

## **ITEM FOR PUBLIC WORKS SUBCOMMITTEE OF FINANCE COMMITTEE**

### **HEAD 704 – DRAINAGE**

#### **Civil Engineering – Drainage and erosion protection**

#### **103CD – Drainage improvement in Northern Hong Kong Island – Hong Kong West drainage tunnel**

#### **104CD – Drainage improvement in Northern Hong Kong Island – lower catchment improvement**

Members are invited to recommend to Finance Committee –

- (a) the upgrading of part of **103CD** and **104CD**, as a combined item, entitled "Drainage improvement in Northern Hong Kong Island – preliminary design and investigations", to Category A at an estimated cost of \$64.6 million in money-of-the-day prices; and
- (b) the retention of the remainder of **103CD** and **104CD** in Category B.

### **PROBLEM**

Due to inadequate capacity of the existing drainage systems, Northern Hong Kong Island is susceptible to flooding during heavy rainstorms.

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**PROPOSAL**

2. The Director of Drainage Services (D of DS), with the support of the Secretary for Works, proposes to upgrade part of **103CD** and **104CD** to Category A for engaging consultants to carry out the following preliminary design and investigations for the proposed works described in paragraphs 3, 4(b) and 4(c) below –

- (a) site investigations and surveys;
- (b) physical modelling tests;
- (c) environmental and traffic impact assessments; and
- (d) preliminary design.

The total estimated cost for the proposed consultancy is \$64.6 million in money-of-the-day (MOD) prices, comprising \$53.7 million for **103CD** and \$10.9 million for **104CD**.

**PROJECT SCOPE AND NATURE**

3. The scope of **103CD** covers the construction of the Hong Kong West drainage tunnel, which consists of –

- (a) a drainage tunnel of about 3.8 kilometres (km) in length and 4.9 metres (m) in diameter from Tai Hang Road to Aberdeen Tunnel; and
- (b) a drainage tunnel of about 6.5 km in length and 7.2 m in diameter from Aberdeen Tunnel to Sandy Bay.

4. The scope of **104CD** includes the construction of –

- (a) about 1.5 km of drains in the Eastern District of the Hong Kong Island;
- (b) about 2.9 km of drains in the Wan Chai, Central and Western districts of Hong Kong Island; and
- (c) the decking of the nullah adjacent to Queen's College.

5. A site plan showing the location of the proposed works is at Enclosure 1.
6. We plan to start the proposed consultancy in August 2002 for completion in October 2005.

## JUSTIFICATION

7. Most of the existing drainage systems in the lower catchment of Northern Hong Kong Island are in major residential and commercial districts, including the Eastern, Wan Chai, Central and Western districts. These drainage systems were built more than 50 years ago to meet the flow requirements at that time. Rapid urbanisation and changes in land use over the past decades have turned natural ground and slopes into paved areas. Rainwater which could previously dissipate naturally through ground filtration can no longer do so. This has led to significant increase in surface runoff and overloading of the existing drainage systems. Although we have been making local improvements to the systems to cater for developments from time to time, the overall drainage systems as a whole are still inadequate to meet the required flood protection standard. Flooding often occurs during heavy rainstorms.

8. To alleviate flooding in Northern Hong Kong Island and meet the community's increased expectations for higher flood protection standard, we commissioned a drainage master plan study for Northern Hong Kong Island to assess the existing drainage systems in the areas. Due to the topography and size of the catchment, the quantity of stormwater flowing from the upper catchment into the lower urban areas can accumulate in a short period of time during heavy rainstorms and overload the drainage system there. Apart from causing flooding, traffic disruption and damage to properties, the fast and large flows from the hills may also impose potential risks to life. In view of the above, the study recommends the construction of a drainage tunnel in the mid level of Western Hong Kong Island from Tai Hang to Sandy Bay (the Hong Kong West drainage tunnel) to intercept and convey the stormwater from the upper catchment directly to the sea. The study also recommends the upgrading of some of the drains in the lower catchment, which are still inadequate even with the proposed drainage tunnel in place. The main benefit of these proposals is that without the need to implement extensive pipelaying works in the busy streets of the Wan Chai, Central and Western districts, the general standard of flood protection in Northern Hong Kong Island can be raised to withstand a rainstorm with a return period of one in 50 years<sup>1</sup>.

