



Territory Development Department
South East New Territories Development Office

ENGINEERING FEASIBILITY STUDY OF DEVELOPMENT OF TSEUNG KWAN O AREA 137



Final Report

Executive Summary
MAIN REPORT
Drawings



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in association with
Urbis Travers Morgan Limited
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ENVIRONMENTAL

Development of Area 137, during both construction and operation phases, present potential impacts on the existing environment. The assessment has addressed impacts of the proposed development, in particular those under the main indicator headings of water and air quality, noise and visual impact. The Hong Kong Planning Standards and Guidelines (HKPSG) and the relevant water, air and noise control ordinances create the advisory and legislative framework against which the findings are measured. The assessment has been able to identify appropriate mitigation for any exceedence of advisory or legislative requirements.

Water Quality

The impact of the final development on the marine waters of Hong Kong has been assessed using the WAHMO suite of mathematical models. The modelling has predicted that the reclamation would have no significant effect on water quality.

The construction phase for Area 137 will require dredging and reclamation activities which will impinge on a former spoil ground. Limited survey and testing work on the materials deposited here, supplemented by information from the Contaminated Spoil Management Study (CSM), concluded that there was evidence of heavy metal contamination in the form of lead, zinc and mercury. Further survey is required to assess the quantities of contaminated material to be dredged in relation to the Recommended Development Layout.

Air Quality

Tseung Kwan O is an enclosed basin, defined as a confined airshed, which means that pollutants released are slow to disperse. Historically Tseung Kwan O has experienced air quality problems but the implementation of air quality controls and the relocation of polluting industry outside the airshed have improved the situation. The most recent edition of Environment Hong Kong (EPD 1992) reported that the Junk Bay air quality monitoring station found no exceedences of the Air Quality Objective (AQO) in 1991. Since

環境

不論在興建或操作期間，第一三七區發展都可能對現有環境構成影響。評估工作對發展計劃的影響作出研究，特別就水質、空氣、噪音和景觀等主要環境因素為考慮重點。評估的方法，以香港規劃標準與準則，以及就有關水質、空氣及噪音管制條例等指引和法則作為衡量基礎，如有超出指引和法則規定的環境影響，則提出適當的消滅方法。

水質

最後發展計劃對香港海域水質的影響，曾經採用水質及水利模型評估。評估結果顯示，填海工程對水質並無重大影響。

第一三七區挖泥和填海工程，會涉及一個已廢棄不用的卸泥場。根據受污染廢土管理研究的資料，以及對該處棄置物料所作初步調查測試的結果，顯示該處廢土受鉛、鋅及水銀等重金屬污染。要推行發展建議大綱，所須挖掘受污染物料的質量仍須再作研究。

空氣質素

將軍澳是個多面環山的盆地，屬於空氣封閉區，意即區內的污染空氣極難迅速散去。以往將軍澳曾遇到空氣污染問題，但在推行空氣管制計劃，並把污染性工業遷離空氣封閉區後，情況已有改善。最近一期的香港環境報導（環境保護署，一九九二），將軍澳空氣質素監測站的監測結果，

Area 137 is situated on the southern fringe of the confined airshed a limited air quality monitoring programme was conducted close to Area 137 to confirm the applicability of the Junk Bay monitoring station to the site. The short study suggested that, though the local meteorological conditions varied, the air quality information was similar and it was therefore concluded that pollutants generated in Area 137 would contribute to air quality in Tsung Kwan O.

The majority of the vehicles accessing the area will be heavy, diesel powered, vehicles which generate Carbon Monoxide (CO), Nitrogen Oxide (NO) and particulates. However, given the distances to the closest sensitive receivers (SRs), over 1.5 km, vehicle emissions are not considered to be significant.

Specific industrial operations which will be located in Area 137 are not clearly defined. Of the potential operations, town gas production offers the only significant air pollution source, as other

identified processes do not use combustion and hence do not generate combustion products of SO₂ or NO_x. Town gas production, from naphtha, will generate air pollutants and an assessment, using SO₂ as an indicator, was carried out which concluded that, even in worst case conditions, the additional loading from Area 137 would not cause exceedence of the AQO.

Noise

The closest Noise Sensitive Receivers (NSRs) to Area 137 are sited across the Tathong Channel on Hong Kong Island. Operational impacts include those generated by industry and vehicle movements. Maximum permissible site boundary sound power levels were calculated for compliance with the requirements of HKPSG. It is considered that these permitted noise levels would not be exceeded by the operation of the development. The landscaping and screening which is proposed as visual impact mitigation will also provide some screening of noise generated by Area 137.

