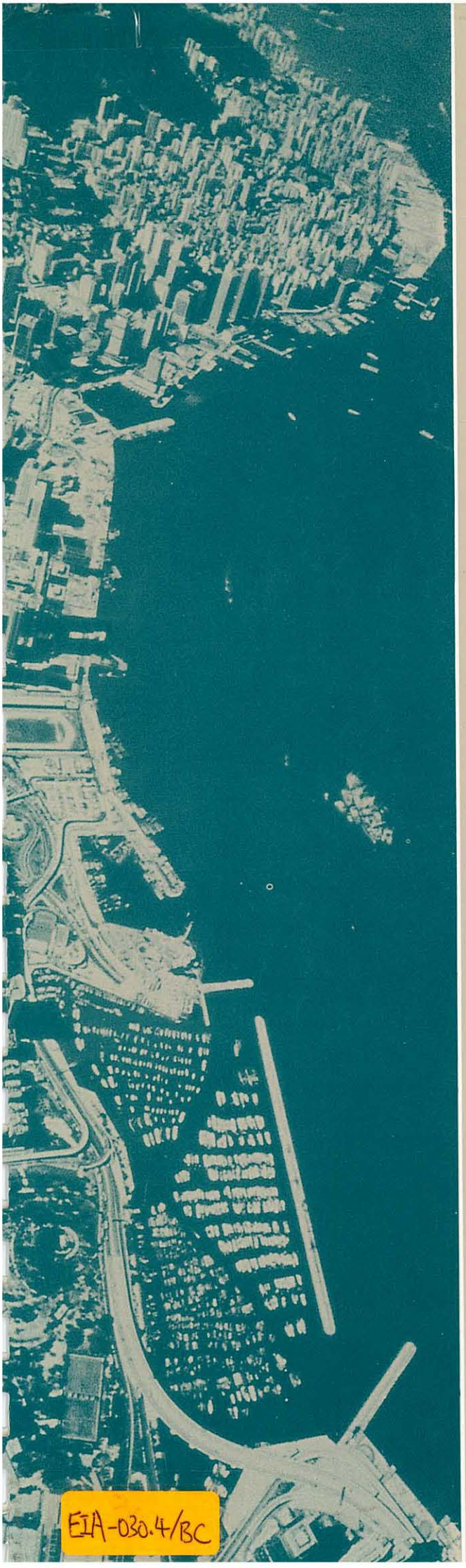




Hong Kong Government
Territory Development Department
Urban Area Development Office

# Central and Wan Chai Reclamation Development

## Focussed Study for the Proposed Extension to the Hong Kong Convention and Exhibition Centre



**Stage 2 Final Report**
**Executive Summary - Environment**

Maunsell Consultants Asia Ltd
in association with
Balfours International (Asia)
MVA Asia Ltd
CES Consultants in Environmental Sciences (Asia) Ltd

Hong Kong Government
Territory Development Department
Urban Area Development Office
Agreement CE 12/93

Central and Wan Chai Reclamation Development

# Focussed Study for the Proposed Extension to the Hong Kong Convention and Exhibition Centre



## Stage 2 Final Report
## Executive Summary - Environment

January 1994

**Maunsell Consultants Asia Ltd.**
in association with
Balfours International (Asia)
MVA Asia Ltd.
CES Consultants in Environmental Sciences (Asia) Ltd.
HWR Hydraulics and Water Research (Asia) Ltd.

# Focused Study for the Proposed Extension to the Hong Kong Convention and Exhibition Centre

## Stage 2 Report
## Executive Summary
## Environment

### 1 Introduction

In 1992 Hong Kong Government commissioned Consultants to look at the infrastructure requirements for an island extension to the Hong Kong Convention and Exhibition Centre (HKCEC). In the same year, the Environmental Protection Department carried out an appraisal of environmental issues relating to the scheme. A number of concerns arose from this appraisal and in order that these be properly addressed, a multi-disciplinary focused study was commissioned.

This latter study was in two stages, namely; an initial assessment to establish the viability of the scheme followed by a more detailed examination of traffic, engineering and environmental issues. This Executive Summary presents the results of the Environmental Impact Assessment (EIA) performed to confirm the environmental acceptability of the scheme and to work out the full environmental requirements and related mitigation measures.

