trend of interactions between the HKSAR and the PRD is expected. The movement of goods and people will intensify the need for provision of adequate transportation infrastructure to cope with the huge demand for cross-boundary traffic.

**Road Traffic Noise**

3.6.3 The increasing cross-boundary movement of goods and people will increase the traffic noise pollution to those inhabitants who live close to the existing and future road corridors of the strategic cross-boundary road network, and those close to local roads linking to the strategic road network along the existing road routes. For new development areas, there are opportunities for noise mitigation and reduction through better planning of different hierarchy of roads, undergrounding major roads, provision of mitigation at source, and protecting noise sensitive uses by non-sensitive uses.

3.6.4 As the HKSAR's population continues to grow, there will be a pressing need for more residential land. This is likely to (but not necessarily) intensify the high urban population density problems thus potentially further increasing the population subject to excessive traffic noise. For existing urban areas, there are not many immediate solutions available regarding noise reduction. It is particularly problematic where flyovers pass through high-rise residential neighbourhoods. Comprehensive urban renewal may help in some areas but is not generally an effective way to address the problem due to the constraints imposed by the dense urban environment and the small size of lots. The retrofitting programme may be able to address the traffic noise issues in some cases, although it is not an ideal tool as most urban roads are not suitable for retrofitting.

3.6.5 It is important that the planning and design for future additional strategic road networks, new town areas and urban redevelopment projects need to recognize road traffic noise as a key issue.

**Rail Traffic Noise**

3.6.6 Railways currently account for over one-third of domestic public transport, and around 90% of the public transport of the land-based cross-boundary travels. According to KCRC’s statistics [11], there is an average of 250,000 crossings daily via Lo Wu, reaching 300,000 during festival holidays peak. Intercity train services are currently available for destinations to several major cities in Mainland, such as Beijing; Shanghai; Dongguan (Changping), Guangzhou East, Foshan and Zhaoqing in the PRD. Other than the current intercity train services operated by KCRC, the HKSAR Government has revealed an intention to develop a regional high-speed railway. The express railway could reduce the travel time between the HKSAR and Guangzhou to about an hour.

3.6.7 A continuous growth in cross-boundary travels will increase the demand for more frequent train services. Should a 24-hour opening of the boundary be realistic, this will intensify a need for extending the train services after midnight hours. The increase in cross-boundary railway services will increase the noise exposure of the population residing along the railway corridors. This implies additional noise mitigation measures will need to be implemented along the existing railway lines.
and those under construction. In order to achieve compliance with the night time noise criteria of the Noise Control Ordinance, it will be a new technical challenge in noise and vibration control.

3.6.8 The MTR system may need to expand to cope with the demands of economic growth and increase in population, implying more underground railway lines. It is anticipated that the traffic noise pollution will reduce if more underground railway systems are being introduced to reduce the demand for the transport mode by motor vehicles. But other concerns of undergrounding, such as costs and disposal of excavated materials etc., will need to be addressed.

Aviation Noise

3.6.9 Aircraft noise nuisance was reduced significantly after the Hong Kong Kai Tak International Airport moved to Chek Lap Kok in 1998. EPD and CAD estimated that the population affected by aircraft noise was reduced dramatically from 380,000 to 200 as a result of the relocation. According to CAD's figures, the annual total aircraft movements at the Hong Kong International Airport have been growing during the last decade. For example, it was 165,154 in 1997, 181,927 in 2000, 196,833 in 2001 and 206,705 in 2002. A continuous growth in the usage of the Airport and in the population implies a potential increase in population exposed to excessive aircraft noise in the future. The situation would be further exacerbated if an aircraft noise limit more stringent than the NEF25 is considered necessary to meet rising expectation for a better quality of life.

Noise from Industrial and Commercial Activities

3.6.10 Factories and commercial operators (e.g. restaurants) generate noise, often from their ventilation systems. This type of noise is strictly controlled under the Noise Control Ordinance, and it has been controlled effectively by EPD serving Noise Abatement Notices to the offenders. With the transformation of the HKSAR to a service-oriented, high-technology and knowledge-based economy, factories have transferred their manufacturing bases to lower cost centres in the Mainland and this trend is likely to continue (and at least not reverse) thus industrial noise (from manufacturing sources) should not be as significant an issue in the future. Should the HKSAR become a leading logistics hub in Asia, the population living close to the existing container ports, cargo handling areas and transport terminals could be subject to a higher noise level due to the increase in cargo handling activities.

Construction Noise

3.6.11 Construction noise problems will continue as long as developments are required. The geographic locations of most of the construction noise complaints will be at rural areas of the New Territories. It is expected that the extent of the problem will be less severe than in the past due to the increasing environmental awareness of the society, noisy construction methods will be minimised and gradually phased out. The future methods and equipment will be those that are much quieter and advanced construction methods and equipment will be selected in order to minimise the environmental impact.

Issues

3.6.12 No perfect solution is available to tackle noise problem as it involves many different sources and factors. Noise usually cannot be eliminated, only contained or moved out of earshot. The removal of the old Kai Tak airport to relatively isolated Chek Lap Kok has successfully relieved some 380,000 people from the aircraft noise...
nuisance, roads and buildings however cannot be moved so easily. While the Noise Control Ordinance applies largely to stationary sources and construction sites, a different approach is needed to address traffic noise. It is important to note that once a busy road has been built next to a residential building, or vice versa, it would be very difficult to solve the noise problem.

3.7 Water Quality

Introduction

3.7.1 Both the river water quality and bathing water quality have been improving over recent years. With the completion of the on-going implementation of SMPs, livestock waste control strategies, the implementation of the Stage I of the Harbour Area Treatment Scheme (HATS) and its remaining stages which are being planned, this trend is expected to continue in the coming years.

3.7.2 The marine waters, particularly those in the Deep Bay, North-Western, Victoria Harbour and Tolo Harbour and Channels WCZs are still suffering from pollution strains. This is reflected in the increasing nutrient levels, bacterial levels, decreasing DO levels and may be associated with the occurrence of some red tides.

3.7.3 It has been demonstrated from a recently completed study [12] that large-scale coastal developments and in particular pollution load reduction schemes in HKSAR have profound effect on the marine and bathing water quality in HKSAR. As such, the implementation of the HATS should improve the water quality noticeably in Victoria Harbour, Western Buffer, Eastern Buffer and Southern WCZs.

3.7.4 The collection and supply of drinking water and provision of the necessary associated facilities is considered to be a public health engineering issue rather than an environmental issue per-se. However, the freshwater collected in Hong Kong can be considered an environmental resource and any increase in water gathering ground/reservoirs would have land use implications and therefore this aspect is briefly discussed below.

3.7.5 The majority of Hong Kong’s freshwater supply is imported from the Dong Jiang River in Guangdong Province. The growth rate in freshwater consumption is decreasing primarily due to relocation of many industries outside HKSAR. Pollution problems in local freshwater resources have not been a significant issue.

Marine Waters

3.7.6 The developments in the neighbouring region would affect the pollution level in and around the HKSAR waters. This regional impact is most pronounced in the Deep Bay and North-Western WCZs. For example, it is estimated that a reduction of the current pollution load from the Pearl River by 50% could lead to a 30% reduction in Total Nitrogen (TN) and Total Inorganic Nitrogen (TIN) level in North-Western Waters in the wet season [12]. The “Pearl River Effect” is less in other parts of the HKSAR waters and is much less significant during the dry season. The large-scale reclamation at the Pearl River mouth over the years has led to more of the river flow being directed to the western coast of the Pearl River Estuary, which means less contribution by the Pearl River to the HKSAR waters in terms of both pollution level and fresh water element and an increase of salinity in the eastern coast of the Pearl River Estuary. A water quality study [12] has also concluded that the flow regime
and therefore the marine water quality in HKSAR, in particular in and around Victoria Harbour, have been affected by the coastal developments in HKSAR over the years.

3.7.7 Any significant land reclamation from the sea in order to meet the future regional development requirements in the PRD region or local developments in HKSAR could potentially have significant impacts on the water flow regime and therefore on the marine water quality in HKSAR. This would include for instance new cross-boundary bridges such as the proposed bridge to Pearl River West should be taken into consideration in the future land use planning.

3.7.8 Mirs Bay has a long residence time [46], which means a poor tidal flushing condition of the Bay and that any pollutant discharged into the Bay could remain in the Bay for a long period of time. Although currently not heavily polluted, it is sensitive to any increase in pollution discharges which could potentially result from the future developments in the PRD region and in HKSAR.

3.7.9 In the foreseeable future, the population in both HKSAR and the neighbouring region is expected to continue to increase, which means a continuous increase in pollution load, adding further pollution strain on the future marine water quality of HKSAR. This increasing trend in pollution load and the environmental targets set out in the IAR will have to be matched by additional sewerage infrastructure, which should be taken into account in future land use planning. The planned sewerage schemes such as HATS, upgrading of the Pillar Point Sewage Treatment Works and the on-going implementation of SMPs are part of the HKSARG’s effort in meeting the future water environmental demand.

3.7.10 As many of the manufacturing industries have already been relocated to outside the HKSAR, significant increase in toxic chemical effluent discharges into HKSAR waters is not expected in the foreseeable future. However, there will be a potential increase in toxic chemical effluent discharged into the Pearl River and subsequently transported into the HKSAR waters. Additional port facilities for the HKSAR and new cross-boundary bridges such as the proposed bridge to Pearl River West could also increase the risks of chemical pollution in the marine waters resulting from accidental spillages or leakages.

River Waters

3.7.11 Compared to the marine waters, the river waters in the HKSAR are less affected by the Key Issues and Influencing Factors. However, it should be recognised that the Shenzhen River bordering Hong Kong is currently heavily polluted, contributing significantly to the water pollution in the Deep Bay area. The on-going implementation of the Shenzhen River Regulation Project jointly by the Shenzhen Government and the HKSAR Government should alleviate the situation. Other contributors to river pollution are unsewered villages and livestock wastes. As it is the long-term objective of the HKSAR Government to achieve full sewerage connection for villages and with the continued implementation of the Livestock Waste Control Scheme and the relevant sewerage master plans by the HKSAR Government, the river water quality in HKSAR is expected to continue to improve in the future. However, future land use plans should allow for the land requirement to achieve the full sewerage connection for both the existing unconnected villages and future developments.
Bathing Waters

3.7.12 As most bacteria have a relatively short life span (typically 6 hours for Escherichia Coliforms during the bathing season), the bathing water quality is mainly affected by local pollution discharges such as combined sewer overflows during heavy rainfall and point source discharges such as those from long sea outfall. Predicted population increase in future will increase the pollution load, thus adding pressure on the need for new or improved sewage treatment facilities, which will require a certain amount of land allocation in the future land use planning.

Water Resources

3.7.13 Hong Kong is not self sufficient in terms of fresh water resources. In spite of a decreasing trend in the growth of water consumption, the projected population increase in the SAR and the improvement of living standards will demand either more water to be imported from the Dong Jiang River or alternative water resources to be sought after. It should be noted that the population increase in the catchment of the Dong Jiang itself would also demand more water supply from the river, which could eventually lead to a reduction of the potable water available to Hong Kong.

3.7.14 With the rapid economic growth in the PRD Region increased pollution occurred in the Dong Jiang and its catchment and along the water supply route. It is envisaged that the on-going construction of a closed water supply aqueduct due to be completed in 2003 would minimise the contamination from along the route of the water supply aqueduct, thus reducing the costs of local water treatment. It should however be recognised that the contaminants from the catchment of the Dong Jiang can still find their way into the water supply source.