**/Wan Chai .....**

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<sup>1</sup> "Return period" means the average number of years during which a certain severity of flooding will occur once, statistically. A longer return period means a rarer chance of occurrence of a more severe flooding.

**Wan Chai, Central and Western districts**

9. We need to proceed with the preliminary design and associated investigations and surveys to finalise the scope of the Hong Kong West drainage tunnel scheme and the associated lower catchment drainage improvement works for the Wan Chai, Central and Western districts (as set out in paragraphs 3 and 4(b) and (c) above), taking into consideration land requirements, environmental, traffic and other impacts on the areas concerned. Based on findings of the investigations and surveys, we would proceed with detailed design stage for the proposed works.

10. As the scope of the Hong Kong West drainage tunnel and the associated lower catchment drainage improvement works for the Wan Chai, Central and Western districts are inter-related, we propose to carry out the preliminary design and investigations under one consultancy and two works contracts.

11. Due to lack of in-house staff resources and expertise, D of DS proposes to employ consultants to carry out the site investigations, surveys, physical modelling tests, impact assessments and preliminary design to facilitate the implementation of the proposed drainage improvement works.

**Eastern District**

12. In the Eastern District of Hong Kong Island where implementing the drainage tunnel scheme is not cost-effective, we propose to carry out the drainage improvement works (as set out in paragraph 4(a) above) in the lower catchment to increase the flood protection level in general. Since construction of drains in the Eastern District is not affected by the Hong Kong West drainage tunnel scheme, we will proceed with the design of these improvement works at an estimated cost of \$4.0 million under a separate consultancy funded under the block allocation **Subhead 4100DX** "Drainage works, studies and investigations for items in Category D of the Public Works Programme". This will help expedite implementation of these works.

**FINANCIAL IMPLICATIONS**

13. We estimate the cost of the proposed consultancy to be \$64.6 million in MOD prices (see paragraph 14 below), made up as follows –

/(a) .....

		\$ million	
		103CD	104CD
(a)	Site investigations, surveys and physical modelling tests	30.4	3.0
(b)	Consultants' fees	18.0	6.9
(i)	supervision of site investigations and surveys	3.9	0.4
(ii)	environmental impact assessment	2.6	-
(iii)	traffic impact assessment	0.4	2.2
(iv)	preliminary design	11.1	4.3
(c)	Contingencies	4.8	1.0
	Sub-total	53.2	10.9 (in September 2001 prices)
(d)	Provision for price adjustment	0.5	-
	Total	53.7	10.9 (in MOD prices)

\_\_\_\_\_ A breakdown of the estimates for the consultants' fees by man-months is at Enclosure 2.

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14. Subject to approval, we will phase the expenditure as follows –

Year	\$ million (Sept 2001)		Price adjustment factor	\$ million (MOD)	
	103CD	104CD		103CD	104CD
2002 – 2003	3.0	1.0	0.99700	3.0	1.0
2003 – 2004	23.9	6.0	1.00398	24.0	6.0
2004 – 2005	20.9	2.9	1.01101	21.1	2.9
2005 – 2006	3.0	0.9	1.01808	3.1	0.9
2006 – 2007	2.0	0.1	1.02521	2.1	0.1
2007 – 2008	0.4	-	1.03239	0.4	-
Total	<u>53.2</u>	<u>10.9</u>		<u>53.7</u>	<u>10.9</u>

15. We have derived the MOD estimates on the basis of the Government's latest forecast of trend labour and construction prices for the period 2002 to 2008. We will tender the proposed consultancy under a lump-sum contract with provision for price adjustment as the consultancy agreement will exceed 12 months. The physical modelling contract will be let on a lump-sum basis without price adjustment. The contract for site investigations and surveys will be let on a re-measurement basis as we cannot determine in advance the exact extent of the required works. All the three contracts will be awarded by the Government following a competitive tendering process and will be supervised by the consultants and site staff employed by the consultants.

