Legislative Council Panel on Development

A Strategy for Total Water Management in Hong Kong

PURPOSE

This paper briefs Members on Government's Total Water Management (TWM) Strategy and seek Members' views on the Strategy. It also updates Members on the latest position of an important component in the TWM strategy, the replacement and rehabilitation (R & R) programme for aged water mains, and seeks Members' support to implementing the remaining phases of the R&R programme.

TOTAL WATER MANAGEMENT

2. In the 2003 Policy Address, Government pledged to implement a TWM programme to enhance water conservation and water resource protection, and to explore new water resources. In order to formulate an integrated, multi-sectoral and sustainable strategy for TWM in Hong Kong, Water Supplies Department (WSD) commissioned a comprehensive study to examine the fresh water demand and supply situations in Hong Kong and evaluated water demand and supply management measures that would be applicable in Hong Kong. Based on the findings of the study, we formulated a proposal for a TWM strategy for the period up to year 2030. The key elements of the TWM Strategy are summarized below.

Total Water Management Strategy

3. A TWM strategy is required to better prepare Hong Kong for uncertainties such as acute climate changes and low rainfall. It also helps enhance Hong Kong's role as a good partner of other municipalities in the Pearl River Delta in promoting sustainable use of water in the light of the rapid growth in water demand in the region.

4. The TWM strategy to be adopted is to proactively manage demand and supply of water in an integrated, multi-sectoral and sustainable manner.

Water Demand

5. In 2007, the total fresh water demand in Hong Kong was 951 million cubic metres (mcm). Domestic (35%) and non-domestic (25%) consumption accounts for most of the water demand. Water mains leakage (23%) aside, the other important consumption of fresh water includes flushing and fire-fighting. Under the scenario of reference population of 8.4 million by 2030, the fresh water demand will grow to 1,315 mcm.

Water Demand Management

6. In the strategy, initial emphasis will be put on the demand side of stepping up water conservation as follows.

(a) Public Education on Water Conservation

Further to the current activities on promotion of water conservation, public education will be stepped up in all sectors and directions. The focus will be on education programmes for the younger generation with due consideration given to the inclusion of the concept and details of water conservation in the school programmes.

(b) Promotion of Use of Water Saving Devices

Water saving devices¹ use less water than conventional facilities or appliances. WSD will investigate the feasibility of developing a "Water Efficiency Labelling Scheme" (WELS) the concept of which is similar to the Energy Efficiency Labelling Scheme operated by the Electrical and Mechanical Services Department. WELS would be set up on a voluntary basis to facilitate the consumers to select plumbing fixtures and appliances that would help conserve water. In addition, the Government will promote installation of water saving devices through incorporating them in its projects and buildings as far as practicable.

¹ Examples are taps that limit flow, low-flow showerheads and flow restrictors.

(c) Active Leakage Control

The first step to control water leakage is to implement a replacement and rehabilitation (R & R) programme on the aged water distribution network. The current plan is to tackle about 3 000 km of the 7 700 km network. An update on this programme is in the second part of this paper.

WSD will conduct a review on the management of underground assets. Subject to the finding of the review, WSD would continue with the R&R of water mains to cover the remaining parts of the network.

In addition, WSD would implement comprehensive pressure management to optimize water mains pressure, and enhance leakage detection and monitoring so that leakage could be detected for early remedial actions.

(d) Use of Seawater for Toilet Flushing

WSD has used seawater for toilet flushing in the metropolitan areas and most of the new towns to conserve fresh water. WSD has been planning for extension of the salt water flushing supply system wherever it is economically justified. Preparatory works are in progress for the supply to Pokfulam, Yuen Long and Tin Shui Wai.

Water Supply

7. Surface water collected locally from water gathering grounds ("local yield") provides 20 to 30 percent of water supply to Hong Kong at present. The annual local yield averages at 295 mcm per year and can provide a reliable supply of 210 mcm per year in a one-in-one-hundred year drought (99 percent reliability). About 70 to 80 percent of water is imported from Dongjiang under our agreement with Guangdong authorities. The capacity available through the Dongjiang water supply system will be sufficient to cope with the projected demand in the coming two decades.