3.7.15 As a result of local water resources shortage, Hong Kong has developed a high usage of seawater for toilet flushing (nearly 80% in 2001 [13]). The HKSAR Government is currently studying the feasibility of increasing local water resources by building new reservoirs locally, desalination of seawater and water reuse as alternative water resources. It should be noted that the development of possible additional water resources, in particular by constructing new local reservoirs, would have significant implications to future land use in the SAR.

3.8 Waste Management

Introduction

3.8.1 As with all developed countries, waste management is a major issue in Hong Kong. Production of Municipal Solid Waste (MSW) has increased by 32% in the last decade, this means that landfills built in the early 1990s, which were designed to accept waste until at least 2020, are likely to be full well before then, some predictions show that the landfills will be full as early as 2008-2011. As a response to this problem, the Waste Reduction Framework Plan was introduced in November 1998, however, even if all targets are achieved, landfills will be full by between 2012 and 2018.

3.8.2 The Plan identified the requirement to reduce, reuse, and recycle waste to extend the useful life of these landfills. Whilst alternative disposal options are to be investigated, landfilling will still be required and as such valuable land space will be required. To slow down the use of non-renewable resources, and reduce the area of land required for landfill, waste volumes produced must be controlled and
minimised where possible.

Issues

3.8.3 The most fundamental issue is that land is in short supply in Hong Kong. Sites suitable for landfilling activities are likely to be undeveloped greenfield sites, at some distance from development. However, as populations increase, sites which fit these requirements will become scarcer, and obviously landfill development will take up land of use for nature conservation purposes and recreation.

3.8.4 The Government identified that the greatest potential for increasing the existing landfill capacity is to extend one or more of the existing sites, beyond which it will be necessary to provide new disposal facilities. Strategic studies conducted in the 1980s for the current landfill sites identified that there were few sites that had the necessary land area, and were also suitable for landfill development and operation.

3.8.5 A study was commissioned by EPD in 2000 [24] to identify areas suitable for the extension of existing landfills and suitable sites for potential new ones. The study identified potential sites for extension of the NENT and WENT landfill sites, although further detailed investigation is required. The study also recommended a land-based site at Pillar Point Valley North and a marine-based site at South Cheung Chau Disposal Ground for further examination as new landfills, and a site at Lamma Breakwater as a reserve alternative to South Cheung Chau Disposal Ground [25].

3.8.6 An alternative to identify additional landfill sites is the development of large-scale waste treatment facilities which would reduce the volume of waste requiring disposal. Nonetheless landfills would still be required for holding the residual waste. It is noted that the Government has invited expressions of interest from local and overseas waste management industry on the development of such facilities. Current proposals are being considered to examine ways to develop large scale treatment facilities which would involve landtake, but they do reduce the need to develop mega landfills. The strategy for disposal of waste involves a variety of mechanisms which are needed to accommodate different types of waste.

3.8.7 The waste recovery industry of Hong Kong is and has always been export-oriented. In 2001, a total of 1.94m tonnes of waste materials were recovered for recycling, of which 1.72m tonnes were exported. According to EPD's figures, over 95% of the export quantity was done by ocean or river. In particular, 1.47m tonnes of paper and metal were exported using these modes of transport. A major portion of these materials was handled in Public Cargo Working Areas (PCWAs). In terms of export value, the 1.47m tonnes of materials amount to an annual turnover of HK$1.64 billion. Under the Planning Study on the Harbour and Its Waterfront Areas, one of the planning principles is to minimise physical and visual intrusion to the Harbour, uses incompatible to the recreational and tourism focus of the Inner Harbour Area should therefore be relocated outside this area where opportunity arises. For the sake of sustainable use of resources and conservation of our limited landfill capacity, adequate waterfront facilities should be provided to allow a continued operation and potential expansion of waste recovery activities.

3.8.8 It is worth noting that only some of the inert C&D materials are suitable for recycling into construction material while the majority is only suitable for reuse in reclamation and site formation works. These inert materials such as earth, soil, broken rock, broken concrete etc. should not be disposed of at landfills. The problem is that with delay and scaling back of planned reclamation projects, there will be an acute
shortage of public filling capacity to accommodate inert C&D materials in the coming years. It is estimated that the shortfall in public filling capacity would reach 24 million tonnes by end 2005. Possible measures to address this problem are to prepare and implement C&D materials management plans, process and recycle hard inert C&D materials at quarries and recycling plant, establish temporary fill banks, introduce construction waste charging scheme and identify outlets including using the materials to restore marine borrow areas, or in reclamation or land formation projects in the Mainland.

3.8.9 The land use implication of special waste treatment facilities is also identified as one of the key issues. Given that these are mostly unwelcome facilities and some of which are currently situated close to densely populated areas such as Tsing Yi, consideration should be given where, in the long term, these facilities are to be built with a view to ensuring smoother implementation and avoiding confrontation with local residents. Factors to be taken into account include:
- future waste arising
- future town planning
- preferred transportation mode and route of the waste
- environmental implications (e.g. emissions problem) to the neighbourhood

3.9 Potentially Hazardous Installations

Introduction

3.9.1 The Government’s policy is to minimise the potential risks associated with potentially hazardous installations (PHIs) to internationally acceptable levels by controlling the siting of these facilities, controlling the land use and by requiring the installation to be constructed and operated to specified standards. [28]

3.9.2 For each PHI, a Consultation Zone (CZ) is defined which takes account of the nature of the PHI and their risks. The extent and size of the CZ is defined taking account of adjacent uses, topography, the types of PHI and their storage capacities. For explosives factories and depots, in addition to the CZ, a Safety Zone (SZ) is defined in accordance with the current British Table of Safety Distances (Explosives Acts 1875 and 1923). [28]

3.9.3 Proposals for development that will result in an increase in the number of persons living or working in the CZ have to be submitted to the Coordinating Committee on Land-use Planning Control relating to Potentially Hazardous Installations (CC PHI) for consideration. [28]

3.9.4 In Hong Kong there are currently 33 existing PHIs – two on Hong Kong Island, one on Ap Lei Chau, three on Lantau Island, five on Tsing Yi Island and the rest (twenty-two) on Kowloon Peninsula and the New Territories. Locations of the existing PHI sites are depicted in a map on Figure 3.11 of the Initial Assessment Report. The majority of these facilities are located in rural areas although some are located in the densely populated urban areas such as To Kwa Wan and Mei Foo Sun Chuen, whose facilities are the gas production plant of Hong Kong and China Gas Company and Mobile Estate LPG Store, respectively. [8]
3.9.5 Among the 33 existing PHIs, they can be classified as chlorine stores (17), explosive depots (2), gas production plants (3), LPG/Oil terminals (5) and LPG stores (6). [8]

**Implication to HK2030**

3.9.6 The key issues with regard to PHIs are mainly of two aspects: the development constraints imposed by the CZ of PHIs and the requirement of new facilities to accommodate future demand.

3.9.7 According to HKPSG, planning restrictions may be imposed on future developments within the CZ of PHIs. Sizable developments are normally not approved. As mentioned in section 3.9.4 above, some of the existing PHIs are located in the densely populated urban areas. The development potential of adjoining sites is therefore frozen or reduced. Development opportunities may arise if a facility is decommissioned / relocated or if the dangerous goods storage capacity is reduced to below the PHI threshold quantity, then the site would no longer be classified as a PHI and development constraints inside the CZ could be eliminated. However, if the storage capacity is only just less than the threshold quantity then certain licensing requirements and constraints could remain due to risk issues associated with dangerous goods storage. During the last few years, several PHI sites have been declassified (e.g. chlorine stores at Tai Po Road, Aberdeen, Eastern Water Treatment Works and explosive depots at Stonecutters Island and Ma Yau Tong).

3.9.8 There is a possibility that where facilities are decommissioned, the land could be freed up for further development. This could have a positive effect in terms of the overall development plans for the HK2030, but it should be noted that there would be various studies required to determine the future use (and possible costs involved in recovery) to which the land could be put.

3.9.9 Where existing PHIs are retained, the potential effects of development plans, for example the expansion of communities in close proximity, abutting the edge of CZs with new strategic corridors etc., need to be considered as part of the option selection process. In the context of HK2030, the existing PHIs would be regarded as constraints to further development. The risk factor of PHIs will be taken into account in the environmental evaluation of the Development Options.

3.9.10 With the continuing population growth anticipated in the next thirty years, the need for new facilities could arise within a particular area. Table 3.2 lists out the possible influencing factors that may increase / reduce the number of PHIs or size of CZs. It is important to note that Hong Kong is constrained by the lack of land resources, particularly within developed urban areas. TKO Area 137 and Tuen Mun Port have been identified for future PHI sites but there are competing land uses in these areas, particularly TKO Area 137.

3.9.11 The transport risk issue would be another implication. In many instances the impact of the CZ could be reduced by relocation / import / consolidation options but attention should be paid to the possibility that increased transportation risks may result in a net risk increase to the community as a whole.
<table>
<thead>
<tr>
<th>Type of Facility</th>
<th>Influences likely to Increase No. of PHIs / Size of CZs</th>
<th>Influences likely to Reduce No. of PHIs / Size of CZs</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Sites</td>
<td>• Increasing population</td>
<td>• Consolidation of sites – fewer but larger, better located facilities</td>
</tr>
<tr>
<td></td>
<td>• Growth of Industrial / Commercial Activities in Hong Kong</td>
<td>• Trend towards process optimisation – inventories below PHI thresholds</td>
</tr>
<tr>
<td></td>
<td>• Consolidation of sites – fewer but larger, better located facilities</td>
<td>• Application of new / alternative technology</td>
</tr>
<tr>
<td>Chlorine Storages</td>
<td>• Growth of new population centres</td>
<td>• Reduction of chlorine usage, for example by reducing the dosing concentration levels. This may be achievable by the introduction of additional upstream treatment and/or improved distribution network</td>
</tr>
<tr>
<td>(Water Treatment)</td>
<td>• Reduction in water quality of imported water from Guangdong</td>
<td>• Adoption of alternative treatment technology such as sodium hypochlorite dosing, UV, ozone treatment, nano filtration, etc. Reduces need for Chlorine and therefore the quantity stored</td>
</tr>
<tr>
<td>Fuel/LPG Storages</td>
<td>• Growth of LPG use as vehicle fuel</td>
<td>• LPG import via pipeline from mainland or offshore</td>
</tr>
<tr>
<td></td>
<td>• Increase reticulated gas network, reducing demand for LPG hence lower storage requirement</td>
<td>• Increase reticulated gas network, reducing demand for LPG hence lower storage requirement</td>
</tr>
<tr>
<td></td>
<td>• Consolidation of LPG storage sites into a single large storage facility – using refrigerated or cavern technology</td>
<td>• Consolidation of LPG storage sites into a single large storage facility – using refrigerated or cavern technology</td>
</tr>
<tr>
<td></td>
<td>• Significant growth in electric and hybrid vehicle usage</td>
<td>• Significant growth in electric and hybrid vehicle usage</td>
</tr>
<tr>
<td>Gas Processing / Production Plants</td>
<td>• Growth of new population centres</td>
<td>• Development of Hydrogen fuel cell technology</td>
</tr>
<tr>
<td>Explosives Depots</td>
<td>• Increased construction requiring blasting</td>
<td>• Increased gas import from the Mainland or offshore</td>
</tr>
<tr>
<td></td>
<td>• Increased storage and use of display pyrotechnics (note 2)</td>
<td>• Increase in use of renewable energy sources</td>
</tr>
<tr>
<td></td>
<td>• Consolidation of depots into a single site</td>
<td>• Consolidation of depots into a single site</td>
</tr>
</tbody>
</table>

Note 1 – Growth of hydrogen fuel cell usage may require the installation of plants producing gaseous hydrogen and lead to the development of a distribution infrastructure.