顯示一九九一年的空氣污染程度並無超越空氣質素指標的規定。第一三七區位於空氣封閉區的南端，為證實將軍澳空氣質素監測站的監測結果是否適用於此，特在第一三七區附近推行了小型空氣質素監測計劃；結果顯示，雖然個別地區的氣象情況有別，空氣質素情況卻大致相若，因此第一三七區產生的污染空氣，會對將軍澳地區的整體空氣質素有所影響。

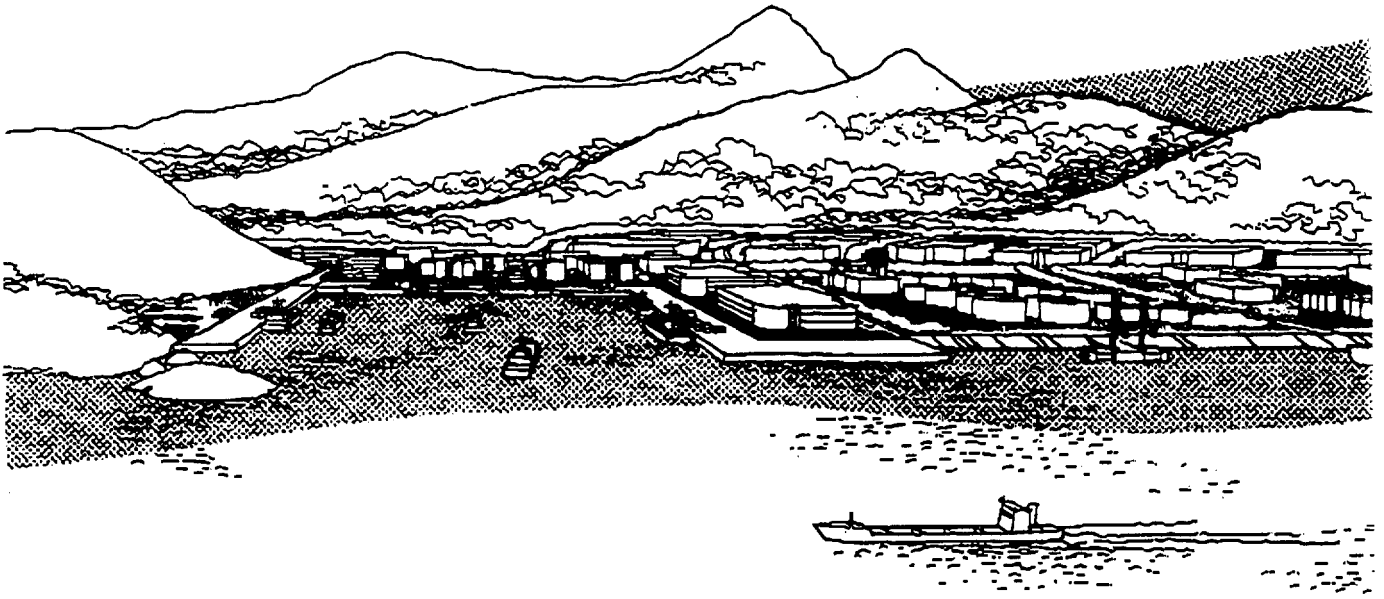
來往該區車輛，多數是重型車輛，以柴油推動，並會產生一氧化碳、氧化氮和粒子等污染物。然而，最接近的敏感接收地區也在1.5公里以外，汽車產生的污染對該等地區影響不大嚴重。

第一三七區內實際上有某些工業，目前仍

未能具體決定。在可能發展的工業中，只有煤氣廠會造成較嚴重的空氣污染，因其他工業不會涉及燃燒過程，不會產生二氧化硫或氧化氮等污染物。煤氣以石腦油製造，會產生污染物；一項以二氧化硫為指標的評估工作結果顯示，就算在最嚴重的情況下，第一三七區內的額外污染物也不會使污染程度超越空氣質素指標的規定。

噪音

最接近第一三七區的噪音敏感接收地區，位於藍塘海峽對岸的香港島。影響的來源是工廠和來往車輛。為符合香港規劃標準與準則的要求，該區邊界的最高可接受聲浪亦已計算。該區的發展，應不會超出這些最高規定。為美化區內環境而設的景物設計和屏障，也可消滅區內的噪音。



Perspective
概念圖

Visual Impact

Locating industry, particularly PHIs, at Area 137 will permanently alter the visual characteristics of the area when viewed from the visual envelope which extends from the eastern end of Hong Kong Island at Shek O through Chai Wan and Lei Yue Mun. In addition there are approaching views from passing ships. The night time impact will be accentuated by the use of security and safety lighting which are a necessary part of any industrial development.