Water Supply Management

8. The focus of the supply management is on the following three areas:

(a) Protection of Water Resources

WSD plans to strengthen the current practice in protection of water resources. Firstly, a study is in progress to develop the water pollution risks and impact assessment framework for protection of water resources from development in water gathering grounds. Secondly, WSD is planning to start a major capital works project to improve the existing catchwater system for safe and effective collection of surface water.

(b) New Water Resources

WSD completed a pilot seawater desalination plant study using reverse osmosis technology in 2007. Seawater desalination could be used in the process as it would yield the largest quantity of new water. It is a proven technology internationally and suitably tested in Hong Kong. However, the present day technology involves high capital costs, high level of electricity consumption, and possible negative impact on the marine ecology. In light of this, WSD will closely monitor any further technological advancement that could enhance the viability of such system.

(c) Water Reclamation

Water reclamation is to use lower quality water to replace high quality water currently used for non-potable purposes such as toilet flushing and landscape irrigation. Subject to the final results of the two current pilot schemes on the use of reclaimed water at Ngong Ping and Shek Wu Hui, reclaimed water from Shek Wu Hui Sewage Treatment Works could be planned for provision to consumers in Sheung Shui / Fanling for toilet flushing and other non-potable uses.

As for reuse of grey water and rainwater harvesting, the Government will conduct trials in projects of appropriate scale and nature to gather experience and encourage private developers to consider them.

PUBLIC CONSULTATION

9. We consulted the Advisory Council on the Environment and the Advisory Committee on the Quality of Water Supplies on the proposed TWM strategy in April 2008. They considered the TWM strategy a good direction towards the proactive management of water demand and supply resources. We also consulted the relevant professional bodies, tertiary institutions, green groups and non-government organizations in May 2008 and they considered that the strategy is on the right track for the sustainable use of our precious water resources.

REPLACEMENT AND REHABILITATION OF WATER MAINS

10. The foregoing part of this paper mentions that a key component of the TWM Strategy is the replacement and rehabilitation of water mains as an important measure to control leakage and water bursting. Major aspects of the replacement and rehabilitation of water mains are described below.

The R&R Programme

11. Hong Kong's fresh water and salt water supplies are provided through a network of about 7 700 kilometres (km) of water mains. Most of these water mains are underground. A substantial portion of the water mains was laid more than 30 years ago. They are progressively approaching the end of their service lives and have become increasingly difficult and costly to maintain. As a result of the ageing problem, we faced an increasing number of main bursts and leakage causing inconvenience to the public and loss of precious water resources. The previous way of carrying out piece-meal and small-scale replacement works was not considered effective. WSD therefore started in 2000 to implement a comprehensive and cost-effective management plan for the water supply network. This involves the replacement and rehabilitation of some 3 000 km of aged water mains in stages to prevent further deterioration of the water supply network.

12. In view of the large scale of works and the long project duration, the R & R programme was to be implemented in four stages, within a period of twenty years

between 2000 and 2020. Higher priority is given to the replacement and rehabilitation of those water mains that are in more critical conditions to bring about early benefits. In 2005, WSD decided to advance the target completion of the R & R programme from 2020 to 2015. We will continue reviewing the R & R programme taking into account prevailing constraints with a view to achieving an earlier completion.

13. Further details of the various stages of the R & R programme are at **Appendix 1**. A summary of the current status of the various stages is given in the table below.

	Length (km)	Start	Completion	Length Completed (km)	Progress as of 30 April 2008
Stage 1 Phase 1	350	Dec 2000	Dec 2008	333	95%
Stage 1 Phase 2	250	Sep 2005	Mar 2010	84	34%
Stage 2	750	Jan 2007	Jun 2011	63	8%
Stage 3	800	Aug 2008	Dec 2013		Design substantially completed
Stage 4	850	2011	2015		Planning completed
Total	3000			480	16 %

14. The stages 1 and 2 works are now in progress. As at end of April 2008, about 480 km of main-laying works have been completed. The remaining works for these two stages will be completed by 2010 and 2011 respectively. As for the stage 3 works, we plan to commence construction in August 2008. We also plan to engage consultants for the investigation and design of the stage 4 works in late 2008. We have scheduled to submit the proposed upgrading of the stage 3 works under **186WC** and part upgrading of the stage 4 works under **189WC** to Category A for consideration by the Public Works Sub-committee in June 2008. Details of the proposed upgrading are given in **Appendix 2**.