### 2 Scope of Work

The EIA addressed issues relating to sewerage and drainage, water quality, disposal of dredged muds, air quality, noise and solid waste disposal. Numerical modelling was used as part of the investigations into water quality (sediment plume and pollutants), air and noise impacts . Marine mud disposal for the scheme was the subject of a separate report which established the nature and extent of contaminated mud (Reference 1). This latter report was referred to in assessing the impact of the dredging works. The main issues and conclusions of each of the foregoing issues are summarised separately below.

### 3 Sewerage and Drainage

The existing sewer reticulation within the Wan Chai area will not be directly affected by the proposed Island Scheme. Current proposals for the Wan Chai section of the Sewerage Master Plan are programmed for completion in 1998. Flows from the HKCEC will be routed to the existing Wan Chai East Sewage Screening Plant, which will be expanded. Effluent from this plant discharges into Victoria Harbour 600 m from the sea wall. The predicted peak sewage flow from the development is approximately 80 $l.s^{-1}$ which will produce a daily pollution load of 450 $kg.d^{-1}$ for both Biochemical Oxygen Demand and suspended solids.

There are eleven stormwater systems which discharge within 1 km either side of the proposed site. Of these, the reclamation will have an affect on only one; Catchment M (see Figure entitled 'Location of Stormwater Outfalls'). The outfall from Catchment M lies within the tidal range of the harbour water and was ranked fourth highest in terms of pollution loads based on BOD. This will therefore have a significant impact on water quality around the island reclamation.

Catchment M has been demonstrated to have insufficient capacity which may lead to flooding. Analysis of the effect of the reclamation has indicated that there would be a minor increase in predicted flooding. The proposed island will be 75 m offshore of the mainland and Outfall M will discharge directly into the Harbour at its present position, into the channel between the island and mainland. Remedial works will not be required for the island reclamation phase of the development and may be deferred until the full reclamation of the Exhibition Cell is implemented. The drainage culvert will eventually have to be extended through the full reclamation to the new sea wall to maintain its discharge to the Harbour.

Large sections of the seawall in the vicinity of the development are occupied by numerous cooling water intakes and outlets. Currently about 7 $m^3.s^{-1}$ of seawater during peak summer demand is supplied to existing airconditioning and toilet flushing systems. Reprovisioning of these systems will not be required for the proposed reclamation. However, silt levels in the water during reclamation will be higher than at present and this requires careful monitoring and mitigation if required.

Contaminated stormwater from Outfall M will probably have the greatest impact on water quality. This contamination arises from expedient connections within the network. A survey of expedient connections is required to determine the source and location of all connections of foul flows to the stormwater system before remedial measures can be proposed. This work should ideally be carried out before the SMP detailed design stage commences in 1994 so that the findings could be incorporated within the SMP improvement measures. In anticipation of improvements, mitigation scenarios for the purposes of water quality modelling were based on a 25% reduction in loading.

## 4 Water Quality Impacts

Existing water quality in Victoria Harbour is poor. If compared to general water quality objectives applicable to gazetted Water Control Zones, all parameters would fail the required standards with the exception of dissolved oxygen. Sediments in the Harbour are highly contaminated with metals and also contain high concentrations of organics and nutrients. Therefore any additional inputs of contaminants into the water column will exacerbate the present situation. The key issues in this respect are increases in suspended sediments during dredging and the affect of those sediments on water quality, additional inputs of sewage from the Extension, and the affect of reclamation programmes on the dispersion of contaminants within Victoria Harbour.

Sediment plume modelling was based on dredging 500,000 $m^3$ of mud with a 3% loss to the water column. On this basis, most of the area would experience increases in suspended sediment loads of 0.001 to 0.005 $kg.m^{-3}$ for surface and bottom waters respectively, compared with an existing depth average of 0.01 $kg.m^{-3}$. The sediment plume was narrow and extended for 7 km just offshore and parallel to, Central and Wan Chai. North Point was predicted as receiving the greatest sediment loads as this was the limit of tidal excursion and local conditions favour deposition. Wet season spring tide simulations represented the worst case for North Point with 0.01 $kg.m^{-3}$ and 0.005 $kg.m^{-3}$ for bottom and surface waters respectively.

Pro rata reductions in suspended sediment loads for lower volumes of dredged mud (220,000 and 50,000 $m^3$) for worst case conditions at North Point would result in concentrations of 0.044 and 0.01 $kg.m^{-3}$ for bottom waters and 0.002 and 0.0005 $kg.m^{-3}$ for surface waters. Throughout the general area, increases in suspended solids would

not be physically measurable for these lower dredging volumes. In view of the wide lateral dispersion of suspended sediments and the tendency for the highest concentrations to be found in the bottom waters, visual impacts of suspended sediments arising from dredging are not likely to be a key issue other than in the immediate vicinity of the dredger. It is also unlikely that local accumulations of sediment will occur.