16. The proposed consultancy will not give rise to any recurrent expenditure.

## PUBLIC CONSULTATION

17. We presented the findings and recommendations of the study under **75CD** "Stormwater Drainage Master Plan Study on Northern Hong Kong Island" to the Works and Project Committee of the Wan Chai District Council on 30 January 2001, the Works and Development Committee of the Eastern District Council on 12 February 2001, the Food, Environment, Hygiene and Works Committee of the Central and Western District Council on 22 February 2001 and the Capital Works Committee

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of the Southern District Council on 26 February 2001. The Works and Development Committee of the Eastern District Council supported the implementation of projects **103CD** and **104CD**. The other committees expressed no objection to the implementation. We will consult the relevant District Councils again during the detailed design stage and before commencement of the proposed works.

18. On 5 March 2001, we consulted the LegCo Panel on Planning, Lands and Works on the proposed drainage improvement projects for Northern Hong Kong Island, West Kowloon and Tsuen Wan. Members raised no objection to the implementation of the projects. Nevertheless, some Members requested the Administration to provide more details about these projects, including background information on the need to improve the existing drainage systems and an assessment on the restriction in land uses due to the proposed drainage tunnels. In response, we submitted detailed supplementary information to Members in late March 2001 vide LC Paper No.CB(1)866/00-01.

19. At the Public Works Subcommittee meeting held on 4 April 2001 for discussion of the proposal to upgrade part of **110CD** "Drainage improvement in Tsuen Wan, Kwai Chung and Tsing Yi – urban drainage improvement works" and part of **111CD** "Drainage improvement in Tsuen Wan, Kwai Chung and Tsing Yi – Tsuen Wan drainage tunnel", as a combined item, for investigations and detailed design, Members expressed concerns over the cost-effectiveness of the interception approach in tackling flooding problem in urban areas (i.e., the construction of drainage tunnels to intercept and convey the upland flows directly to the sea to reduce the risk of flooding in urban areas in the lower catchment), and requested the Administration to conduct more thorough consultation with the Panel, the industry and relevant professional bodies. The Administration withdrew the proposal, pending the outcome of further consultation.

20. Since then, we have re-assessed and compared the relative cost of drainage improvement works under two different approaches – the interception approach and the traditional approach (i.e., through pipelaying). We have selected three drainage improvement projects (the drainage improvement projects for Northern Hong Kong Island, Lai Chi Kok and Tsuen Wan) for comparison. It is found that the construction costs of these projects under both approaches are generally comparable. However, taking into account the social costs in terms of disruption to traffic and the environment, the total cost under the traditional approach would be very much higher than the interception approach in all cases. We therefore believe that the interception approach is a more cost-effective option. A table comparing the interception approach and traditional approach to improving the drainage systems in Northern Hong Kong Island under **103CD** and **104CD** (excluding the drainage improvement works in the

Eastern District as described in paragraph 4(a) above), in terms of length of drains/tunnel to be constructed, construction cost and construction time is at Enclosure 3 for Members' reference. We have also consulted the industry, relevant professional bodies and other interested parties on our findings. There is general support for implementation of the drainage tunnel projects.

21. We have also carried out a cost-benefit analysis on the three proposed drainage tunnel projects mentioned in paragraph 20 above. In terms of tangible benefits, implementation of these proposed drainage tunnel projects would help minimise flood damages, including damages to properties/goods/merchandise, repair costs, traffic disruption and loss of business, etc. Setting aside intangible elements such as nuisance and other social losses, the result of the analysis shows that the benefit/cost ratio of implementing these drainage tunnel projects is about 2.3<sup>2</sup>.