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Benefits and Challenges

Benefits

15. Implementing the R & R programme will significantly increase the reliability of the water supply and distribution system and will greatly reduce the number of main bursts and leaks and the inconvenience to the public. With the R & R works completed to-date, the total number of bursts and leaks has been reduced from the peak of about 25 500 in 2002/03 to 15 200 in 2007/08. We anticipate the leakage rate will be further decreased from 25 % in 2001 to 15 % upon completion of the current R & R programme.

Challenges

16. The scale, extent and duration of the current R & R programme are unprecedented. An added challenge is that a significant portion of the works falls within urban areas and many of the water mains are under very busy roads. Experience from stages 1 and 2 reveals that accelerating the programme would increase the number of work fronts and would intensify the impact on traffic and bring inconvenience to the public. WSD would continue with active public engagement to take account of public views in devising mitigation measures for the works.

WAY FORWARD

17. The TWM strategy will form the foundation for future reviews and continuous monitoring of the state of water demand and supply in Hong Kong. It will also help WSD initiate new measures to meet challenges, for optimal utilization and development of water resources.

18. As regards the R & R programme, WSD shall make every endeavor to complete the remaining stages of the current R&R programme before 2015, and would extend the programme further to help conserve water and reduce the inconvenience of water mains bursts.

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ADVICE SOUGHT

19. Members are requested to –

- (a) give views on the TWM strategy;
- (b) note the latest position of the R&R programme; and
- (c) support the proposals to upgrade **186WC** and part of **189WC**.

Development Bureau Water Supplies Department May 2008

Appendix 1

Current status on the four stages of the water mains replacement and rehabilitation programme

PWP Item	Item Description	Status
90WC	Stage 1 phase 1 – Replacement and rehabilitation of 246 km of fresh water mains and 104 km of salt water mains Total approved project estimate: \$2,432 million	The project was part-upgraded to Category A in several packages as 95WC , 175WC , 177WC and 179WC for engaging consultants to carry out investigation and detailed design, and for implementing the early parts of the works. The remaining part of the project was upgraded to Category A as 90WC in May 2003. Construction works are now in progress for completion in December 2008.
174WC	Stage 1 phase 2 – Replacement and rehabilitation of 210 km of fresh water mains and 40 km of salt water mains Total approved project estimate: \$1,327 million	The project was part-upgraded to Category A as 178WC for engaging consultants to carry out investigation and impact assessments. The project was part-upgraded to Category A again as 185WC in June 2005 for construction of the works in Sha Tin and Tai Wai. The remaining part of the project was upgraded to Category A as 174WC in April 2006. Construction works commenced in August 2006 for completion in March 2010.

PWP Item	Item Description	Status
182WC	Stage 2 – Replacement and rehabilitation of 670 km of fresh water mains, 80 km of salt water mains and 3 km of raw water mains Total approved project estimate: \$3,220 million comprising \$3,167 million under 182WC and \$53 million under 184WC (part-upgraded from 182WC)	The project was part-upgraded to Category A as 184WC in March 2005 for engaging consultants to carry out investigation and detailed design. The remaining part of the project was upgraded to Category A as 182WC in December 2006. The construction works commenced in early 2007 for completion in June 2011.
186WC	Stage 3 – Replacement and rehabilitation of 635 km of fresh water mains and 165 km of salt water mains Estimated project cost: \$5,615 million comprising \$5,550 million under 186WC and \$65 million under 187WC (part-upgraded from 186WC)	The project was part-upgraded to Category A as 187WC in July 2006 for engaging consultants to carry out investigation and detailed design. The proposed investigation and design consultancies are in progress for completion by early 2009. The remaining part of the project is scheduled to be upgraded to Category A in July 2008. Construction works are scheduled to commence in August 2008 for completion in 2013.
189WC	Stage 4 – Replacement and rehabilitation of 737 km of fresh water mains and 113 km of salt water mains Estimated project cost: \$6,689 million	The project is scheduled to be part- upgraded to Category A in July 2008 for engaging consultants to carry out investigation and detailed design. The proposed investigation and design consultancies are scheduled to commence in October 2008 for completion by phases around mid 2011. Construction works are scheduled to commence in early 2011 for completion in 2015.