Increased BOD arising from sediment resuspension under the proposed dredging rates will be negligible. The oxygen demand is dependent on dredging rate and the volume of water available for dispersion, not the total volume of mud to be removed. BOD resulting from dredging activities is therefore not considered to be a key issue.

Water quality modelling of several scenarios identified the option with least water quality impact to be that in which all stormwater loads were reduced by 25% together with a 50% reduction on outfall M (which discharges into the channel between the shoreline and the island extension). This scenario included committed reclamations for Central and Wan Chai, and the island extension. Water quality parameters were predicted to be marginally better than for the Baseline condition (committed reclamations without the island extension) except at two monitoring stations which lie within the channel between the island extension and shoreline. Here, water quality was marginally poorer than for the Baseline although this effect would appear to be localised.

Additional sewage from the HKCEC Extension would represent 2% of the present load entering from Central and Wanchai. Water quality model predictions indicated an increase in *E.coli* of 8.6% for wet season neap tide. This disproportionate increase in *E.coli* concentration arises from the reduced volume and assimilation capacity of Victoria Harbour resulting from the proposed reclamations. The modelled scenario representing the best mitigation measures in reducing the impact of *E.coli* and other water quality parameters will still result in an increase over present levels, albeit relatively small. Until there is an improvement in sewage treatment capability, no real improvement in water quality can be expected in the study area.

Floating debris will continue to be a problem in the study area, as at present. The construction of the island extension will provide opportunity for floating debris to collect on the east and west sides of the island. However, as the island nature of the extension will be a temporary measure pending further reclamations, there are probably no mitigation measures which could sensibly be incorporated into the design of the island within existing constraints. It is considered unlikely that the presence of the island extension will significantly increase the accumulation of debris in the general area and that the best option will be physical collection.

## 5 Marine Mud Disposal

Sediments in the study area have been classified as Class C and therefore require special dredging and disposal methods. Five metals (Pb, Zn, Hg, Cu and Cr) were present in particularly high concentrations. Concentrations of cadmium and nickel were low in all cases.

The Class C sediment was limited to the surface layer (<30 cm depth) or non-existent, depending on location, with the exception of one station where the depth of contaminated sediment was 1 m. Typically, metal concentrations diminished as a function of increasing depth. For the purposes of practical dredging, the

contaminated muds have been defined as the top 1 m for contaminated locations. Depending on the dredging scenario adopted (part or all of the new sea wall), the volume of contaminated mud has been estimated to be between 11,500 and 34,000 $m^3$.

## 6 Air Quality

The major potential additional impacts from the HKCEC Extension will arise from dust generated during reclamation and construction. Vehicle and plant exhaust emissions are not considered to be a key issue.

In the absence of mitigation measures, there may be adverse impacts at some of the sensitive receivers which have a direct line of sight with the reclamation ie HKCEC, Grand Hyatt Hotel, New World Harbour View Hotel, Great Eagle Centre and Harbour Centre. Calculations have shown that TSP concentrations may exceed acceptable limits by up to 35%. However, with the adoption of dust suppression measures, particularly an effective watering programme, calculations have shown that the TSP concentration at all receivers will be within the acceptable limit.

The evaluation of air quality assessment during the operational phase was considered for design horizons of 2001 and 2006. All predicted concentrations for CO, $NO_2$ and TSP were compliant with Air Quality Objectives.

## 7 Noise

It has been concluded that the 75 dB(A) non-statutory day-time limit for construction noise will be slightly exceeded at all NSR's but due to the mitigating effects of central air conditioning, high quality double glazing and shielding by other buildings, noise levels within the buildings will be acceptable. Furthermore, as the calculations were based on all equipment operating at one location simultaneously to simulate the worst case scenario, in reality, noise levels will be even lower than calculated. Mitigation would be necessary for night-time work in the form of noise barriers around stationary plant and would have to comply with the requirements of the Construction Noise Permit. Noise from Percussive Piling will be controlled by license under the Noise Control Ordinance.