22. On 4 January 2002, we consulted Members of the LegCo Panel on Planning, Lands and Works on our findings on the interception approach. Experts in hydraulics and representatives from various professional bodies also participated at the meeting. We thoroughly discussed the causes of major flooding in recent years, the technical feasibility of the proposed drainage tunnel projects, the cost effectiveness as well as cost and benefit of the interception approach. We agreed to provide Members with supplementary information on the possible sedimentation and hygienic issues of the tunnels after the meeting. Noting that the experts and representatives from professional bodies considered the proposal feasible and cost effective, Members had no objection to the implementation of the proposed drainage projects. We provided the supplementary information to Members on 17 January 2002 vide LC Paper No.CB(1)/833/01-02(1).

## ENVIRONMENTAL IMPLICATIONS

23. The proposed tunnel project under **103CD** is a designated project under Schedule 2 of the Environmental Impact Assessment (EIA) Ordinance. An environmental permit is required for the project. We will prepare an EIA report to meet the requirements under the EIA Ordinance. We will incorporate all the measures recommended in the EIA study report into the detailed design and relevant works contract, and will apply for an environmental permit before the project construction work commences.

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<sup>2</sup> A project would be considered as cost-effective if its benefit/cost ratio is greater than one.



24. For the lower catchment drainage improvement works under **104CD**, we completed a Preliminary Environmental Review (PER) in March 1999. The PER concluded that the project would not give rise to impacts that exceed established criteria. The Director of Environmental Protection vetted the PER and agreed that EIA would not be necessary. For short-term impacts, we will control noise, dust and site run-off nuisance during site investigations through the implementation of mitigation measures, such as the use of silenced construction plant to reduce noise generation and water-spraying to reduce emission of fugitive dust in relevant works contracts.

25. The proposed consultancy for preliminary design and site investigation works will not cause any adverse environmental implications. The site investigations under the proposed consultancy will generate minimal amount of construction and demolition (C&D) materials. We will require the consultants to fully consider and propose measures for minimising the generation of C&D materials and for reusing/recycling C&D materials as much as possible when carrying out the site investigation works and at construction stage in future.

## **LAND ACQUISITION**

26. The proposed consultancy does not require any land acquisition.

## **BACKGROUND INFORMATION**

27. We commissioned **75CD** "Stormwater Drainage Master Plan Study in Northern Hong Kong Island" in 1996 and completed the study in February 1999. We upgraded **103CD** and **104CD** to Category B in September 2000.

### **Wan Chai, Central and Western districts**

28. As the scope of the Hong Kong West drainage tunnel scheme (paragraph 3 above refers) and the lower catchment drainage improvement works for Wanchai, Central and Western districts (paragraphs 4(b) and 4(c) above refer) are inter-related, we plan to start the investigations and preliminary design for these works under one consultancy agreement and two works contracts to save administration cost and time. Subject to findings of the proposed consultancy, we plan to commence detailed design for the lower catchment drainage improvement works for the Wan Chai, Central and Western districts in March 2004 and the Hong Kong West drainage tunnel scheme in August 2004. As the Hong Kong West drainage tunnel scheme is technically complex, and involves specialised tunnelling works, we need to allow sufficient time to carry out detailed site investigations, physical modeling tests and the necessary statutory

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procedures. This would facilitate the appropriate design of the drainage tunnel and enable construction to proceed safely, efficiently and in a controlled manner in future.

29. We plan to implement the lower catchment drainage improvement works for the Wan Chai, Central and Western districts (see paragraph 4(b) above) in September 2005 for completion in September 2009. Subject to prior enactment of the relevant legislation<sup>3</sup>, we plan to commence construction of the Hong Kong West drainage tunnel scheme (see paragraph 3 above) in late 2006 for completion in late 2010. As decking of the nullah adjacent to Queen's College (see paragraph 4(c) above) before commissioning of the tunnel scheme will impose constraints to flow and affect the nullah's hydraulic performance, we will start implementing the decking works in late 2010 for completion in early 2012.

### **Eastern District**

30. Since the lower catchment drainage improvement works for the Eastern District (see paragraph 4(a) above) are not affected by the Hong Kong West drainage tunnel scheme and the scope is well defined, we will proceed with the design of these works in May 2002 under a separate consultancy funded under block allocation for fast track implementation. We plan to start the lower catchment drainage improvement works for the Eastern District in January 2004 for completion in January 2007.