Note 2 – It is not clear whether display pyrotechnics (fireworks) will fall within the definition of explosives from the viewpoint of PHI definition. The inclusion of such stores has been included in line with the precautionary principle.
3.10 Energy and Natural Resources

Introduction

3.10.1 This Section examines energy and natural resource issues in Hong Kong. Firstly assessing the current situation regarding energy production and use, requirements and future predictions. Then determining the problems associated with energy production and use, and finally the main issues which need to be addressed to provide a more sustainable solution to energy use in the future.

3.10.2 Energy is closely linked with natural resources. The categories of natural resources examined in this section are limited to those associated with energy production. While energy production and use does not directly relate to strategic land use it does involve indirect land use implications. For example, energy conservation and use of renewable sources could reduce the need for power station capacity and land for disposal of wastes produced in the generation process. On the other hand, land is required to build wind turbines. In addition to energy usage, fossil fuel dependence and development of renewable energy sources and implementation are critical factors in attainment of sustainability.

Non-Renewable Natural Resources

3.10.3 Electricity in Hong Kong is provided primarily through the combustion of fossil fuels and is supplied to Hong Kong through two private sector companies; CLP Power Limited (CLP Power) and the Hongkong Electric Company Ltd. (HEC) which are investor-owned. CLP Power has three power stations, Black Point gas fired Power Station, and Castle Peak Coal Power Station in the New Territories, and Penny’s Bay diesel fired Power Station on Lantau. CLP Power supplies electricity to Kowloon and the New Territories, including Lantau, Cheung Chau and several outlying islands. HEC’s only power station is on Lamma Island. HEC supplies electricity to Hong Kong Island and the neighbouring islands Ap Lei Chau and Lamma.

3.10.4 Hong Kong has a total installed electricity generating capacity of 11,568 MW (including 70% of the capacity of units 1 and 2 of the Guangdong Nuclear Power Station at Daya Bay, and 50% of Phase 1 of the Guangzhou Pumped Storage Power Station). Lamma power station is to be extended to increase generating capacity by 60% with the installation of a gas fired power station adjacent, with the new facilities interconnected with the existing Lamma power station in 2004. The power mix for power generation is shown in Table 3.3 below.

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Percentage Installed Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>57.1</td>
</tr>
<tr>
<td>Oil</td>
<td>9.6</td>
</tr>
<tr>
<td>Natural gas</td>
<td>16.2</td>
</tr>
<tr>
<td>Nuclear energy</td>
<td>11.9</td>
</tr>
<tr>
<td>Pumped storage</td>
<td>5.2</td>
</tr>
</tbody>
</table>

3.10.5 Fuel gas is supplied for domestic, commercial and industrial uses. Two main types of fuel gas are available: Towngas, distributed by the Hong Kong and China Gas Company Limited and Liquefied Petroleum Gas (LPG), supplied by oil companies.

3.10.6 Natural Gas, although the source of which makes this a fossil fuel, is considered to be a more environmentally friendly fuel. It was first used in power generation at the Black Point and Castle Peak Power Stations in 1995. The Government supports further use of natural gas for power generation, and a Liquefied Natural Gas (LNG) terminal is to be built in Shenzhen to commence operation in 2005 (www.emsd.gov.hk). This provides more opportunities for the use of natural gas as an alternative fuel source in Hong Kong.

3.10.7 Demand-side management (DSM) programmes are increasingly used in Hong Kong for the planning, implementing, and monitoring activities of electric utilities which are designed to encourage consumers to modify their level and pattern of electricity usage. In Hong Kong under the Scheme of Control Agreement (SCA) power companies are required to draw up DSM programs for consideration by the government in the context of their generation development proposals. This scheme allows expenditure incurred by companies promoting energy efficiency and its consideration are specifically recognised as a legitimate category of operating expenses to be recovered through tariffs.

3.10.8 The other main consumer of energy, fossil fuels in particular, is the transport sector. Of the 0.5 million licensed vehicles in Hong Kong (September 2001 data – Motor Vehicles Emissions Group, EPD), 71% are petrol, 2% LPG and the remaining 27% are diesel (60% light duty, 40% heavy duty). Air pollution as a result of fossil fuel use in the internal combustion engine has led to government initiatives to prevent the use of diesel in road vehicles through the conversion to LPG, and the encouragement of ‘greener’ forms of transportation.

Renewable Energy Resources

3.10.9 In the United Nations system, “renewable sources of energy” refers to large and small-scale hydropower, modern and traditional biomass energy, solar energy, wind energy, ocean energy, urban and rural organic waste, and geothermal energy (UN, 1994) [30]. Large hydropower and traditional biomass are, the most important among them. The new and emerging renewable energy technologies such as solar, wind, modern biomass and geothermal, contribute only a small proportion at present (Hui, 1997). [31]

3.10.10 Hong Kong has a number of natural renewable resources which have the potential to be utilized more extensively. The most abundant of which is probably solar power. Opportunities for harvesting solar energy arise primarily in serving small-scale energy needs of individual buildings.

3.10.11 In Hong Kong, the present use of solar energy is primarily to provide hot water for a number of swimming pools and for the new slaughterhouse in Sheung Shui. Some small scale photovoltaic and wind systems including 20 automatic weather stations, powered by solar energy, have been installed by the Hong Kong Observatory to generate nominal electrical power in remote areas to operate lighting and on-site data recording equipment. From 2000, wind power has also been utilised at some stations (http://www.weather.gov.hk/education/wind_power/windturbine-Jan2001_v2e.htm). New technologies are also being investigated as alternative sources of energy. For example, fuel cell technology can generate electricity without combustion by combining hydrogen ions with oxygen atoms. However, this
technology is still in its early stages of development and generation costs at present are high (www.emsd.gov.hk/emsd/eng_txt/sgi/re.htm).

3.10.12 To further identify opportunities for use of renewable energy, Electrical and Mechanical Services Department has commissioned a consultancy study on renewable energy which commenced at the end of 2000. This study investigates the viability of using renewable energy resources such as solar energy, wind energy, wave energy and landfill gas etc. in Hong Kong. As part of the study, various institutional, legal, regulatory and financial issues associated with the application of renewable energy in Hong Kong are to be assessed. This study also includes a project to install photovoltaic panels in an existing high-rise government building to demonstrate the application of renewable energy technologies to the general public.

Environmental Problems of Energy Production and Use

3.10.13 In Hong Kong, it has been shown that energy consumption follows GDP very closely (Energy Wit, 2001). In 1998, electricity accounted for 45% of Total End-use Energy Consumption (TEUC), town gas and LPG about 10%, with the remainder consisting of other oil products such as petrol, diesel, kerosene etc. (Energy Wits, 2001).

3.10.14 Hong Kong is totally dependent on imported fuels for energy generation, and globally stocks of non-renewable natural resources, fossil fuels are diminishing. The extraction, transportation, and use of primary fuels (mainly fossil) and generation and transmission of electricity affect the environment at global, regional and local levels.

3.10.15 Current problems associated with energy production and use from an environmental perspective include:

- **Pollutant Emissions.** Combustion of diesel and coal contributes to ground-level ozone due to emissions of NOx. Ozone in particular decreases lung function, and can increase the susceptibility of vegetation to disease, insect attack and other pollutants. Fossil fuel combustion, particularly coal and oil fractions, results in the release of particulates, sulphur, nitrogen and carbon dioxide.

- **Greenhouse Gas Emissions.** (As already described in Para 3.5.9)

- **Waste Products.** The coal combustion wastes (CCW) are currently disposed of at Pulverised Fuel Ash (PFA) lagoons of which there is one at Nim Wan, Tuen Mun. As part of a long term disposal strategy for PFA from Lamma power station, an investigation was conducted in the 1990s by Binnie Consultants Ltd. PFA production, which is estimated to be 700m$^3$/day over the next few years, is to be used in restoration of Lamma Quarry which will be handed over to HEC when quarrying has ceased. This lagoon is designed to have a life of 6-8 years with an ultimate capacity of 1.5Mm$^3$ (Binnie, 1993/1994). [16] A storage lagoon adjacent to Lamma power station was constructed in 1996 (www.hec.com.hk).

  - Power Plant CCW contains concentrated levels of numerous contaminants, particularly metals like arsenic, mercury, lead, chromium and cadmium, and radioactive elements found naturally in coal. There is the potential for dispersal of these contaminants through leaching, surface water run off, wave action or through air dispersal.

  - In terms of alternative fuel sources, nuclear fuel is used in many countries, and although it can be considered in some ways a ‘clean’ fuel due to the fact...
it has no waste emissions, the spent fuel rods, which require disposal, remain radioactive for thousands of years after use. Hong Kong has 50% capacity of the nuclear power station at Daya Bay, as such the implications of radioactive waste disposal should be considered. As yet, no environmentally acceptable disposal method has been identified to ensure the safe storage of this hazardous material.

- **Environmental Degradation.** The method of extracting fossil fuels can lead to environmental damage, and can have a significant impact on terrestrial and marine environments, either through habitat loss, from mining and drilling operations and dam construction. Alteration to drainage patterns, acidification of ecosystems from acid deposition and mine drainage, degradation and pollution of ground and surface waters, in addition to visual and landscape impacts. Although mining is not conducted within Hong Kong and therefore there are no extractive and primary process related impacts. However, a Life Cycle Assessment approach and considering sustainability in using there materials means that Hong Kong has an obligation to consider the local impacts that extraction has elsewhere. There are also the application and release of herbicides to maintain transmission and pipeline rights-of-way. The issues associated with contaminated land include the potential for causing contamination as a result of fossil fuel spillage. The great devastation of oil spills on marine ecosystems has been seen on numerous occasions.

- One step forward is Hong Kong’s effort to increase its reliance on natural gas in the future as an environmentally friendly alternative option to coal and oil. However, the natural gas to be used is a fossil fuel, and as such exploitation of the gas is conducted in conjunction with oil deposits. Opportunities for the use of methane from landfill sites or from other organic matter decomposition facilities will provide a more environmentally sustainable (although limited) alternative.

**Issues**

3.10.16 The main issues associated with energy production in Hong Kong, whether it be for electricity production, or for use in vehicles, is the fact that it is produced from finite fossil fuels, combustion of which releases stores of carbon (which have been removed from the carbon cycle), and re-releases them back into the atmosphere.

3.10.17 As energy demands in the future increase (due to anticipated population increases) alternative sources of fuel will be needed/preferred, and energy created from fossil fuel combustion utilised more efficiently.

3.10.18 However, the progress into the diffusion and deployment of renewable energy is slow. Options for a future energy system compatible with sustainable development include:

- more efficient use of energy and energy-intensive materials
- increased use of renewable sources of energy
- more efficient production and use of fossil fuels
- fuel substitutions, from high-carbon to low-carbon to no carbon based fuels
Despite the opportunities, only moderate growth in the use of renewable energy resources is projected for the next 20 years, as the low fossil fuel prices continue to constrain research and development. [31] Technical developments over the last decade have made renewable energy more viable by increasing the conversion efficiency and greatly reducing the cost of material requirements.

At present the environmental costs, and the price paid by society of using fossil fuels, in terms of climate change and environmental degradation are not reflected in the price of electricity and fuel. If these environmental costs were to be internalised, the comparative costs of renewable energy would become much more competitive.

Government support for renewable energy is required. This, along with incentives for use would be a practical way of increasing renewable energy use in Hong Kong.

