ACQWS Paper No. 9
Quality of Water in Buildings
(Supplementary Paper No. 2)

1. Background and objective

1.1 On 15 January and 12 July 2001, Members considered ACQWS Paper Nos. 7 and 8 respectively on the strategy to enhance measures for maintaining good water quality in the entire water supply system. The aim is to enable the public to have a clear understanding of the water quality and the free choice with confidence to drink water direct from their taps. Members generally agreed to the proposed strategy.

1.2 The objective of this paper is to set out the actions under the strategy and to map out an implementation plan for Members' consideration before public consultation is carried out.

2. Quality of water in the public water supply systems

2.1 The quality of the final treated water at the water treatment works in Hong Kong fully complies with the World Health Organization (WHO) guidelines for drinking water. There is always an adequate level of residual chlorine in the water to ensure that it is free from bacterial growth throughout the public water supply systems, which are designed to operate in an enclosed manner to prevent ingress of foreign matters. Even air vents at service reservoirs are so designed and maintained to prevent ingress of foreign matters, such as insects etc. Nevertheless, there could still be small quantities of fine sediments deposited inside the supply system and they could be stirred up on some occasions, especially when there is a sudden change of flow rate or direction in large pipelines due to valve operations associated with main burst repairs. To ensure that good water quality is maintained throughout the supply systems up to the connection points of buildings, Water Supplies Department (WSD) has well-established practices of regular cleaning of service reservoirs, flushing dead-end mains etc. The risks of having water quality problem in distribution mains are normally minimal.

2.2 WSD monitors the water quality throughout the supply systems by taking samples at treatment works, service reservoirs, distribution mains, connection points and customers' taps. Some of the tests on water samples are done on the spot but most of the samples are meticulously analysed at WSD's laboratories by qualified staff. In 2000/2001, the number of treated water samples taken for analysis of bacteria and other health related parameters were over 25,000. The results fully complied with WHO guidelines.

3. Scale and extent of problems in quality of water in buildings

3.1 When the water enters individual buildings through the connection points, the water quality may suffer degradation depending on the conditions of the inside services within the building lots. The water may be susceptible to discolouration in passing through rusty pipes or quality degradation in poorly maintained water tanks. Since maintenance of the plumbing systems and cleaning of water tanks within the building lots are the responsibility of the registered consumers or registered agents, it is important to let them understand that assurance of good water quality at their taps relies heavily on their active participation.

3.2 Quality of water in a building is basically related to the condition of its inside service, which often links to the age of the building. Generally speaking, new buildings with plumbing proposals submitted after Dec 1995 should have already used corrosion-resistant pipe materials and therefore the problem of discolouration due to rusting pipes should be quite rare. Buildings over 30 years old will most likely be considered for redevelopment, and as such, systematic re-plumbing is not likely. For buildings ranging from 5 to 29 years old, the owners should be more interested to improve the quality of their tap water by re-plumbing. It is estimated that there are about 33,000 buildings in this group, and about 23,000 of which would be the potential target group for promoting better maintenance of inside services. Nevertheless, buildings not within the target group are also welcomed to improve their quality of water. Further details are given in **Appendix 1**.

4. Proposed strategy

4.1 To raise customers' confidence in drinking water direct from the tap, it is necessary to improve the conditions of inside services in buildings and to raise the awareness of the need for their proper maintenance. The proposed strategy is to start with public education and follow with legislative action if necessary. The proposed strategy will require actions in stages as follows.

4.2 Stage 1 focuses on publicity and public education. Customers will be informed of what causes water quality problems in buildings, what can be done to resolve them and how they can participate in improving the quality of water they drink. The aim is to raise public awareness of the problem and to encourage customer participation in solving it. Stage 1 actions will take about 3 years to complete.

4.3 Starting from the beginning of the third year of Stage 1 implementation, a review will be made to assess their effectiveness. If the results

are promising, the actions will be sustained to achieve long-term results.

4.4 The review of Stage 1 actions is estimated to take 1 year. If Stage 1 actions do not produce the expected results, it will be necessary to proceed to Stage 2 for setting up mandatory requirement, backed up with legislation to ensure that good practice in maintenance of inside services are followed to prevent degradation of water quality in buildings.

5. Detailed actions

5.1 Stage 1 actions.

5.1.1 Strengthening supervision of existing practices on quality assurance in the public water supply system

5.1.1.1 WSD will strengthen supervision of existing practices on quality assurance in the public water supply system. Moreover, to upkeep the good quality of water in the distribution systems, WSD will step up the control of operational or maintenance activities that may cause water quality problems, and will strengthen the measures, such as flushing of water mains etc., to ensure good water quality throughout the whole supply network.

5.1.1.2 WSD will continue to make efforts to replace and rehabilitate old water mains, especially the unlined galvanised steel sub-mains.

5.1.2 More publicity on quality of water supplied by WSD

Customer confidence in drinking water should first be built on the thorough understanding in how well the public water supply systems are designed, operated and maintained. WSD will continue to publish Dongjiang Water Quality Data and drinking water quality data. WSD and Department of Health (D of Health) will continue to monitor and keep the public informed of health issues relating to drinking water quality. WSD continues to coordinate with Home Affairs Department (HAD) in reaching out to building owners and encourage them to improve the maintenance of their buildings.