Appendix 2

186WC – Replacement and rehabilitation of water mains, stage 3

189WC - Replacement and rehabilitation of water mains, stage 4

PURPOSE

We intend to upgrade the remaining part of **186WC** "Replacement and rehabilitation of water mains, stage 3" and part-upgrade **189WC** "Replacement and rehabilitation of water mains, stage 4 – investigation and detailed design" to Category A at estimated costs of \$5,550 million and \$198.4 million respectively in money-of-the-day (MOD) prices.

PROPOSALS

186WC "Replacement and rehabilitation of water mains, stage 3"

2. The stage 3 works under **186WC** comprise the replacement and rehabilitation of water mains in various districts throughout the territory as shown in **Enclosure 1** and summarized below -

- (a) about 635 km of fresh water mains ranging from 20 to 1 500 millimetres (mm) in diameter including associated service pipes and connections; and
- (b) about 165 km of salt water mains ranging from 20 to 1 000 mm in diameter including associated service pipes and connections.

3. In July 2006, Finance Committee approved the part-upgrading of **186WC** to Category A as **187WC** for engaging consultants to carry out investigation and detailed design of the works. We now propose to upgrade the construction works under **186WC** to Category A at an estimated cost of \$5,550 million in MOD prices.

4. The construction period, commencing from mid 2008 for completion in late 2013, includes laying associated service pipes and completing service connections to households.

189WC (part-upgrade) "Replacement and rehabilitation of water mains, stage 4"

5. The stage 4 works under **189WC** is the last stage of the current replacement and rehabilitation programme for aged water mains. It comprises the replacement and rehabilitation of remaining water mains to be covered under the programme at an estimated cost of \$6,689 million in MOD prices. Similar to previous stages, the water mains scatter in various districts throughout the territory as shown in **Enclosure 2** and summarized below -

- (a) about 737 km of fresh water mains ranging from 20 to 2 200 mm in diameter including associated service pipes and connections; and
- (b) about 113 km of salt water mains ranging from 25 to 1 200 mm in diameter including associated service pipes and connections.

6. We propose to engage consultants to carry out investigation and design for the project at an estimated cost of \$198.4 million in MOD prices. The scope of the proposed consultancy includes -

- (a) detailed design of the replacement and rehabilitation works;
- (b) traffic impact assessments;
- (c) drainage impact assessments;
- (d) environmental reviews; and
- (e) site investigation and condition survey works.

JUSTIFICATION

7. To prevent further deterioration of the water supply network, we need to implement the R & R programme as soon as possible. As part of the programme, the proposed stage 3 works under **186WC** will help bring about earlier improvement to the supply system and avoid loss of precious water resources. It will also minimize

inconvenience to the public due to frequent main bursts. Upon the completion of the stage 3 works, about 800 km of water mains will be replaced or rehabilitated.

8. As regards stage 4 of the programme, we need to commence investigation and detailed design works in mid 2008 in order to enable the construction works to commence by early 2011 as scheduled. In view of the scale and complexity, the proposed works demand considerable resources over a relatively short period. As WSD does not have adequate in-house resources to carry out the works under **189WC**, it is therefore proposed to part-upgrade **189WC** for engagement of consultants to carry out investigation, impact assessments and detailed design of the proposed stage 4 works.

FINANCIAL IMPLICATIONS

186WC

9. We estimate the cost of the proposed works to be about \$5,550 million in MOD prices made up as follows –

			\$ million
(a)	Water main replacement by		3,100
	(i) traditional mainlaying method(ii) trenchless methods	2,686 414	
(b)	Water main rehabilitation by trenchless methods		1,540
(c)	Environmental mitigation measures		55
(d)	Consultants' fees for		525
	(i) contract administration	25	
	(ii) site supervision	500	

(e) Contingencies

330

Total 5,550 (in MOD prices)

189WC (part-upgrade)

10. We estimate the cost of the proposed consultancies for the investigation, impact assessments and detailed design of the proposed works to be \$198.4 million in MOD prices made up as follows –

				\$ millio	n
(a)	Cons	Consultants' fees			
	(i)	Design, tender documentation	10.0		
		and assessment	49.3		
	(ii)	Traffic impact assessment	4.3		
	(iii)	Drainage impact assessment	1.1		
	(iv)	Environmental review	2.1		
	(v)	Supervision of site investigation and condition survey works	12.7		
(b)	Site i	nvestigation and condition survey we	orks	110.2	
(c)	Cont	ingencies		18.7	_
			Total	198.4	(in MOD prices)
					_

11. There will be no additional recurrent expenditure arising from completion of the proposed works under **186WC** and from the part of **189WC** we now propose to upgrade to Category A.