**Constraints of Renewable Resources**

The opportunities and constraints associated with renewable resources use are specific to each energy type. No one renewable energy source is likely to provide all Hong Kong’s energy needs, a combination will be required. Solar energy for example, whilst providing emission free energy during operation, may not be able to operate at night, or in low light conditions. Wind energy can only be generated when the wind is blowing.

Renewable energy generators, including wind generators and solar panels can have an impact on the local landscape, however, it is often a matter of opinion as to whether they are considered as blight.

Briefly, the constraints of the various ‘renewable’ energy resources include:

- **Solar** – cannot generate energy when the sky is overcast (i.e. low light conditions).
- **Wind** – wind must be blowing, and numerous facilities are required with moveable parts to ensure exploitation of available wind energy regardless of the wind direction. This may create land-use conflicts, whilst erection of wind turbines may require the removal of vegetation. Wind turbines also represent a hazard to birds. Potential noise and visual impacts also constrain their use.
- **Biomass** – Energy production through the use of biomass requires land to be set aside for planting, farming, storage and then combustion which will still result in greenhouse gas emissions.
- **Hydropower** – particularly wave, provide potential obstacles to shipping, interference with fish and large mammal migration routes, and the potential build up of sediments due to wave attenuation.
- **Hydroelectric** – appropriate topography required, may create land use conflicts associated with the construction of dams.
- **Nuclear** – potential radioactive releases and production of persistent radioactive wastes.
Summary

3.10.25 In addition to the diminishing global fossil fuel stocks, environmental issues such as the greenhouse effect, acid rain, and urban air pollution problems, have highlighted the requirement (or at least desirability) for cleaner, renewable and ultimately more sustainable energy production methods.

3.10.26 Although it may not be possible to eliminate Hong Kong's reliance on fossil fuels in the next thirty years, reducing or minimising the demand and requirements for fossil fuels through increasing energy efficiency and identification of alternative preferred renewable energy sources will provide a more sustainable long term environmental option.

3.10.27 There are a number of opportunities for Hong Kong, to increasing the use of solar energy is one of the more obvious ones. The establishment of energy-from-waste facilities and the use of landfill gas for energy production may also be applicable to Hong Kong.
4. Potential Solutions

4.1 Introduction

4.1.1 Many potential environmental problems have been avoided during the last decade through strategic environmental planning and assessment. This process needs to be continued and even greater efforts will be required to safeguard Hong Kong's environment over the next 3 decades. A number of environmentally friendly strategic options which can provide partial or even complete solutions to development issues in certain areas by minimising impacts and avoiding pollution have been identified. These are discussed in this section under suitable headings, however, many of them could be equally well placed under other headings. It should be noted that some of these measures are being followed up or even implemented by Government Departments.

4.1.2 In essence, the HK2030 Study needs to balance the sustainability criteria and environmentally friendly options (putting residential population where existing infrastructure is in place, locating jobs in easy access to residential developments, railways, renewable energy, etc) with the land use requirements. This will be a key issue to be addressed/incorporated for all elements of the HK2030 Study Development Options and ultimate strategies.

4.1.3 Some environmentally friendly measures have a direct effect on land use by making land available for use (which would otherwise not be) such as placing facilities underground. Other measures are very important in environmental and sustainability terms but only have an indirect land use implication (such as energy saving measures which reduce the need for land for power supply expansion). This report has largely focussed on those issues with direct land use effects and has briefly discussed those issues which are considered important for moving towards sustainability.

4.2 Strategic Land use Planning Options

4.2.1 When formulating the Development Options for the HK2030 Study, great emphasis will be placed on ensuring these are “sustainable and environmentally preferred”. Key issues to be addressed include the transport networks, the residential and commercial developments and centres of population and the land uses for other purposes such as industrial activities, undesirable uses, recreational facilities etc.

Development Density

4.2.2 The Main Urban Area is now the home for about 60% of the total population in Hong Kong. The high densities in many parts of the Main Urban Area are symptomatic of the generally lower environmental standards that a large proportion of the population has to tolerate. These include air pollution, noise pollution, insufficient sewage infrastructures, community facilities and open space etc. For example, the close proximity of incompatible land uses and lack of adequate separation between pollution sources and sensitive uses are both common problems. Heavy traffic flows throughout the Main Urban Area also result in noise and air quality impacts.
4.2.3 Reducing the overall development densities in the Main Urban Area would bring about a better quality environment for living, less congestion, more “green space” etc. However, it should also be recognised that the better the standards, the greater will be the resource demands with particular regard to the provision of serviced land and inter-district infrastructure services.

4.2.4 On the other hand, further intensification of development densities in the Main Urban Area could be possible if there is spare capacity in existing environmental infrastructures. Environmental infrastructures are considered to include wastewater collection, treatment and disposal systems, water supply and utilities, solid waste disposal and collection systems, transport networks etc. The concepts of reducing / intensifying the overall development densities in the Main Urban Area will be discussed in the HK2030 Study, and their applicability and desirability will be assessed in the evaluation process.

4.2.5 Jobs Closer to Home

It is estimated that of about 3.2 million jobs currently available in the Territory, some 80% are provided in the Main Urban Area. As the proportion of the population living in the New Territories increases, the imbalance in job provision between the New Territories and the Main Urban Area could intensify. The over-concentration of jobs in the Main Urban Area can bring about problems like traffic congestion, particularly along cross-harbour routes, air pollution, traffic noise and sub-optimal use of expensive transport infrastructure.

4.2.6 The realization of more jobs closer to home would be compatible with increased walking to/from work. The use of protected (e.g. elevated) walkways and pedestrian only zones would be a beneficial and less polluting initiative which are also relevant to the sub-sections on Improvement of Urban Environment and Environmentally Sound Technologies below.

4.2.7 With the Government’s policy to accord priority to rail transport, it offers an opportunity to promote the development of more decentralised and selected off-centre office and business nodes at accessible points, for example at the key nodal transport points along the railway lines on periphery of urban area and in the New Territories. It would encourage the use of environmentally friendly type of public transport (i.e. railway) and reduce the passenger trips going into the Main Urban Area where there is already an acute air and noise pollution problem.

4.2.8 Priority Given to Sites being Under-utilised or with Obsolete Uses

In urban areas, with the relocation of manufacturing industries from Hong Kong to the PRD region, some of the sites vacated by manufacturing or other industrial uses will become available for redevelopment for less environmentally problematic uses. As a result, the environmental impacts to the surrounding land uses associated with the manufacturing activities existed before could be removed. As seen, a lot of such premises have already been converted to office use, which has helped to “clean up” old industrial areas. Where local conditions permit, redevelopment or conversion of old factory sites to residential use or uses related to creative industries can also be considered. Moreover, some of the government sites in existing built-up areas (e.g. work depots) could be better utilised through redevelopment to meet the growing demand for residential or general business uses. With the ageing trend, some of the sites planned for school development may also be considered for alternative uses.
4.2.9 In rural areas, there are many sites used as temporary storage/garage which have caused nuisance and environmental problems. There are also some abandoned farmlands and fish ponds, if upgraded or regenerated for other uses, could achieve a better environment with a higher landscape quality. The designation of NDAs could provide an opportunity to upgrade these derelict areas.

“No-Go” Areas

4.2.10 “No-go” areas are identified for the purpose of strategic planning to cover locations that are considered as unsuitable for developing into population centres or accommodating large-scale infrastructure projects due to the need to protect ecological, landscape or heritage resources of recognized importance.

4.2.11 To illustrate the latter point, in the TDSR, the “no-go” appellation was given to the SENT for major development as the basic tenet was to protect this remaining relatively unspoilt area. Limited residential development was proposed in the SENT but only in areas where infrastructure already existed to avoid adverse impacts. The precept was that limited development could take place but only within well defined boundaries. This allowed for some development in the area to ensure there was no part of Hong Kong which was neglected in terms of planning for the future, but it did preclude strategic development options as planned for NWNT or NENT.

Landscape, Ecological and Cultural Heritage Corridors

4.2.12 Protecting and even enhancing the landscape, ecological and cultural heritage resources of Hong Kong when preparing the Development Options for the HK2030 Study will be essential. Identified high quality landscape, ecological and cultural heritage resources will be overlaid with the Development Options. In particular, those resources which have been under designated protection would be avoided. If there should be a conflict between development and the valued resources, this could impose a constraint and alternative development options should be considered. Opportunities to further enhance the Territory’s landscape, ecological and cultural heritage quality through selecting Development Options which benefit the existing character need to be supported.

4.2.13 Hong Kong and Kowloon are both endowed with stunning views from the hills in the hinterland and the Harbour to the forefront. As part of a framework for enhancement of the landscape resources within the urban area, advantage could be taken of these features by connecting the hills and water through “landscape/view corridors”. Within the urban area, there are many examples of landscape resources such as landscaping, planting, open spaces, park areas and trees. Connections could be made between such resources within districts to enhance the living environment.

4.2.14 The Urban Design Guidelines for Hong Kong, completed in November 2002, has proposed a number of view corridors in order to preserve important views from vantage points, such as those on both sides of the Harbour. This view corridor to the hills concept has been introduced in other cities around the world where urban revitalisation has seen to be a key priority, such as the Rambels in Barcelona.

4.2.15 In more rural areas, the concepts of “ecological corridors” should be given consideration as part of the overall planning process. This concept involves linking of fragmented habitats and providing for movement of fauna and flora among these habitats and possibly thereby enhancing their viability/sustainability. In addition, it has the benefits of avoiding fragmentation of existing habitats and bifurcation of
natural resources such as wetlands through for example the disposition of new residential developments (both private and public developments) with cognisance given to the retention of immediate surrounds if these have ecological importance or are connected to other resources.

4.2.16 There are two different but related aspects to this concept of "ecological corridors":
- One aspect involves creating such corridors in appropriate areas where, for example, two areas of ecological significance are located relatively close together and can be connected or joined up by an area of land which is probably not ecologically significant. This connecting land is given protection from incompatible development and the net land area created is likely to be more ecologically viable than the individual areas.
- A second aspect is protecting existing areas by not allowing future development to break up or bifurcate them. This already addressed via the EIA process.

4.2.17 The existing heritage trails in Ping Shan (Yuen Long) and Lung Yeuk Tau (Fanling) could function as models to be expanded using international best practice in a proposed Cultural Heritage Corridor to be illustrated in the final report of this study. Data from the on-going Landscape Value Mapping Study will be incorporated into later parts of this study as it becomes available.

4.2.18 There is a need for acknowledgement of the relative significance of heritage resources. This would involve a system which incorporates a statement of relative significance into the process; if it is acknowledged that not every heritage resource is of equal value or deserving of equal treatment, planning can channel and target preservation efforts more effectively.

Recreational and Tourism Planning

4.2.19 Development of major new tourism facilities can have significant land use implications ranging from extensive direct landtake for the tourism facility itself to further landtake for associated supporting facilities and utilities such as road, rail, power and water supply. The land requirements for the Hong Kong Disney in Penny’s Bay of Lantau Island and supporting facilities illustrate this very clearly. In addition, environmental impacts relating to all or most aspects (including noise, air, waste, water, visual, landscape, ecological, cultural heritage, archaeological and nuisance to local residents) can be generated.

4.2.20 Recreational strategies need to be carefully considered in overall terms as part of the HK2030. The unspoilt South Lantau area has been identified as an area for development of the tourism trade. The use of environmentally friendly transport options, attractions and facilities will need to be considered to avoid opening up one of the last remaining rural community areas in Hong Kong. Care should also be taken to protect our valuable natural assets from damage caused by increased human activities in these areas.