景觀

在第一三七區興建工廠，尤其是潛在危險設施，將使該區的面貌永久改變，由香港東面的石澳，以至柴灣、鯉魚門等地觀看，該區的景象也會有一定程度的改變。來往的船隻，亦可察覺該區面貌的改變；工業區所需的保安和防衛照明，也加深地影響該區晚間的景觀。

The development will not compromise the existing ridgelines of the Clear Water Bay Country Park and extensive landscaping and tree planting has been proposed to minimise the visual impact of the development. Glare impacts can be minimised, though not removed, by using low intensity lighting, orientation of lighting away from SRs and use of the landscaping buffers and tree screens.

該區的發展，與清水灣郊野公園的山脊並不協調，必須用景物設計以美化環境，並須廣泛植樹，才可以減低工業發展對景觀的影響。使用強度較低的照明設施、調校照明設施的方向，使能不會直接照射感應強的地區、使用景物設計和樹木作為緩衝區及屏障等，都可減低強光的影響。



Environmental Monitoring and Auditing

Environmental monitoring schedules and audit procedures are essential in order to:

- ensure that any environmental impacts resulting from the construction and operation of the Area 137 development are minimised or kept to 'acceptable' levels at all times;

- establish procedures for checking that mitigation measures have been applied and are effective, and that the appropriate corrective action is undertaken if and when required;
- provide a means of checking compliance with environmental objectives, recording anomalies and documenting corrective action.

環境監測和審核

必須制訂環境監測計劃和審核步驟，以便：

- 確保第一三七區的建設和操作所帶來的環境影響能降至最低，或經常維持在「可接受」水平；

- 建立制度，監察是否已實行消滅措施，有關措施是否有效，而在有需要時是否已採取行動改善情況；
- 當局可檢查是否符合環境目標、記錄不合規定的情況、並記下改善行動。

9.3.3 Dredging and Disposal of Sediments

Background

It is known that the sediments within Junk Bay are contaminated due to historical industrial practises and the influence of contaminants from Victoria Harbour. Potentially more significant is the fact that Area 137 will be sited on a former spoil ground. The information relating to the types of material which were dumped is not well documented. A limited sampling and testing programme has been carried out as part of this Study and, together with, results from other studies, has been used to identify potential impacts.

The dredging for Area 137 is likely to be carried out by grab dredgers and will involve the removal of some 2.9 Mm³ from the area to form the berthing areas, approach channels and the seawall trenches. It will be necessary to ensure that any grab dredgers used are fitted with tightly closing grabs in a well maintained condition, all dredging occurs within silt curtains and that no overflowing of the barges is allowed. Water quality schedules and action plans are provided in Section 9.8.

It is believed that more intensive survey work will be necessary in the detailed design phases of the project implementation to investigate the contaminated aspect further. The closest SR to Area 137 is the fish culture zone sited off the north western coast of Tung Lung Island section.