31. Upon completion of the proposed Hong Kong West drainage tunnel and the lower catchment drainage improvement works for the Eastern, Wan Chai Central and Western Districts, the flood protection level in Northern Hong Kong Island areas will generally be brought up to withstand a rainstorm with a return period of one in 50 years and the chance of flooding during heavy rainstorms will be very small.

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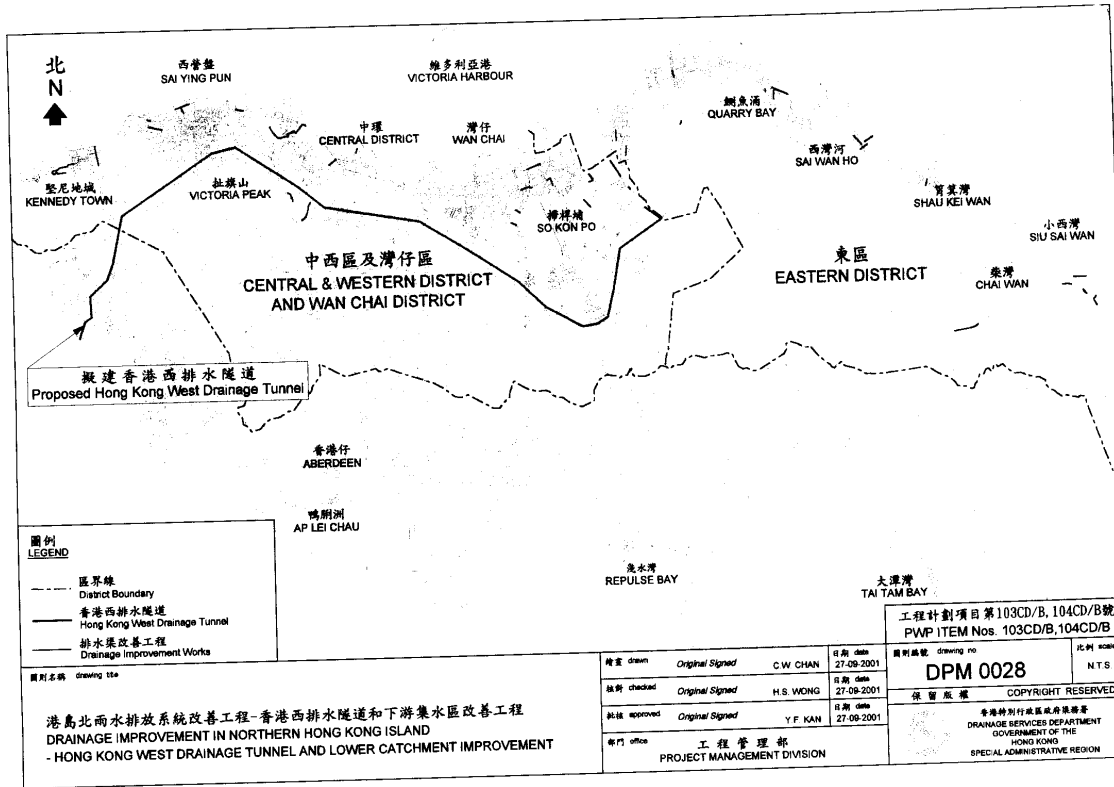
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<sup>3</sup> The proposed drainage tunnels will pass under some private lands. The Government will draft and seek enactment of the relevant bill in order to provide easements and other rights over land for the purpose of the construction, maintenance and operation of drainage tunnels. The drainage tunnel project will then be gazetted under the relevant ordinance which will provide channels for objections and appeals from the public, and authorised before commencement of construction. Subject to the approval of this proposed item, we will proceed to draft and seek enactment of the relevant bill. The law drafting and enactment process would normally take about two years to complete.

32. We estimate that the consultancy will create some 45 jobs, comprising 20 professional/technical staff and 25 labourers, totalling 1 300 man-months.