4.2.21 On the other hand, the tourism industry is considered to be sensitive to many factors including environmental conditions. An Environmentally Sustainable Development Strategy was prepared for the Hong Kong Travel and Tourism Industry. [39] The development strategy focused on what the travel and tourism industry should do regarding sustainable development although it also considered land-use planning for new tourism product development. Recommendations from that study will be considered in the review of Development Options. The strategy
can be used to help steer future travel and tourism industry growth on a path towards environmentally sustainable development.  

4.2.22 During the above strategy formulation, a series of focus group meetings (involving various stakeholders) discussed a range of issues including new tourism products. It was suggested that an Eco-Village (possibly on an outlying island or more centrally located) should be established. This would be a tourist attraction and could also be used as a pilot project to demonstrate the benefits of environmentally sustainable operation.

4.2.23 Eco-Tourism and Heritage-Tourism: In the conventional property development sense, nature and cultural heritage conservation will render much of the land resources "undevelopable". However, planning should assume that some of these resources could be beneficially deployed for eco-tourism and heritage-tourism. On the other hand, the principles of eco-tourism should be adopted and tailored to local conditions to avoid significant damage to the environment by for example mountain bikes, day-trippers and water sports enthusiasts etc.

4.3 Infrastructure and Transportation Planning

Introduction

4.3.1 Many of the Key Issues and Influencing Factors, in particular PRD Development, Population Growth and Dynamics and Economic Transformation, are likely to create a demand for additional major transportation infrastructure as well as other infrastructure facilities such as sewage/water treatment works and waste management facilities etc. This would involve very significant land use impact requiring large corridors of new or redeveloped land to be devoted to transportation uses. Providing this land will be problematic for many reasons (especially environmental aspects) which could affect sustainability if simply imposed as a necessary development with major landtake implications. More environmentally (and land use driven) acceptable solutions are discussed in this section.

Avoiding Protected and Strategic Resources

4.3.2 It is assumed that those resources already identified as under statutory protection and others recognised as important for other reasons such as wetlands, cultural heritage sites etc., will be recognized as a constraint to transport and other infrastructure related development and avoided.

Rail as an Environmentally Friendly Transport Mode

4.3.3 As discussed earlier, the RDS-2’s review of environmental benefits from implementing rail schemes supported the view that railways can provide substantial environmental benefits over road-based forms of transportation. In particular from a land use point of view, it was found that:

- rail infrastructure was shown to be less land consuming than equivalent capacity roads, and this was found to result in a lower potential in affecting environmental resources
- the greater landtake requirements of highways have commensurately greater impacts upon ecological, landscape and heritage resources and on the ability of project proponents to effectively mitigate predicted impacts
• it was concluded that the landtake requirements of railway developments provide greater opportunities to manage the allocation of land in a sustainable manner, particularly in the context of Hong Kong’s limited available land area.

4.3.4 It follows from an environmental point of view that where practical and appropriate rail schemes should be developed in preference to road based schemes for new transport infrastructure developments although it is recognised that the latter forms an integral part of integrated transport facilities and some of its functions cannot be replaced by rail. Moreover, in the longer term as population growth tends towards levelling out, patronage (and therefore viability) will become critical factors in the consideration of new rail systems.

4.3.5 In addition, the RDS-2 study produced a number of Strategic Guiding Principles which are recommended for application when considering the future development of rail in Hong Kong. These are reproduced in Table 4.1 and they will be considered during Development Options preparation and evaluation and in preparation of the Action Plan for this study. The RDS-2 also recommended that similar principles should be developed for other forms of transportation (such as road and water-borne) to ensure that “all transportation projects can move towards achieving their full potential for environmental performance”.

**Table 4.1 Recommended Strategic Guiding Principles in RDS-2**

<table>
<thead>
<tr>
<th>Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>In corridors where the case for rail is marginal or non-viable, a multi modal assessment should be undertaken considering all the transport alternatives including rail, LRT and other environmentally friendly road based modes as well as roads and conventional buses.</td>
</tr>
<tr>
<td>Heavy rail links, especially in new areas of development, should be served and provide interchange facilities with ‘environmentally friendly’ feeder and distribution systems such as LRT, trolley-bus and electric bus in preference to private car, taxi and conventional bus.</td>
</tr>
<tr>
<td>Comprehensive pedestrian links (both open and covered/air conditioned) and cycleway should be emphasised, particularly in connection with residential and commercial developments around stations.</td>
</tr>
<tr>
<td>Undergrounding should be adopted as the ‘base case’ vertical alignment when developing rail links, with proposals for at grade or elevated options being pursued only after undergrounding has been clearly established as unfeasible (acknowledging that such options would still be preferable overall to an equivalent road option).</td>
</tr>
<tr>
<td>Bored tunnel construction methods should be adopted in preference to cut and cover methods, with a similar ‘justification’ requirement for cut and cover over bored tunnel as for at grade or elevated options above.</td>
</tr>
<tr>
<td>Develop and maintain guidelines on environmentally preferred design and specification measures for rail links. The manual would include, inter alia, suggestions on topics such as at source noise attenuation maximising natural light within stations, enhancing energy efficiency and using energy efficient appliances, ‘environmentally friendly’ materials, and provide guidance on the preferred construction methodologies and materials to minimise environmental impacts.</td>
</tr>
<tr>
<td>There should be improved co-ordination between government departments, or possibly institutional modifications to ensure that there is both the efficient and timely exchange of information pertaining to the integration of land use requirements and planned housing developments into the railway planning and development process.</td>
</tr>
<tr>
<td>Consideration should be given to the adoption of measures which support and enhance the role of railways as the principal means of passenger transportation in Hong Kong; this may include changes or improvements in policy or at the institutional level.</td>
</tr>
</tbody>
</table>
If there are any major changes in the planning assumptions used during the development to the network that lead to higher transport demand, the railway development plan should be reviewed so that the implementation of the proposed rail infrastructure is, as far as practicable, undertaken in time to reduce the reliance on road transport.

4.3.6 Given the environmental preference for mass transit systems where practical and appropriate, it will be important to supplement the major mass transit systems (such as heavy rail links) by integration of environmentally favoured feeder system (such as trams and electric trolley buses etc.) rather than taxis or conventional buses.

Placing Infrastructure and Facilities Underground

4.3.7 With the rapid advancement of modern excavation techniques and the lack of surface space to cope with land use demands in rapidly growing cities around the world, there has been a renewed interest in the use of underground space. Among those which vigorously pursue underground development are the mountainous countries (where as for Hong Kong developable land is often at a premium) such as Norway where many public recreational facilities are built in man-made rock caverns.

4.3.8 Rail – There are significant environmental benefits achievable by positioning railways underground. These include avoiding operation and maintenance noise impacts, minimizing ecological, cultural heritage, landscape and visual impacts and due to the greatly reduced landtake, providing opportunities to retain valuable land use functions or introduce new uses. It is, however, likely that there would be increased waste disposal requirements from tunnel spoil and other excavation activities.

4.3.9 Road – If roads/expressways are placed underground then the same benefits as described above for railways can be achieved. In addition, air quality impacts from vehicle emissions can be removed with emissions concentrated at known locations (portals and vent shafts etc) where sensitive receivers can be avoided. There is, however, a view that the likely growth in use of electric vehicles over the next decade or so would remove most of the noise and air quality impacts anyway and that avoidance of these impacts alone would not therefore justify the greater costs construction and connectivity difficulties associated with going underground.

4.3.10 In order to maintain the integrity of land with ecological importance, placing roads underground could be considered for future roads in appropriate locations. This would provide a solution to avoid the bifurcation of the natural environment. The creation of such an “ecological corridor” could also serve the function as "air buffers" to allow breezeways and improve urban airflow in certain locations.

4.3.11 The benefits / disbenefits of underground and at grade roads have been considered. An attempt to quantify benefits with respect to noise was included in the CTS-3 as follows:

“A sensitivity test was performed on the likely noise benefits of underground roads using the Central Kowloon Route as an example. This estimated that putting a major link underground would bring about a 6% improvement to the traffic noise levels of the related areas.” [51]
4.3.12 It should be noted however that there are a number of environmental implications of this approach of locating roads underground (such as increased energy requirements for lighting and the need for ventilation) and the decision to place a road underground will need full justification.

4.3.13 The land use related impacts and benefits described above (ecological, cultural heritage, landscape and visual, nuisance, separation and landtake impacts) would however justify underground placement in many cases. It is worth noting in this regard that for at grade expressways, the actual landtake saving for underground alignments would be even greater than for railways due to the larger landtake 'footprint' associated with the typically wider corridors involved for expressways compared with rail lines. Thus the saving in land cost could offset, or be even greater than, the additional construction cost for building roads underground.

4.3.14 As an example, the landtake associated with a dual three-lane expressway including carriageway widths and separation and setbacks is a strip approximately 34 metres wide. This multiplied by the length of the road gives the total landtake of a major road. It will be necessary to make some deductions from this total due to the need for certain non-building areas along the alignment. However these would be project and/or location specific.

4.3.15 Other Facilities – Putting other infrastructure facilities (particularly those considered as undesirable neighbours such as sewage and water treatment works, waste management facilities etc) underground is quite common internationally, for example in the UK and Norway. The benefits are mostly related to nuisance and aesthetics with reduced landscape and visual impacts of importance particularly in areas of high scenic, recreational and tourism areas. In addition, the potential for development of the land above the facility provides an opportunity for imaginative development and significant income which could subsidise the capital and recurrent/operational costs of the facility.

4.3.16 "A Study of the Potential Use of Underground Space" (SPUN) carried out in 1988 was to explore the potential for forming and developing space underground, and construction of underground facilities has been successfully undertaken in Hong Kong with the construction of the Island West Waste Transfer Station in an underground cavern at Mount Davis. In this case, by housing all the major plant and equipment and confining the waste handling operation within the cavern away from the main urban areas, the cavern design provides environmental benefits superior to a surface option in terms of containment of noise and odour and avoidance of visual impact. In addition, the construction of the Stanley Sewage Treatment Works underground overcame the problem of unavailability of suitable land and minimised visual impacts. If undergrounding is not practicable, HKPSG have provided broad guidelines on the required separation distance from the roads / rail lines to sensitive uses. Tables 4.2 and 4.3 summarise the separation requirements.
Table 4.2 Broad Guidelines on Separations Required between Various Types of Road and Residential Developments

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Assumptions</th>
<th>Distance Separation to meet $L_{10(1h)}$ 70dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traffic flow (veh/h)</td>
<td>Vehicular speed (kph)</td>
</tr>
<tr>
<td>Trunk</td>
<td>5000</td>
<td>70</td>
</tr>
<tr>
<td>Primary Distributor</td>
<td>3000</td>
<td>50</td>
</tr>
<tr>
<td>Secondary Distributor</td>
<td>2000</td>
<td>50</td>
</tr>
</tbody>
</table>

*under or about 45° angle of view of receiver on road traffic

Table 4.3 Broad Guidelines on Horizontal Separation between Rail Track and Sensitive Uses

<table>
<thead>
<tr>
<th>Train Type</th>
<th>Horizontal separation from the edge of track to the façade of sensitive uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass Transit Railway (MTR)</td>
<td>150m (open from construction)</td>
</tr>
<tr>
<td></td>
<td>25m (the side parapets break the line of sight of the bogie)</td>
</tr>
<tr>
<td>Kowloon-Canton Railway (KCR)</td>
<td>85m</td>
</tr>
<tr>
<td>Light Rail Train (LRT)</td>
<td>25m</td>
</tr>
</tbody>
</table>

4.3.17 Putting facilities underground is usually more complicated in engineering terms and more costly in construction terms. The ability to offset these aspects by utilization of the land above the facility would be an important aspect in weighing up the pros and cons for such developments. While land in Hong Kong will inevitably become even more precious and scarce due to the growing population, the financial value of the land in dollar terms will vary with the economy and property market. This will affect any cost benefit analysis.