Traffic noise assessment was based on predicted figures for 2001 and 2006 which are higher than those at present, and predicted that the HKPSG limits may be exceeded by a maximum 4 dB(A) in those years. The maximum exceedance appears at the northern facade of The Academy for Performing Arts for both design years. However, these figures reflect the overall change in traffic flows in the study area, which are dominated by Gloucester Road and Harbour Road, and do not represent noise specifically due to HKCEC traffic. The presence of central air conditioning, high quality double glazing and the building fabric would reduce the impact of traffic noise on the occupants of the buildings. Traffic noise levels at residential buildings are predicted to be lower in the future than at present, and there will not be any additional noise impact arising from the development.

## 8 Solid Waste Disposal

Disposal of marine muds has been discussed in 5 above. The main source of wastes for disposal will derive from demolition and construction activities although there will be very little demolition waste. The fate of these wastes will depend upon the fill material used in the reclamation. If the site is categorised as a public dump site then

all or most of the material produced by demolition and construction can be disposed of on site. Publicly dumped material would be limited to concrete or inert material of a size complying with the specification for the area. Contractor-sourced fill as opposed to public dump fill may be preferable as this would permit more control on site traffic movements.

## 9 Conclusions

There are unlikely to be major environmental impacts arising from the proposed island extension. The influence of dredging activity on suspended sediments and water quality parameters is predicted to be minimal due to the small volume of sediment to be removed ie only for foundations for the new sea wall. Suspended sediments will be distributed over a distance of 7 km by water currents, further reducing the local impact. Sewage loading to the area will increase by only 2% and this will be discharged through the existing outfall 600 m offshore. The existing poor water quality will be further degraded but only to a small extent, arising mainly from the reduction in volume of Victoria Harbour as all proposed reclamations in the area progress.

Stormwater outflow from Catchment M into the channel between the waterfront and the island extension may cause local problems in water quality. This will be a temporary situation pending completion of proposals for the whole Exhibition Cell when this channel will be reclaimed.

Air quality impacts can be successfully mitigated by the adoption of dust suppression measures, particularly an effective watering programme. Noise sensitive receivers may be exposed to levels which exceed the non-statutory day-time limit but noise is expected to be attenuated by existing glazing and air conditioning. Mitigation against noise may be necessary for night-time work.

**Reference 1** "Focused Study for the Proposed Extension to the Hong Kong Convention and Exhibition Centre - Sediment Quality Report" published in September 1993.

# 香港會議展覽中心
# 擴建計劃專注研究

## 第二期報告
## 行政綱要
## 環境方面

1. 導言

香港政府在一九九二年委托顧問公司對香港會議展覽中心島式擴建工程的基礎結構要求進行研究。 環境保護署於同年亦對該工程有關的環境問題進行評估。爲了探討其中若干受關注的問題，香港政府再而委辦了一項多科目的專題研究。

這項研究分兩個階段進行：初步評估，以確定本項目的可行性；隨後，對交通、工程和環境等問題再進行一項更爲詳盡的考察調查。本報告根據環境影響評估(EIA)的結果進行了總結，以確定該項工程在環境上的可接受性，並制訂出全面的環境要求和有關舒緩環境影響的措施。

2. 工作範圍

環境影響評估涉及的問題包括：污水及下水道需求、水質、挖掘擬泥的處置、空氣質量、噪音和固體廢物處置等。研究工作中的一部份是對水質(沉積帶和污染物)、空氣和噪音影響進行數值模擬。此工程中的一份獨立報告(參考一)確認了海底受污染污泥的性質和範圍，爲對挖泥工程影響評估的參考。上述各問題的要點和結論總結如下：

3. 污水系統和排水系統

灣仔區目前的排污系統將不會直接受建議中的人工島工程影響。建議中污水收集整體計劃灣仔段工程將於1998年完成。現有灣仔東區污水過濾廠將擴建，以

處理從香港會議展覽中心排出的污水。經處理污水將送至離維多利亞港護岸600米的地方排放。預計新開發區的高峰污水流量可達每秒80升，相對的生化需氧量(BOD)和懸浮固體(SS)的污染負荷達每日450千克。

在建議中的工地兩側一公里的範圍共有11個暴雨排水系統。填海工程僅會影響其中M集水區(見“暴雨排水區位置”圖)。這集水區的溢水道位於海港水潮汐範圍內，而以生化需氧量爲基準的污染負荷是第四高。因此，此島的填海工程將對周圍的水質產生顯著影響。