ENVIRONMENTAL IMPLICATIONS

186WC

12. This is not a designated project under Environmental Impact Assessment (EIA) Ordinance. The project does not have any long-term environmental impact. Short-term construction impacts will be mitigated through the implementation of standard pollution control measures on abatement of air, noise, water and waste pollutions. We have included about \$55 million in MOD prices to implement these mitigation measures and will incorporate these requirements into the works contracts for implementation.

13. We have considered the alignments of the proposed water mains in the planning and design stages to reduce the generation of construction waste where possible. In addition, we will require the contractor to reuse inert construction waste (e.g. excavated soil) on site or in other suitable construction sites as far as possible, in order to minimize the disposal of inert construction waste to public fill reception facilities. We will encourage the contractor to maximize the use of recycled or recyclable inert construction waste, as well as the use of non-timber formwork to further minimize the generation of construction waste.

14. We will also require the contractor to submit for approval a plan setting out the waste management measures, which will include appropriate mitigation means to avoid, reduce, reuse and recycle inert construction waste. We will ensure that the day-to-day operations on site comply with the approved plan. We will require the contractor to separate the inert portion from non-inert construction waste on site for disposal at appropriate facilities. We will control the disposal of inert construction waste and non-inert construction waste to public fill reception facilities and landfills respectively through a trip-ticket system.

15. We estimate that the project will generate in total about 1 108 000 tonnes of construction waste. Of these, we will reuse about 602 000 tonnes (about 54.3%) of inert

construction waste on site and deliver 492 000 tonnes (about 44.4%) of inert construction waste to public fill reception facilities¹ for subsequent reuse. In addition, we will dispose of 14 000 tonnes (about 1.3%) of non-inert construction waste at landfills. The total cost for accommodating construction waste at public fill reception facilities and landfill sites is estimated to be \$15 million for this project (based on an unit cost of \$27/tonne for disposal at public fill reception facilities and \$125/tonne² at landfills).

16. The proposed works will not involve any tree felling proposal.

189WC (part-upgrade)

17. The proposed consultancies will not have adverse environmental implications. We will look into the environmental implications of the project. If any designated project under the EIA Ordinance is identified in the course of the consultancies, we will follow and comply with the statutory process under the Ordinance.

18. The proposed design consultancy and site investigation works will only generate very little construction waste. We will require the consultant to fully consider measures to minimize the generation of construction waste and to reuse/recycle construction waste as much as possible in the future implementation of the construction projects.

19. The proposed site investigation and condition survey works will not involve any tree felling proposal.

HERITAGE IMPLICATIONS

20. The stage 3 works under **186WC** will not affect any heritage site, i.e. all declared monuments, proposed monuments, graded historic sites/buildings, sites of

¹ Public fill reception facilities are specified in Schedule 4 of the Waste Disposal (Charges for Disposal of Construction Waste) Regulation. Disposal of inert construction waste in public fill reception facilities requires a license issued by the Director of Civil Engineering and Development.

² This estimate has taken into account the cost for developing, operating and restoring the landfills after they are filled and the aftercare required. It does not include the land opportunity cost for existing landfill sites (which is estimated at $90/m^3$), nor the cost to provide new landfills (which is likely to be more expensive) when the existing ones are filled.

archaeological interest and Government historic sites identified by the Antiquities and Monuments Office.

21. The proposed site investigation and condition survey works for stage 4 works under **189WC** will not affect any heritage site, i.e. all declared monuments, proposed monuments, graded historic sites/buildings, sites of archaeological interest and Government historic sites identified by the Antiquities and Monuments Office.

TRAFFIC IMPACT

22. We have carried out traffic impact assessments (TIA) for the proposed works under **186WC**. The cumulative effects of adjacent projects are also covered in the TIA. The TIA has concluded that the proposed works would not cause any unacceptable traffic impact. We will implement temporary traffic arrangements to minimize impacts on traffic during construction and will display notice boards on site to explain the reason of temporary traffic arrangements and the expected completion date of the concerned section of works. In addition, we will set up telephone hotlines for public enquiries or complaints. Furthermore, trenchless methods will be used whenever practicable for works along busy roads, e.g. Nathan Road and Queensway.