Regulation of Traffic Flow and Demand

4.3.18 Given that traffic generates significant noise and air quality impacts, a possible partial solution would be to regulate traffic levels and flows to offset the adverse impacts caused by increased development pressures. There are a number of ways to regulate or reduce demand and discourage use of private vehicles. Some examples include:

- Financial deterrents such as increasing first registration costs, fuel tax etc. These affect the traffic fleet as a whole and would reduce overall emissions.
- Increase tunnel, bridge, expressway tolls to deter traffic from entering certain areas. This can be used as a means to reduce traffic flows and densities in overcrowded areas.
• Computerised traffic control systems (e.g. using electronically transmitted permits (via mobile phone as recently introduced in London) to access busy areas.

• Electronic Road Pricing (ERP) - This is a method of regulating traffic to achieve selected objectives by the introduction of charges for use of specific roads or areas.

4.3.19 An ERP feasibility study [5] has been completed which considered issues such as practicality, available technology and implications of introducing ERP in selected areas chosen for several reasons including traffic congestion. The environmental implications (essentially noise and air quality impacts) were considered for various traffic related scenarios and these depended greatly on assumptions such as level of charge and timing of charge period and strategic decisions such as changes in characteristics of the traffic fleet.

4.3.20 The ERP feasibility study showed that changes in traffic distribution could be effected using cost charging as a deterrent. ERP has been implemented internationally in a number of countries such as Singapore and Norway. It is an example of a strategic planning tool combined with the application of new technology which could contribute to sustainability.

4.3.21 Another important traffic regulation aspect is the significant number of heavy vehicle trips particularly container trucks to and from the PRD. These diesel engines add to air pollution emissions, noise and nuisance impacts on the main routes. A mechanism to minimize these impacts and reduce unnecessary trips (such as a policy initiative to change custom controls to avoid trips with empty containers) would be beneficial.

4.3.22 A further noise problem is the unnecessary movement of heavy vehicles and container trucks within residential areas causing night-time disturbance. In developing new towns, this could be prevented through the planning of no-through roads to avoid the entering of heavy goods vehicles into residential areas as well as by a number of possible traffic control measures such as providing a form of physical barrier(s) to restrict such movements.

Potentially Hazardous Installations

4.3.23 Integration of the PHIs into the planning principles for the next 30 years requires an appraisal to be carried out of the plans for the existing PHIs and the future plans for their use or improvements in technology which could affect the land uses in the surrounding areas. For those private sector facilities, the provisional plans, if any, will be difficult to obtain due to confidentiality and commercial considerations. Therefore, only plans for the public sector PHIs can be discussed with the regulators or operators. Consultation with EMSD and WSD concludes that there are currently no provisional plans or specific proposals on decommissioning, relocating or declassifying any PHIs under their jurisdiction.

4.3.24 However, in the context of land use planning, the basic tenet of the HK2030 Study is to examine the opportunities for use of land where the existing PHIs are planned to be relocated, downgraded or could possibly be retrofitted with new technology. Such situations may provide the opportunity to reduce the consultation zone (CZ) (or eliminate it totally) thereby providing potential development area(s). The potential for development of course is determined by many factors such as the surrounding land uses, plans for future land uses and the area available.
4.3.25 The broad planning principle as far as PHIs is concerned relates to the elimination or relocation of facilities and use of the former PHI sites in preference to greenfield sites or the inclusion of new technology to permit a reduction in the CZ and thereby “free up” more developable land.

4.3.26 In practical terms, there are only likely to be a few cases where PHI sites could possibly be used as part of the overall development options as for example there is unlikely to be expansion of the residential developments on Tsing Yi, however, options will become more apparent when evaluating the developments proposed.

4.3.27 In the context of the HK2030 Study, where the Development Options are in conflict with a PHI, appraisals of the CZ shall be made to determine alternative solutions or means to circumvent the problem. An example of such an issue would be where a strategic population growth area was being considered in close proximity to a PHI’s CZ, consideration may be given to relocation of the growth area, downgrading of the PHI (e.g. if the PHI is a water treatment works chlorine store, the size of storage may be reduced or chlorine changed to ozone etc) or relocation of the PHI.

4.4 Improvement of Urban Environment

4.4.1 For an urban environment, issues on air and noise are relevant to the health and quality of life of the population. There are sensible and sustainable alternatives for improving the urban environment that will address the present problems.

4.4.2 The majority of our air pollution comes from road traffic, as such any efforts to reduce vehicular road traffic or emissions from it would have a beneficial effect on the air quality, particularly in the Main Urban Area.

4.4.3 The use of mass transit railways can be encouraged by designing high-density developments within walking distance of rail stations. This will effectively reduce private car trips on the roads, and would be facilitated by the provision of park-and-ride facilities at the fringe of the town as well as the provision of comfortable and convenient pedestrian linkages to the stations. Restriction of car parking provisions at congested areas and at convenient locations could also be considered.

4.4.4 For the dense urban areas, bus routes need to be rationalised (viz. Causeway Bay). Pedestrianisation schemes or entry time restrictions for busy streets are planned to be extended to help reduce the public’s exposure to air and noise pollution in blackspot areas. This has been proved to be successful in Causeway Bay and Mongkok. While this is a local planning issue, consideration could be given to the introduction of more traffic free zones in strategic developments. [6]

4.4.5 In the planning of transport infrastructure projects, environmental consideration is one of the important factors. To ensure that the environmental implications have been properly addressed, all major proposed transport infrastructures, be it rail or road, would be subject to the appropriate environmental requirements under the EIAO before their implementation. This reflects the importance that Government has attached to ensure that the provision of the infrastructure would be in an environmentally acceptable manner.
4.4.6 Regulations for the “Prevention of Air Pollution from Ships” are introduced in MARPOL 73/78 (Annex VI). The issue of controlling air pollution from ships – in particular, noxious gases from ships exhausts – was discussed in the lead up to the adoption of the 1973 MARPOL Convention by the International Maritime Organisation (IMO). However it was decided not to include regulations concerning air pollution at the time.

4.4.7 The Protocol and Annex VI to MARPOL 73/78 will come into force 12 months after being accepted by 15 states with not less than 50% of world merchant shipping tonnage.

4.4.8 MARPOL Annex VI, when it comes into force, will set limits on sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibit deliberate emissions of ozone depleting substances.

4.4.9 The Sub-Committee on Ship Design and Equipment (DE) has been instructed to develop guidelines relevant to implementation of the Annex VI, including, as a high priority, guidelines on sampling of fuel delivered for use onboard ships and guidelines for onboard nitrogen oxide monitoring and recording devices.

4.5 Ecological Conservation

4.5.1 As mentioned in Section 3.2, the key issues in relation to ecological conservation would be tackled with the measures as detailed in the following paragraphs.

Determine the current ecological value of Hong Kong's environment

4.5.2 The Biodiversity Survey (Version 3.0) conducted by Hong Kong University for the Environment and Conservation Fund is now available and ready for use. The database compiled in the Biodiversity Survey is the most comprehensive and up-to-date database available at this stage. However, the findings are not adequate to provide a comprehensive account of the habitats of high conservation value in Hong Kong. Therefore, AFCD is going to establish an ecological database for Hong Kong by 2005 and conduct regular biodiversity surveys to take inventory and update the status of our natural assets.

4.5.3 A similarly comprehensive database on the marine environment is not yet available although a number of significant studies have been undertaken which have increased our knowledge of Hong Kong's marine environment. These include:

- Fisheries Resources and Fishing Operations in Hong Kong waters
- Study of Red Tide Monitoring and Management in Hong Kong
- Population Biology of the Indo-Pacific Hump-backed Dolphin in Hong Kong Waters
- Conservation Biology of the Indo-Pacific Hump-backed Dolphin in Hong Kong Waters

4.5.4 A second necessary initiative is the process of relative valuation of the resources within the database. This requires consensus building among the involved parties and stakeholders to produce a defensible valuation process. The process must be systematic and overseas experience would be valuable if modified to suit Hong Kong. A list of different categories of sites for different levels of protection could be
produced from this process and this can then focus subsequent conservation efforts.

4.5.5 A distinction needs to be drawn, based on guidelines, between ecological value and the definable and somewhat subjective issue of preservation of areas of natural beauty, landscape value and amenity value.

**Determine what level of protection is required**

4.5.6 The level of protection required for the valued resources also needs to be decided possibly through a set of guidelines that result from knowledge and consensus building initiatives. Producing these guidelines is a key issue that primarily relates to the ecological requirements of the species or sites concerned, as well as other factors such as threats faced by the species or sites.

4.5.7 A potential outcome of the application of new guidelines would be the review of currently protected areas and an assessment of the conservation values of different parts of the protected areas (e.g. country parks) so that they could be given appropriate levels of protection or be utilized for different purposes (e.g. picnic areas in less ecologically sensitive parts of our Country Parks).

**Develop the best tools to implement this protection**

4.5.8 The tools used to implement the required level of protection are planning instruments and the various options currently available under Hong Kong’s legislation such as SSSI and Country/Marine Park offer different degrees of protection. Reviewing and where necessary, adding to these tools, is a key issue that needs to be addressed.

**Achieve public acceptability for the process and its implementation**

4.5.9 A further initiative will be the need to achieve a high level of public acceptability so that support continues to flourish. Transparency and accountability are important factors.

**Develop new initiatives within the EIA process**

4.5.10 Currently, private developments tend to address ecological issues on an as needed basis. Ways to encourage early participation from the private sector need to be explored as a longer-term objective.

### 4.6 Cultural Heritage Conservation

4.6.1 As mentioned in Section 3.3, solutions to the key issues facing cultural heritage conservation could be initiated using the measures highlighted in the following section.

**Design and Implementation of a Focussed Legal and Administrative Framework for Cultural Heritage Conservation**

4.6.2 A review is needed of the various ordinances which play a part in cultural heritage conservation; including the Antiquities and Monuments Ordinance, the Town Planning Ordinance and ordinances which govern the EIA process and the Urban Renewal Authority. Integration at this level would benefit the overall process. Similarly, the works of the relevant government departments and agencies need to
Define the Nature and Extent of Our Cultural Heritage

4.6.3 The database of heritage resources must include more than just graded buildings, and deemed and declared monuments. If not, problems will inevitably occur at a later stage when some of the many other historical resources are potentially impacted by options designed with insufficient heritage input. As a result, reference to other varied and dispersed sources will be required to augment the limited database and to identify potential constraints on development which are not in the available files.

4.6.4 The use of information technology would substantially improve the management of all cultural heritage in Hong Kong. Networks of database, GIS mapping and computerised heritage inventories are used widely overseas to quantify, manage, categorize and preserve. Most importantly, it would enable implementation of a more comprehensive system of advance notification to inform planners of the presence of important heritage resources in an area. Planning can only help preserve heritage if it knows where and what and how valuable it is. Programmes used in best practice cases overseas should be considered and, if appropriate, recommendations should be made to improve this situation. Nonetheless, it should be noted that the development of such a database system would involve high initial capital cost as well as resources implications in respect of the need to maintaining the updatedness of the data.