模擬顯示M集水區的容量不足，因而可能導致氾濫。根據填海影響分析，預期的洪水量將可能稍有增加。建議中的人工島將會位於離岸75米的位置，M集水區的溢水道將會在目前的位置將水直接排入人工島與海岸間水域。此集水區於日後中環至灣仔填海工程中展覽館部份實施前，將不需要進行任何舒緩工作。排水道涵洞最終必須擴展，通過整個填海區擴展至新的護岸，以將污水排至海港。

在開發區附近的護岸上大部份均佈滿了無數冷卻水進水管和排水管。目前，在夏季高峰期間，提供給現有空調系統和洗手間沖水系統的海水量大約是每秒7立方米。擬議中的填海工程將不需要重新配置此等系統。然而，在填海期間，海水的淤泥量一定比現時爲高，需予以嚴加監控，在必要時採取適當的舒緩措施。

從M溢水道流出的受污染溼流預計會對水質的影響最大。排水系統內的非法接駁亦是污染來源之一。需要調查這類連接，以確定流入雨水排泄系統所有污水連接管的來源和位置，然後建議補救辦法。這項工作最好在1994年污水收集整體計劃進行詳細設計階段前進行，以便將這些調查的結果加入污水收集整體計劃的改進措施中。電腦模擬中的舒緩措施是以預計減少25%負荷量爲基礎。

4. 水質影響

目前維多利亞港的水質欠佳。若將其與憲報上刊出的水質控制區的水質目標相比，除溶氧量外，其他所有參數都不能符合標準。海港沉積物內含有大量金

屬、高濃度有機物和營養物。因此，向此水域引入任何額外的污染物都會令目前的情況更加惡化。這方面的關鍵問題包括：在挖泥過程中，懸浮的沉積物增加，以及這些沉積物對水質的影響；從擴建工程排出額外的污水；以及填海工程對維多利亞港內污染物擴散的影響。

沉積帶的模擬是以每挖掘50萬立方米的泥，有百分之三散落到水域內爲基礎。在此基礎上，與現時懸孚沉積物平均深度值0.01公斤/立方米相比，大部份區域的表面淺水層和水底深水層的懸浮沉積負荷將分別增加至0.001及0.005公斤/立方米。沉積帶形狀狹窄，從中環對開7公里漫延至北角。因爲潮汐漂移的關係和當地條件適合沉積，預測北角將接受最大的沉積負荷。雨季替潮模擬顯示沉積最嚴重期間，北角對開表面淺層和水底深層的沉積負荷會分別增加0.001和0.005公斤/立方米。

在最惡劣情況下，降低挖泥量(220,000和50,000立方米)可使懸浮沉積物按比例減少，而北角海底的懸浮物濃度將可減至0.044和0.01千克/立方米，表面區懸浮物濃度則可減至0.002和0.0005千克/立方米。預計低挖掘量將不會導至水中懸浮固體有實質可量度的增加。由於高濃度懸浮沉積物只集中在海底而且會廣泛平面分散，視覺影響除在鄰近挖泥機範圍內將不會成爲關鍵問題。

在建議的挖泥速度情況下，由沉積物的再懸浮導致的生化需氧量增加可以不需要考慮。水中氧氣需求是取決於挖泥的速度以及可用作分散的水量，而不是總挖泥量。因此，由挖泥產生的生化需氧量將不成爲一個關鍵問題。

根據若干不同情況下的水質模擬，證實了對水質影響最少的方法是：所有涇流負荷量都減少25%，與此同時，流入M溢水道的水量亦減少50%(M溢水道將水排入海岸線與新填島之間的水域內)。這些情況包括中環和灣仔填海區，以及人工島擴展工程的填海部份。據預測，除位於島擴建工程與海岸之間的兩個模擬點外，水質參數一般都比基線條件(完成填海但未建擴建項目)好。而只有此兩模擬點範圍內的水質較基線條件遜色。

從香港會議展覽中心擴建部份排出的污水約佔現中環和灣仔兩區流出的負荷量的2%。水質模擬預測表明，在雨季小潮時大腸菌數量將增加8.6%。這項大腸菌數量不按比例的增加是由於建議中的填海工程導致維多利亞港的水量和消化能力降低之緣故。再者，模擬結果指出即使使用最佳減少大腸桿菌和其他水質參數的措施，此等參數儘管相對地較小，但仍會超過現有水平。只有改善污水處理效能，研究區域內之水質方能獲得切實的改善。