PUBLIC CONSULTATION

23. We advised the then Legislative Council Panel on Planning, Lands and Works (the Panel) on 16 May 2006 through circulation of an information paper regarding implementation of the stage 3 works, and received support from Members when we proposed to upgrade part of **186WC** – "Replacement and rehabilitation of water mains, stage 3" for the investigation and detailed design for the stage 3 works.

24. We also updated Members through circulation of an information paper on 19 July 2006 on the various stages of the water mains replacement and rehabilitation programme when we consulted the Panel on **182WC** – "Replacement and rehabilitation of water mains, stage 2" on our proposal to replace and rehabilitate 750 km of water mains.

25. We have consulted all District Councils recently on **186WC**. All the District Councils except Central and Western District Council³ (C&WDC) have rendered support on the implementation of the works. A table showing details of the consultations is at **Enclosure 3**. In view of some District Councils' concern about traffic and environmental impacts arising from the proposed works, we will implement adequate traffic and environmental mitigation measures under the works contracts. We will also closely monitor implementation of these mitigation measures and the interfacing of works, and will keep the relevant District Councils informed during the project period. We will consult the relevant District Councils again and take their views into consideration at the design stage of **189WC**.

LAND ACQUISITION

26. The proposed works do not require any land acquisition.

JOB CREATION

27. We estimate that the proposed works under **186WC** and **189WC** (part-upgrade) will create about 1 900 jobs (1 540 for labourers and another 360 for professional/technical staff) and 89 jobs (38 for labourers and another 51 for professional/technical staff) respectively providing a total employment of 111 660 (109 100 for **186WC** and 2560 for **189WC**) man-months.

WAY FORWARD

28. We intend to submit the proposed upgrading of **186WC** and part-upgrading of **189WC** to Category A for consideration by the Public Works Sub-committee in June 2008 with a view to seeking funding approval from the Finance Committee in July 2008.

³ We consulted the Food, Environment, Hygiene and Works Committee of C&WDC on 13 March 2008. Members sought further information on several issues. We will consult the Committee again on 22 May 2008.





REF. 62007-175.DWG

Appendix 2 Enclosure 3 (Sheet 1 of 2)

186WC – Replacement and rehabilitation of water mains, stage 3 Consultation with District Councils

District Council	Date of Meeting	Decision
Tai Po District Council Environment, Housing and Works Committee	16 January 2008	Supported
Wan Chai District Council Development, Planning and Transport Committee	14 February 2008	Supported
Wong Tai Sin District Council Traffic and Transport Committee	19 February 2008	Supported
Sai Kung District Council Traffic and Transport Committee	21 February 2008	Supported
Kwai Tsing District Council Traffic and Transport Committee	21 February 2008	Supported
Sha Tin District Council Development and Housing Committee	21 February 2008	Supported
Tsuen Wan District Council Traffic and Transport Committee, and Environmental and Health Affairs Committee	25 February 2008 & 28 February 2008	Supported
Kwun Tong District Council Traffic and Transport Committee	27 February 2008	Supported
Kowloon City District Council Housing and Infrastructure Committee	6 March 2008	Supported
Yau Tsim Mong District Council Traffic and Transport Committee	6 March 2008	Supported
Eastern District Council Planning, Works and Housing Committee	7 March 2008	Supported
Southern District Council District Development and Environment Committee	10 March 2008	Supported

Appendix 2 Enclosure 3 (Sheet 2 of 2)

186WC – Replacement and rehabilitation of water mains, stage 3 Consultation with District Councils

District Council	Date of Meeting	Decision
North District Council District Minor Works and Environmental Improvement Committee	17 March 2008	Supported
Yuen Long District Council Town Planning and Development Committee	19 March 2008	Supported
Sham Shui Po District Council Transport and Housing Affairs Committee	27 March 2008	Supported
Tuen Mun District Council Environmental, Hygiene and District Development Committee	28 March 2008	Supported
Islands District Council	14 April 2008	Supported
Central and Western District Council Food, Environment, Hygiene and Works Committee	13 March 2008 & 22 May 2008	Support to be sought