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Works Bureau  
January 2002



**圖例**  
LEGEND

- 區界線  
District Boundary
- 香港西排水隧道  
Hong Kong West Drainage Tunnel
- 排水渠改善工程  
Drainage Improvement Works

圖則名稱 drawing title

港島北雨水排放系統改善工程-香港西排水隧道和下游集水區改善工程  
DRAINAGE IMPROVEMENT IN NORTHERN HONG KONG ISLAND  
- HONG KONG WEST DRAINAGE TUNNEL AND LOWER CATCHMENT IMPROVEMENT

繪圖 drawn	Original Signed	C.W. CHAN	日期 date	27-09-2001
核對 checked	Original Signed	H.S. WONG	日期 date	27-09-2001
批准 approved	Original Signed	Y.F. KAN	日期 date	27-09-2001
部門 office	工程管理部 PROJECT MANAGEMENT DIVISION			

工程計劃項目第103CD/B, 104CD/B號 PWP ITEM Nos. 103CD/B, 104CD/B	
圖則編號 drawing no	比例 scale
<b>DPM 0028</b>	NTS
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附件 1 Enclosure 1

**Enclosure 2 to PWSC(2001-02)99**

**103CD – Drainage improvement in Northern Hong Kong Island  
– Hong Kong West drainage tunnel**

**104CD – Drainage improvement in Northern Hong Kong Island  
– lower catchment improvement**

**Breakdown of the estimates for the consultants' fees**

**A. 103CD – Drainage improvement in Northern Hong Kong Island  
– Hong Kong West drainage tunnel**

Consultants' staff costs			Estimated man-months	Average MPS* salary point	Multiplier	Estimated fee (\$ million)
(a)	Supervision of site investigations and surveys	Professional	19	38	1.7	2.0
		Technical	57	14	1.7	1.9
(b)	Environmental impact assessment	Professional	15	38	2.4	2.2
		Technical	9	14	2.4	0.4
(c)	Traffic impact assessment	Professional	2	38	2.4	0.3
		Technical	2	14	2.4	0.1
(d)	Preliminary design	Professional	47	38	2.4	6.8
		Technical	92	14	2.4	4.3
<b>Total consultants' staff costs</b>						18.0

**B. 104CD – Drainage improvement in Northern Hong Kong Island  
– lower catchment improvement**

Consultants' staff costs			Estimated man-months	Average MPS* salary point	Multiplier	Estimated fee (\$ million)
(a)	Supervision of site investigations and surveys	Professional	2	38	1.7	0.2
		Technical	6	14	1.7	0.2
(b)	Traffic impact assessment	Professional	12	38	2.4	1.7
		Technical	10	14	2.4	0.5
(c)	Preliminary design	Professional	20	38	2.4	2.9
		Technical	30	14	2.4	1.4
<b>Total consultants' staff costs</b>						6.9

\* MPS = Master Pay Scale

**Notes:**

1. A multiplier of 2.4 is applied to the average MPS point to estimate the full staff costs including the consultants' overheads and profit, as the staff will be employed in the consultants' offices. A multiplier of 1.7 is applied in the case of resident site staff supplied by the consultants. (As at 1.4.2001, MPS pt. 38 = \$60,395 per month and MPS pt. 14 = \$19,510 per month).
2. The figures given above are based on estimates prepared by the Director of Drainage Services. We will only know the actual man-months and actual fee when we have selected the consultants through the usual competitive fee bid system.

**Table of Comparison - Interception Approach and Traditional Approach**

**103CD – Drainage improvement in Northern Hong Kong Island  
– Hong Kong West drainage tunnel**

**104CD – Drainage improvement in Northern Hong Kong Island  
– lower catchment improvement**

	Interception approach (with drainage tunnel)			Traditional approach (through pipelaying)
	Urban drainage works	Tunnel works	Total	Urban drainage works
Length	3 km	10 km	3 km of drains + a tunnel of 10 km	18 km
Construction cost	\$200 million	\$1,100 million	\$1,300 million	\$1,200 million
Construction time	4 to 6 years	4 years	4 to 6 years	6 to 10 years