在研究區域內，漂浮垃圾的問題將仍舊存在。島式擴建工程將會提供搜集港島東、西兩岸漂浮垃圾的機會。然而，由於該工程爲臨時性質而填海工程還會繼續進行，在目前限制條件情況下，可能沒有一個適合在擴建項目設計工作中可同時考慮的舒緩措施。一般而言，人工島的建成將不會顯著地增加水域內漂浮垃圾的積聚。人工收集將是清除積聚垃圾的最佳辦法。

5. 海底污泥的處理

在研究區內的沉積土被列爲C級，因此需要採用特別的挖掘和處理方法。其中五種金屬(鉛、鋅、汞、銅和鉻)的含量特高，而鎘和鎳的含量則較低。

C級沉積物的位置，大多限於表層(不到30公分深)或不存在。其中只有一個站是例外，而該處污染的沉積物厚度達一米。一般金屬含量隨深度的增加而減少。爲了合乎實際挖泥之情況，將於污染區上層一米深的積泥定爲受污染處理。根據所採用的挖泥情況(部份或全部新護岸)，估計污泥量將介於11,500和34,000立方米之間。

6. 空氣質量

香港會議展覽中心建項目對空氣的潛在附加影響主要來自填海和建築期間產生的塵埃。車輛和設施的排氣將不會構成大問題。

在缺乏舒緩措施的情況下，填海工程可能會對某些與其同一視線上的感應強的地方(如：香港會議展覽中心、凱悅酒店、新世界海港酒店、鷹君中心和海港中

心等)產生影響。計算表明，總懸浮粒子的數量可能高出可接受量達35%。然而，若經採用塵埃抑制措施，特別是有效的洒水系統後，所有感應強的地方的總懸浮粒子數量將在可接受限度之內。

對運作期間空氣質量的評估是以2001年及至2006年爲設計水平。所有參數(一氧化碳、二氧化氮和總懸浮粒子)的含量預計將符合空氣質目標。

7. 噪音

研究結論表明，若非中央空調系統，高質量雙層玻璃幕墻及其他建築物所提供的舒緩效果，所有噪音感應強地方(NSR)在施工期所受的最高噪音水平將超過非法例規定日間建築75分貝A的聲級極限。再者，由於聲級計算中所有機械同時同地點運作的假設僅是最差情況的摸擬，因此實際噪音聲級將比計算值爲低。爲符合建築噪音許可証的需求，有必要在夜間施工期間在固定機械四周採用噪音屏障一類的舒緩設施。撞擊式打樁工程噪音將受噪音管制條例管制。

根據2001及2006年交通流量預測，交通噪音評估結果指出，在此兩設計年內，尤其於香港演藝學院北門所感受的噪音聲級將可能超出香港規劃標準及指南限度達4分貝A。然而，此噪音值所反映的乃是告羅士打道至海旁道一段研究範圍內的整體交通量，並不僅顯示香港會議展覽中心有關交通產生的噪音級別。香港演藝學院之中央空調系統，雙層玻璃幕墻以及建築物本身將減少交通噪音對其內用戶的影響。預計在未來，住宅樓宇內所感受的噪音水平將比現今爲低，而本發展計劃將不會帶來額外的噪音影響。

8. 固體廢物的處理

有關海泥的處理已在本文第4節中討論過。此島式擴建工程所需處理的廢物極少，主要來自清拆和建築工程。這些廢物的處理方法取決於填海工程中使用的填料。若該工地被介定爲公共堆填區，所有或近乎所有的清拆和建築廢料均可就地處理(公共堆填料會僅限於混凝土或惰性材料，並符合該區規定的尺寸要求)。然而採用源於建築的填料將比採用公共堆填更有利於控制工地內的交通。