Contaminated Sediments

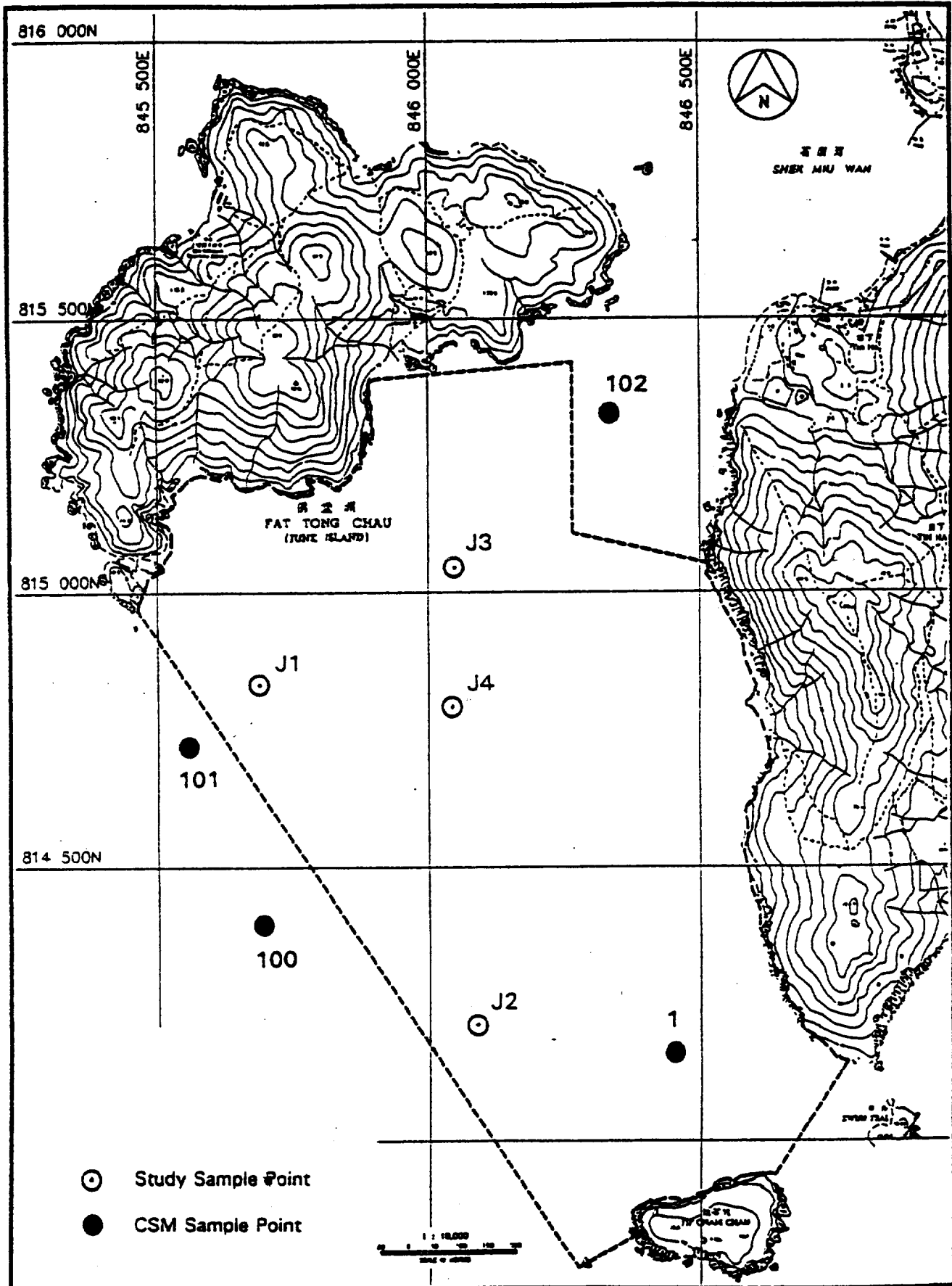
The marine sediments at Tseung Kwan O are routinely monitored by the Environmental Protection Department and show significant metal contamination. However, the EPD sampling does not cover the Area 137 site. As part of the Contaminated Spoil Management Study (CSM) sampling on the old spoil ground beneath Area 137 was carried out and testing showed elevated levels of lead and zinc and excessive mercury contamination. The location of CSM sampling sites in relation to area 137 are shown in Figure 9.5 and results of the testing programme are reproduced in Table 9.1.

TABLE 9.1: CSM STUDY ANALYTICAL RESULTS OF SEDIMENT SAMPLES FROM THE STUDY AREA

Site Ref.	Cu		Cr		Cd		Pb		Zn		Ni		Hg	
	bulk	<63 μm	bulk	<63 μm	bulk	<63 μm	bulk	<63 μm	bulk	<63 μm	bulk	<63 μm	bulk	<63 μm
100	34	48	17	23	.66	.66	45	56	115	122	22	24	.85	
101	39	-	19	-	.55	-	42	-	95	-	20	-	.10	.07
102	18	28	13	27	.57	.44	31	52	49	86	12	19	.71	
1	11	-	12	-	.50	-	35	-	73	-	15	-	.64	.33

Note: Results expressed in mg/kg bulk sample/ <63 μm fraction.