Design a System of Relative Significance

4.6.5 The large majority of heritage resources in Hong Kong, both built heritage and archaeological sites, have not been ranked in terms of their significance. This means that the degree to which a resource poses a constraint on planning decisions is not clear. At present, as each individual case arises it is necessary to liaise with the AMO to clarify their position on preservation, removal, reuse etc. A system based on overseas examples but modified to suit local needs is needed which incorporates a statement of relative significance into the process; if it is acknowledged that not every heritage resource is of equal value or deserving of equal treatment, planning can channel and target preservation efforts more effectively. Effective standards for assessing the significance of a wide range of heritage resources employed in Canada, Britain, Australia, Europe and Asia will be considered and if appropriate incorporated in the assessment of the proposed development options.

Expand Indicators of Sustainability

4.6.6 The issue of defining effective indicators to measure the sustainability of heritage resources is receiving wide attention within the world of heritage resource management. The nature of the resource base makes quantification difficult. It is important that Hong Kong, through liaison with the AMO and other parties, participates in this international dialogue and that a refined set of indicators be developed based on the CASET indicators generated by SUSDEV21.

Criteria for Adaptive Re-use of Heritage Resources

4.6.7 The modification of heritage buildings to suit compatible uses is to be encouraged as it can give them new life and help finance their conservation and maintenance. However, too often this process results in unacceptable changes to the significant fabric, irreversible modification and loss of heritage value. A set of professional guidelines based on international best practice is needed to present best practice...
for adaptive re-use of traditional Chinese domestic, religious and commercial buildings and their colonial counterparts.

**Design a Cultural Heritage Tourism Policy**

4.6.8 The administration of heritage tourism to date suffers from fragmentation and lacks a strategy for the identification of heritage resources with potential for tourism development and for their protection and continuing management. It is recommended that the agencies tasked with development of cultural heritage tourism refer to the UNESCO-Asia-Pacific initiative, *Culture, Heritage Management and Tourism: Models for co-operation among stakeholders*. This programme provides detailed and useful models which could be successfully applied to the local situation.

**Encourage the General Public and the Private Sector**

4.6.9 The long-term success of all cultural heritage conservation plans will depend ultimately on the degree of support they receive from members of the public and from private sector investment. Public education and awareness must be promoted and mechanisms developed which will enable and encourage involvement by the local community and current owners of historic sites and private sector to invest in conservation as good business and effective public relations. Many relevant initiatives have been adopted throughout Asia and further afield; these will be considered in the study.

**4.7 Environmentally Sound Technologies**

4.7.1 The use of environmentally sound technologies (EST) and Cleaner Productivity, as with other environmentally preferred methods, processes and equipment, has a major role to play in minimising environmental impacts and in progressing towards sustainability. In particular, they can be applied to polluting processes to prevent rather than cure pollution.

4.7.2 In some cases, the decision on whether utilising the EST will produce an overall environmental benefit is straightforward, however, in other cases the overall environmental benefit may not be so obvious and a life cycle analysis/assessment would be required to determine the ultimate environmental preference. An example of this situation was reported in DSD's 1999 Environmental Report [40] which stated:

"In planning for output optimisation, we need at times to compromise one environmental benefit for another. For example, the adoption of CEPT at the Stonecutters Island STW requires less energy input than secondary treatment processes would. However, more chemicals would be consumed and increased solid waste (sludge) would be generated. On the other hand, the choice of ultraviolet (UV) rays for disinfection at the Shek Wu Hui STW requires more energy input but consumes fewer chemicals."

4.7.3 In the above example, there would also be some indirect land use implications, however, a strategic assessment would not evaluate aspects to this level of detail.
4.7.4 For the development of new towns, rail services should be preferred and used as the backbone to serving main areas. In addition environmentally preferred transport modes should be considered for residential areas, such as people movers, trolley buses and electric movers.

**Electric Powered Vehicles**

4.7.5 One of the aspects of transport sustainability is whether the transport in Hong Kong should be powered by electricity (an environmentally preferred fuel) and whether the electricity should be generated from renewable sources. [4]

4.7.6 In the foreseeable future, there is potential for a move to electrically powered vehicles, replacing the current petrol and diesel powered cars, mini buses and large (single and double deck) buses. This would dramatically reduce noise and air quality impacts in many locations.

4.7.7 The technology for electric powered cars and smaller passenger vehicles including batteries and fuel cells is currently available and in use around the world such as in England, Canada, United States (e.g. North Texas, San Francisco and San Jose), New Zealand, Australia and France. The number of electric vehicles sold in North America, Western Europe, Asia Pacific and the rest of the world is projected to increase from 9,400 in 1997 to 630,000 in 2003. Electric vehicles are suitable for city dwellers driving short distances such as in Hong Kong. [49] Improvements in terms of performance can reasonably be expected in the foreseeable future. However, electric power for “untethered” larger vehicles such as public buses have proved more difficult and in the foreseeable future these would be likely to require trolley buses with the associated limitations in the routes taken.

4.7.8 For heavy vehicles and freight transportation by road, current technology would require the vehicles to be tethered, either to trolley bus wires or for well established routes (including new links with the Mainland) to trolley wires (and road lanes) dedicated to heavy goods vehicles. [4]

4.7.9 The Transport Department has completed a trial on electric and LPG public light buses in 2001. Both energy sources are less polluting than diesel. The trial confirmed that they are technically feasible options for light bus operation in Hong Kong. A government grant programme, similar to that of the taxis, to encourage the owners of diesel public and private light buses switching to cleaner LPG was introduced in August 2002. It is expected that 6,000 public and private light buses would join the programme. They have the option of switching to either LPG or electric vehicles.

**Use of Water-Cooled Air Conditioning System (WACS)**

4.7.10 A Preliminary Study on Wider Use of WACS in Hong Kong commissioned by EMSD has shown that the WACS are technically feasible and that there are a number of types of WACS schemes that are economically and financially viable. In addition, there are some significant environmental benefits in adopting WACS in terms of energy savings and associated reduction of greenhouse gas emission; reduction of imported fossil fuel for power generation; possible deferral or reduction in power station provision; and hence, at least indirectly, reduce the environmental and land use impacts. Moreover, as already mentioned for other facilities, placing of the WACS underground rather than on roofs of buildings could enable development of so called “sky-gardens”.
Control of Power Plant Emissions

4.7.11 Technology control options for end-of-pipe fuel gas treatments are well established. These measures which are already widely used in coal-fired plants include fuel gas desulphurization, low-NOx burner and electrostatic precipitators for RSP.

4.7.12 Alternate energy such as hydroelectric power, wind energy, solar energy and geothermal energy should be explored. These have been described in section 4.9. The use of cleaner fuels is also one of the possible solutions to reduce power plant emissions.

4.8 Waste Minimisation, Recycling and Reuse

4.8.1 A holistic approach to waste management is necessary, no one scheme will provide the solution to the waste management problem. Reducing packaging, minimising waste volumes for disposal and increasing the reuse and recycling of materials requires the dedication of all parties including the general public, commercial and industrial facilities, and the construction industry. Education on the state of the environment, and the scale of the waste problem is the key to increasing awareness of the need to reduce packaging, reduce and recycle waste. Increasing awareness of environmental issues should encourage consumers to purchase products with improved recyclability, greater durability, and where economically rational, with a higher recycled content.

4.8.2 To ensure that good intentions are put into practice the facilities to allow collection, separation and recycling of materials must be in place and easily accessible. Further research is required into the feasibility of collection and separation schemes, and new buildings need to be designed to incorporate space for such activities.

4.8.3 Economic tools such as the use of landfill charges, if introduced in Hong Kong, will create revenue which can be redistributed to environmentally sound waste management projects. These funds could also be used for research into potential markets for recycled materials.

4.8.4 Not all segments of the recycling industries are profitable, therefore the leasing of land at low rates for use by some of these facilities, or using restored landfill sites for waste recovery and recycling facilities, along with investment in market opportunities for recycled products could be considered to stimulate recycling.

4.8.5 A study on the Long-term Arrangements to Accommodate Inert Construction and Demolition Materials and Dredged Mud was commissioned by CED in 2001 to evaluate possible accommodation arrangements for inert C&D materials in the long term. The possible options will be examined in this study encompassing the reclamation of an artificial island, or a coastal reclamation, or a land-based site. Other possible options include opportunities for beneficial reuse outside HKSAR and identifying environmentally acceptable outlets, placement of inert C&D materials within disused typhoon shelter, infilling of exhausted quarries, the construction of breakwaters and the creation of artificial reefs to enhance biodiversity and fisheries habitat. An alternative approach to tackle the shortage of public filling capacity is to reduce the amount of inert C&D materials generated through, for example, reducing site formation/developments in greenfield sites and encouraging the rehabilitation of old buildings, instead of total redevelopment.
4.8.6 As some of the waste recovery / recycling industry at the waterfront areas may be displaced due to other waterfront developments, it is essential that adequate waterfront facilities are included in the land use plans to enable continued operation and possible expansion of waste recovery activities.

4.9 Resource Conservation

Background

4.9.1 Resource conservation should be a major objective of development planning in line with sustainable development principles. Hong Kong has a shortage of natural resources and is not self sufficient in many of the main resource areas. It therefore depends on import of resources such as for example drinking water, energy, wood and minerals, this makes the need for resource conservation even more relevant, and it can only be anticipated that this will be exacerbated by the projected population growth unless plans and policies can reduce demand.

4.9.2 An international viewpoint on this aspect is the recent report on environmental planning by the Royal Commission on Environmental Pollution in the UK [38], which states that a key purpose of its review of planning in the UK should be to achieve environmental sustainability. It also stated, for example, that “at all levels of town and country planning the availability of water is treated primarily as an issue, not about resources and the environment, but about phasing, given that water companies have a statutory duty to provide supplies once development takes place.” The Commission believed that this approach is not in accordance with sustainable principles.

4.9.3 The Commission also found that “there is no adequate recognition in development plans, or in other plans, of the importance of designing new developments to make less demand on resources”.

Opportunities for Renewable Energy

4.9.4 Increased use of renewable energy that displaces or reduces the use of fossil fuels can help reduce the negative environmental impacts associated with fossil fuel combustion. There are, of course, also negative environmental impacts associated with renewable energy use, especially if examined over the full life cycle of production and decommissioning, although the disadvantages are generally small in comparison to renewable energy’s benefits.

4.9.5 Within Hong Kong, it has been estimated that at the year 2000 around 50% of energy consumed is in commercial buildings and approximately 23% in residential buildings (Energwits). Therefore substantial savings can be made if the energy efficiency of these buildings can be improved. Building design has a significant contribution to make to energy conservation, further details are provided in Section 4.10. The energy consumed by industrial users is decreasing over time as industrial manufacturers relocate to the Mainland where the labour and land costs are much less. Whilst this reduces the electricity requirements locally, electricity production from fossil fuels per se results in GHG emission which is a global problem.
Internationally, research into renewable energy technology is advancing, recent developments which have the potential for application in Hong Kong include:

- **Hybrid Electric Vehicles (HEVs)** – These combine the internal combustion engine of a conventional vehicle with the battery and electric motor of an electric vehicle, resulting in twice the fuel economy of conventional vehicles. This combination offers the extended range and rapid refuelling that consumers expect from a conventional vehicle, with a significant portion of the energy and environmental benefits of an electric vehicle. The practical benefits of HEVs include improved fuel economy and lower emissions compared to conventional vehicles. The inherent flexibility of HEVs will allow them to be used in a wide range of applications, from personal transportation to commercial transportation.

- **Solar Power** – particularly small-scale solar panels placed on structures provide substantial opportunities for energy generation. Three new buildings incorporating solar panels are to be constructed in Hong Kong in 2003 (www.skylin.net-makers.org/new/1201/031201.htm).