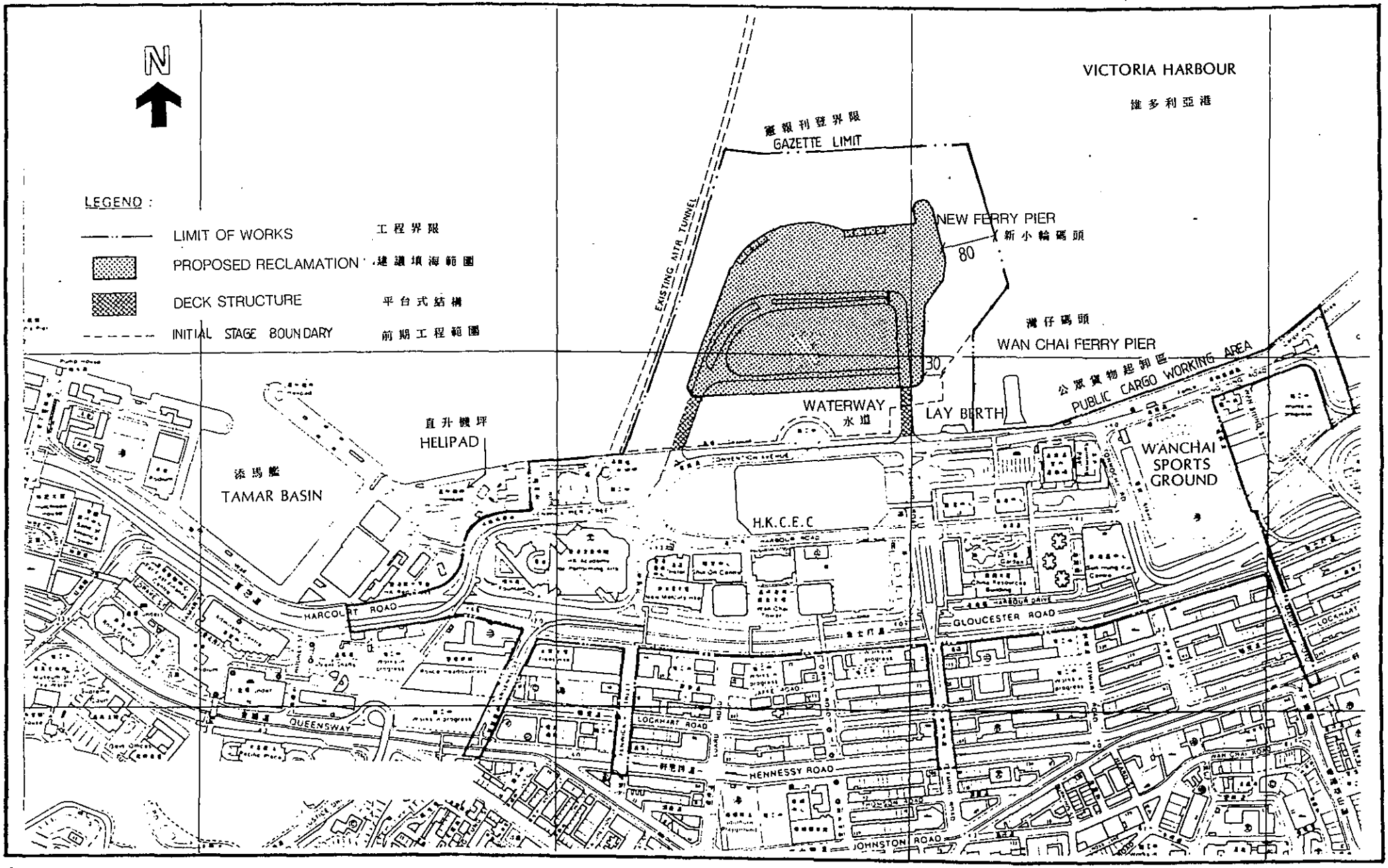
9. 結論

建議中的島式擴建工程將不會對環境產生重大的影響。由於建造新護墻地基只需要挖除少量的沉積物，因此，挖泥工程對懸浮沉積物和水質參數影響估計不大。懸浮沉積物將被水流擴散至7公里以外的地區，進一步降低對局部範圍的影響。污水將通過現有之溢水道帶至離岸600公尺外排放，預計該區域的污水負荷僅會有2%的增加。而目前維多利亞港受污水質隨著建議中的填海工程的開展，及港內水量將逐步減少而進一步惡化，但將並不顯注。