Figure 9.5



SEDIMENT SAMPLING POINTS

As part of this Study additional sampling and testing was carried out and this confirmed the elevated levels of metal contamination, particularly lead. The sampling results are reproduced as Table 9.2.

TABLE 9.2 : AREA 137 STUDY ANALYTICAL RESULTS OF SEDIMENT SAMPLES

Site	Metal						
	Cd	Pb	Ni	Zn	Cr	Hg	Cu
J1 top	<0.13	47	11	56	19	0.11	14.0
middle	<0.12	55	15	60	24	<0.03	4.3
bottom	<0.15	55	27	74	35	<0.03	9.7
J2 top	<0.06	17	21	74	29	0.01	9.6
middle	<0.06	18	18	65	28	0.01	10.0
bottom	<0.06	28	25	89	45	0.03	19.0
J3 top	<0.11	57	21	59	20	0.03	4.4
middle	<0.17	77**	25	64	29	<0.04	6.7
bottom	<0.14	78**	30	70	31	<0.03	8.1
J4 top	<0.1	51	16	50	17	0.05	5.4
middle	<0.13	78**	26	69	30	<0.03	7.7
bottom	<0.13	66*	27	73	34	<0.03	9.2
Target	0.4	35	20	75	25	0.2	20.0
Trigger *	1.0	65	35	150	50	0.8	55.0
Action **	1.5	75	40	200	80	1.0	65.0

The differences between the CSM and recent sampling reflect variations in sampling sites, preparation and analytical methodologies. However, it is apparent from sampling that spoil removal from Area 137 may be problematic and a more effective characterisation will be required to satisfy the requirements of the Fill Management Committee (FMC) who identify and licence contaminated spoil disposal. This further survey work should be undertaken for the defined dredging areas of the Recommended Layout. No final decision has been made on the most appropriate disposal site for contaminated materials though the gazetted pits at East Sha Chau represent a possible location.

Suspended Solids

Dredging and reclamation may affect both benthic and pelagic organisms through smothering or by interference with respiration, through clogging of the gills of susceptible species. These physical effects are distinct from problems associated with the disturbance of contaminated materials, but can be of importance to SRs adjacent to areas of dredging activity. It is recommended therefore that dredging equipment/methods releasing minimal amounts of suspended solids should be employed for any sediment removal in Area 137. The only significant sensitive receiver area is the Tung Lung Chau Fish Culture Zone, (FCZ), which is located approximately 2 km south east of Area 137.

Impact on Tung Lung Chau FCZ

In determining the impact of dredging on marine ecology at Tung Lung Chau a worst case situation is assumed. The seawall trench is assumed to be formed by a grab dredger of 10 m³ capacity working at a production rate of 50,000 m³/week in a 10 m water depth with maximum currents of 0.6 m/s.

Dredging without the use of silt curtains and using an open grab will result in a loss of sediment, (the S-factor), of 10-15 kg/m³ of mud dredged. Assuming 130 operational hours, the rate of sediment release will be 4,800 kg/hr. At a maximum current speed of 0.6 m/s, 2.2 kg of sediment will be injected into the plume per metre. The initial plume width is assumed to be approximately 50 m at a distance of 50 m from the dredger. If the current velocity and direction remains constant, sediment would reach the FCZ in approximately 55 minutes.

Diffusion of the plume is inevitable and at 2 km distance the plume is assumed to have increased its initial width by a factor of 3 giving a worst case scenario of, at most, a suspended solids concentration of 1.6 mg/l above the background at the FCZ.

In addition, Work by Yagi et al., 1976 and Harris et al., 1988, has demonstrated the decline in suspended solids concentration downstream of a grab dredger. Typically, suspended solids values will fall by as much as 80% over a distance of 100 metres. This would support the above as a worst case, and therefore it is most unlikely that suspended solids will have an effect at the FCZ.

Despite this, it is recommended that the following mitigation measures are adopted to minimise the potential dredging impacts, since incorporation of specific requirements within contract conditions offer an effective method of controlling impact, if strictly enforced :

- ▶ utilising a grab which closes tightly preventing sediment loss as it ascends;
- ▶ avoiding sediment overflow from the barge where possible; and
- ▶ using a slower hoisting speed, (research by Yagi et al., has shown that a hoisting speed of 0.85 m/s as opposed to 1.25 m/s, can reduce the suspended solids in the upper water column by 20 to 30%.