- **Wind** – currently small wind power is used to generate energy for unmanned weather monitoring facilities. There is potential for larger scale application, especially through co-operation with Guangdong. It is noted that CLP is conducting some studies in this respect together with Guangdong.

- **Energy From Waste** – there are opportunities for use of volumes of municipal solid waste generated in Hong Kong (approximately 9,000 tonnes per day are currently disposed of to landfill) in energy from waste facilities. There are additional benefits of this method of energy generation, including the reduction of MSW requiring landfill disposal.

- **Landfill Gas** – currently the majority of gas produced from Hong Kong’s 13 closed landfills is flared off. There are opportunities to capture this resource and use it for electricity generation.

To seize the opportunities, Hong Kong could establish a renewable energy market (use of solar, wind, energy from waste etc.) and gradually build up the experience with the technologies, whilst the cost of installing the electricity generating equipment will initially be high, the long term cost in terms of fuel savings and reduced environmental degradation will be great. Establishing such a market would need support from Government and initiatives from both the Government and industrialists.

Serious commitment to reducing emissions is required. This will need the commitment of all sectors. The major challenge for renewables is to get them into a reliable market at a price which is competitive with energy derived from fossil fuel, and without disrupting the local economies. Internalising the external environmental costs of energy production from fossil fuels will provide more realistic figures for energy production and should increase their competitiveness.
4.10 Building Design

4.10.1 To protect and improve the built and natural environment, construction of green and innovative buildings should be promoted. The objective is to encourage the design and construction of buildings that encompass the following features:

- Adopting a holistic life cycle approach to planning, design, construction and maintenance
- Maximising the use of natural renewable resources and recycled/green building material
- Minimising the consumption of energy, in particular those non-renewable types
- Reducing C&D materials which are generated

Incentives

4.10.2 Encouraging the industry to explore ways to improve environmental performance during construction and throughout the life cycle of new buildings by incorporating initially the features as mentioned above is desired. A list of green features that may be exempted from Gross Floor Area (GFA) and Site Coverage (SC) calculations. As mentioned in the Joint Practice Note No. 1 and 2 issued by Buildings Department, Lands Department and Planning Department, the list will be continuously reviewed and revised in pace with the ongoing development of green buildings and new incentives to encourage the provision of new green features in buildings.

Holistic Life Cycle Approach

4.10.3 Consideration of ecology, non-renewable resources such as quarried materials, brick and metals, water consumption and reuse, energy consumption, etc. should be given during the planning, design, construction and maintenance stages in order to achieve environmentally better building concepts.

4.10.4 The process of environmental assessment provides a means of taking time to consider the environmental impacts of a building, and investigating methods to minimise or mitigate identified impacts. Use of the design features which incorporate elements of the natural environment will need to be encouraged to prevent sterilization of the urban landscape. This can be achieved through the incorporation of open or planted areas within a building. One relevant international innovation in environmentally conscious construction and which is eminently practical in nature and is expected to be taken up in Hong Kong is incorporation of a “Communal Sky Garden” for residential buildings. It provides natural ventilation, greenery and recreational garden space for communal use. In the Hong Kong context support for the concept can be seen in the recent Joint Practice Notes from Buildings Department, Lands Department and Planning Department entitled “Green and Innovative Buildings” and “Second Package of Incentives to Promote Green and Innovative Buildings”.

4.10.5 An incentive for incorporation of a Communal Sky Garden is that they are eligible to be exempted from GFA calculations provided they meet certain criteria which include that they must be communal, are not used for commercial purposes and all trees, furniture and equipment are fixed to permanent constructions. Through this initiative there is obviously scope for increasing the numbers of trees, plants and green areas in the urban area.
Recommendations

4.10.6 Recommendations for increasing sustainability through building design include:

• Installation of structures on natural areas should be avoided
• Incorporation of vegetation/green features within the building structure
• Incorporation of space within flats to allow occupants to conduct waste separation/recycling activities
• Provision of central facilities for separated waste which are easily accessible for collection by recycling companies
• Provision of areas for compaction facilities to reduce overall waste volumes
• Incorporation of energy/water saving features
• Maximisation of the use of natural resources, e.g. daylight, ventilation
• Applying appropriate design and carrying out modelling assessments to ensure good air ventilation between building blocks
• Reuse of construction and demolition materials
• Selection and specification of building materials used to allow the preferential selection of ecologically benign alternatives
• Reduction in the use of packaging (for components of the building structure and functionality)

4.10.7 Many of these solutions could also be applicable to other infrastructure development.

4.11 Construction Best Practice

4.11.1 Due to the topography, available land and population density construction is a very noticeable industry in Hong Kong. The proximity of construction sites to sensitive receivers means that construction related environmental impacts can be excessive. Improved construction practises and performance are essential to improve the sustainability of the activity.

4.11.2 A Best Practice Guide for Environmental Protection on Construction Sites – Part 1 was prepared and issued by The Hong Kong Construction Association (HKCA) Limited in 2001. The Guide can serve as a reference to the HKCA members in preparing environmental protection works during project planning and execution. The guidebook covers the best practice guides for project planning, chemical waste management, dust control for open areas and haul roads, and wastewater management.

4.11.3 HKCA has recently published an updated Best Practice Guide (BPG) 2002 [50]. The main areas covered include Environmental Legislation; Project Planning; Dust Control; Construction Noise; Wastewater Management; Construction and Demolition Material Management; Chemical Waste Management; Environmental Impact Assessment Ordinance requirements; ISO 14000 Environmental Management Systems; and Green Site Practices.
4.11.4 Construction related environmental impacts can affect land use, however they are by nature temporary and limited to the duration of the construction activity. Items such as the location, materials used and the finished product are controlled by the planning and design stages and do not normally alter the land-use/land-take aspects.

4.12 Institutional Mechanisms

4.12.1 There are many institutional mechanisms which could be considered for implementation to address the environmental issues raised in this report and in various forums to effect a greater movement towards sustainability. As a subject related example, several Institutional Mechanisms could be considered to address the key issues identified for ecological conservation. These would include:

- Developing stronger and more integrated relationships between the Authorities responsible for environmental protection / conservation and implementation of works (viz. Secretary for Environment, Transport and Works) is a positive step
- Determining appropriate interfaces for consensus building with appropriate key organisations and individuals
- Developing stronger systems to encourage the private sector to constantly invoke ecological conservation principles within their projects

4.12.2 Another subject related example is for water quality issues. Due to the interactive nature between the HKSAR waters and the Mainland waters, good cooperation and coordination between HKSAR and the neighbouring region in combating the shared water pollution problems is essential. In this regard the agreement in the Hong Kong - Guangdong Environmental Protection Liaison Group in 1998 to work towards removing all effluents from the Deep Bay catchments as a long-term goal is encouraging. In addition special Panels have already been set up under the Joint Working Group on Sustainable Development and Environmental Protection to discuss the water quality of the PRD including Deep Bay and Mirs Bay.

4.12.3 These type of mechanisms would have significant long-term effects and will be considered for inclusion in the Strategic Environmental Action Plan as part (Task 8) of this SEA Study. They would not however, in most cases directly affect the consideration of the HK2030 Development Options currently under preparation.

4.12.4 The setting up of the Council for Sustainable Development (CSD) and the Sustainable Development Unit (SDU) will address sustainability issues. More specifically, the main tasks for the SDU are to facilitate the integration of sustainable development into new government initiatives and programmes and in the community generally, and to provide support to the CSD. The CSD is expected to provide expert advice to the Government, keep the public informed about its work and encourage the community to put the concept of sustainable development into practice.
4.13 Increased Investments on Environmental Infrastructure

4.13.1 As discussed in Section 2.5, the increased environmental awareness and education in the community as a whole (public, government, business, industry, academia, visitors and tourists etc.) creates a greater expectancy (and even demand) for a better quality environment and more stringent environmental standards.

4.13.2 Recognition of this situation (and appreciation of the importance of environmental issues) by government has led to environmental issues being given greater prominence and influence in planning and administration of Hong Kong’s affairs.

4.13.3 This inevitably translates into greater public sector expenditure on environmental aspects and management including new or expanded facilities such as sewage treatment works, waste management facilities etc. Many of these have significant land use implications. The total estimate for Government resources devoted to environmental protection work in 2000 was HK$ 8,842 million. [8]. This includes items such as design, construction and operation of wastewater collection, treatment and disposal facilities.

4.13.4 It is expected that this situation will continue and increase in Hong Kong (and internationally particularly in World Class Cities) placing further demands on the limited land availability and needs to be allowed for in land use planning.
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## ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>AFCD</td>
<td>Agriculture, Fisheries and Conservation Department</td>
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<td>AMO</td>
<td>Antiquities and Monuments Office</td>
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<td>API</td>
<td>Air Pollution Index</td>
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<td>C&amp;D</td>
<td>Construction and Demolition</td>
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<td>CAD</td>
<td>Civil Aviation Department</td>
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<td>CCPHI</td>
<td>Coordinating Committee on the Land-use Planning and Control relating to Potentially Hazardous Installations</td>
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<td>CCW</td>
<td>Coal Combustion Waste</td>
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<td>CLP</td>
<td>China Light Power Hong Kong Limited</td>
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<td>CO</td>
<td>Carbon Monoxide</td>
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<td>CO₂</td>
<td>Carbon Dioxide</td>
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<td>CZ</td>
<td>Consultation Zone</td>
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<td>DO</td>
<td>Dissolved Oxygen</td>
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<td>DSM</td>
<td>Demand Side Management</td>
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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>Environmental Impact Assessment Ordinance</td>
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<td>EST</td>
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<td>EU</td>
<td>European Union</td>
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<td>FCA</td>
<td>Frontier Closed Area</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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HKSAR  Hong Kong Special Administrative Region
IAR    Initial Assessment Report
KCRC  Kowloon Canton Railway Corporation
LNG   Liquefied Natural Gas
LPG   Liquefied Petroleum Gas
MSW   Municipal Solid Waste
MTRC  Mass Transit Rail Corporation
NEF   Noise Exposure Forecast
NENT  North East New Territories
NO₂   Nitrogen Dioxide
NOx   Nitrogen Oxide
Pb    Lead
PFA   Pulverised Fuel Ash
PHI   Potentially Hazardous Installations
PM₁₀  Particulates smaller than 10 μm
PRD   Pearl River Delta
RSP   Respirable Suspended Particulates
SC    Site Coverage
SCA   Scheme of Control Agreement
SDU   Sustainable Development Unit
SEA   Strategic Environmental Assessment
SEZ   Special Economic Zone
SMP   Sewerage Master Plans
SO₂   Sulphur Dioxide
SUSDEV 21 Sustainable Development for the 21st Century
SZ    Safety Zone
TDS   Territorial Development Strategy
TEUC  Total End-use Energy Consumption
TN    Total Nitrogen
TIN   Total Inorganic Nitrogen
TSP   Total Suspended Particulates
UN    United Nations
UNCED United Nations Conference on Environment and Development
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<td>Water Control Zone</td>
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<td>WRFP</td>
<td>Waste Reduction Framework Plan</td>
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<td>WTO</td>
<td>World Trade Organisation</td>
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Footnotes


3 The Government is reviewing various waste treatment technologies including waste-to-energy technologies for the development of future integrated waste management facilities in Hong Kong.

4 Sustainable development in relation to the travel and tourism industry is development that meets the needs of present tourists and host regions while protecting and enhancing opportunity for the future. It is envisaged as leading to the management of all resources in such a way that economic, social and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems. (World Tourism Organisation)