從M溢水道帶出的涇流，可能局部引起海岸線與海島擴建工程間的水質惡化。但這短期影響將隨著建議中展覽中心工程的峻工而有所改善。

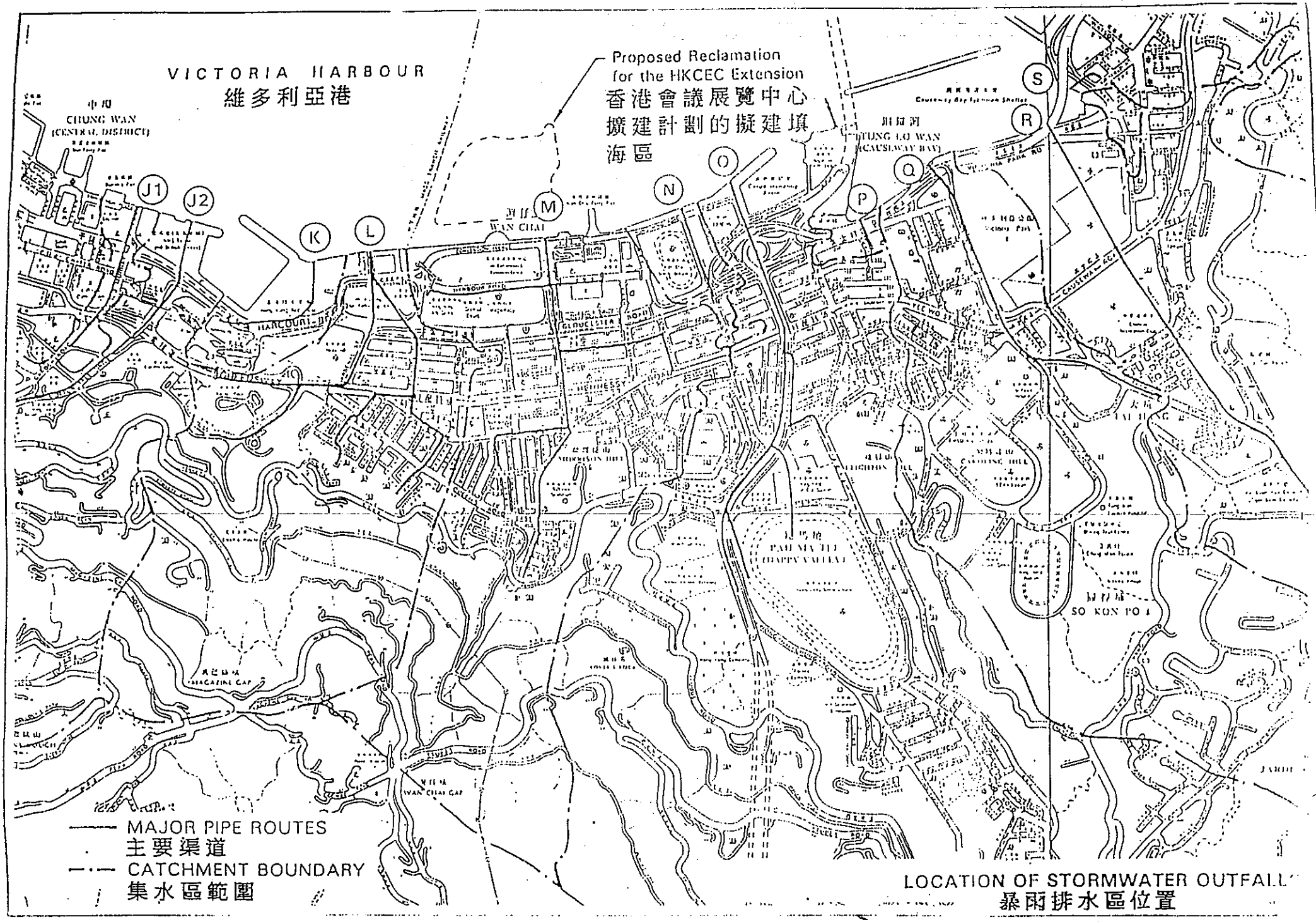
空氣質量的影響，通過採用有效洒水程序等塵埃抑制措施，可舒緩塵埃的影響。噪音感應強的地方將因現有的玻璃幕墻和空調得以舒緩。在擴建期間，夜間作業需採取噪音舒緩措施。

'參考一'於一九九三年九月出版的"香港會議展覽中心擴建計劃專注研究 - 沉澱物質量報告書"中提及。




# Island Scheme – Location Plan

# 島嶼式計劃 – 位置圖


VICTORIA HARBOUR
維多利亞港
Proposed Reclamation
for the HKCEC Extension
香港會議展覽中心
擴建計劃的擬建填
海區
CHUNG WAN
(CENTRAL DISTRICT)
中環
TUNG LO WAN
(CAUSEWAY BAY)
銅鑼灣
WAN CHAI
HARCOURT RD
PAI MA TEI
(HAPPY VALLEY)
SO KON PO
J1
J2
K
L
M
N
O
P
Q
R
S
MAJOR PIPE ROUTES
主要渠道
CATCHMENT BOUNDARY
集水區範圍
LOCATION OF STORMWATER OUTFALL
暴雨排水區位置