5.1.3 Publicity on drinking direct

To ensure that the concerns and needs of customers on the issue of drinking direct from the tap are taken into account, an opinion survey will be conducted. Based on the findings, promotional themes will be formulated

to address the concerns and needs of customers with particular emphasis on safety, convenience, energy-saving and cost-saving.

5.1.4 Information at CTEC on quality of water in specific areas

Openness and spontaneity of reporting incidents of substandard water supply is a must to respect customers' right to know and is another pillar for them to build up confidence in the water supply. Staff of Customer Telephone Enquiry Centre (CTEC) will be equipped with the necessary knowledge to advice the public upon receiving enquiries on water quality in specific areas.

5.1.5 Advice to registered consumers and agents on proper maintenance of inside services

5.1.5.1 On the financial side, customers can make use of loans available for application from the Building Safety Loan Scheme (BSLS) operated by the Building Department (BD) for proper maintenance of inside service. Owners in hardship, e.g. elderly and other persons with very low income, may apply for interest-free loans.

5.1.5.2 On technical assistance, WSD will issue a Plumbing Maintenance Guide for use by customers, management offices and maintenance agents to enable them to have a clear understanding on all key aspects and considerations in plumbing maintenance including re-plumbing. WSD will also continue to organise seminars for staff of management offices to keep them updated on how to preserve water quality. For internal plumbing systems used for supplying water for drinking direct, the Guide will advise agents to employ practitioners of registered bodies to arrange annual checking, water sampling and testing, rectification of defects and submission of inspection reports to WSD. The testing requirements are set out in **Appendix 2**, in which estimated costs of the various tests are also given. A preliminary assessment on the costs and affordability is at **Appendix 3**.

5.1.5.3 WSD will streamline the application procedures on re-plumbing works so that applications can be promptly processed and approved.

5.1.5.4 On coordination aspect, WSD will work in collaboration with other government departments to promote more active participation of Owners' Corporations and Mutual Aid Committees in maintenance of inside services. One suggested way is to provide reference data on various types of plumbing work and plumbing materials. WSD will also liaise

with relevant trade associations with a view to promoting transparency in the implementation of re-plumbing work.

5.1.5.5 To facilitate market operation and to maintain practitioners' skills, WSD will establish a register of qualified personnels, agencies or authorized practitioners in cleaning, inspection, checking and rectifying internal plumbing systems. Water sampling and testing will have to be carried out by laboratories accredited to the required level of testing accuracy. Customers can refer to the list of HOKLAS accredited laboratories in the HKAS Directory of Accredited Laboratories published by the Innovation and Technology Commission or at the government web site http://www.info.gov.hk/itc/hkas.

5.1.5.6 The Government will continue to take the lead in adhering to maintenance requirements in government and quasi-government buildings. Relevant departments and corporations will carry out self-monitoring.

*5.1.6 **Award to buildings with proper maintenance of inside services***

WSD will promote a Water Quality Recognition Scheme to recognize organizations, which have accomplished full compliance with all maintenance requirements of inside services and preserving water quality in buildings. The requirements will include water examination and report submission for one full test on 8 parameters (vide **Appendix 2**) by accredited laboratories. The recognition will be in the form of a certificate bearing water quality mark/logo with a validity period. This logo can be displayed at drinking fountains, dispensers and drinking taps advertised to citizens and tourists as safe direct-drinking points. When there is justified water quality complaint or failure in compliance as revealed by WSD random and surprise checks, the recognition will be withheld for a period. The Scheme would be operated on a voluntary basis. It is expected that owners of hotels, high-end restaurants, properly-maintained buildings will be interested to obtain such recognition. This may bring a market force into play and attract the public to adopt new maintenance requirements.

*5.1.7 **Publicity on successful cases***

WSD will exemplify successful cases to the public on how the customers have enjoyed good quality water and associated benefits after re-plumbing or proper maintenance of inside services. Buildings in the private and the public sectors will be taken as examples so that a benchmark can be set for the public to follow.

5.1.8 A new code of practice for developers

5.1.8.1 In the current competitive property market, some developers intend to achieve competitive advantage by extending guarantee on the quality of their buildings. There is therefore incentive for developers to adopt plumbing designs with long-term water quality at taps as a prime objective.

5.1.8.2 WSD will develop and issue a new code of practice on the plumbing designs, which can protect and preserve drinking water quality to facilitate developers. It will reflect the latest technology and best international practices. The code will cover safety of drinking water and plumbing design to minimise the probability of water quality problems etc. As inputs are required from various professions, an interdepartmental working group with trade representatives and academics will be formed.

5.1.8.3 WSD will regularly organize seminars for developers, designers and academics on the latest technology in designing for preserving water quality.

5.2 Other considerations for implementing Stage 1 actions

5.2.1 For sampling and testing of water samples, there are 14 HOKLAS private laboratories providing such service but currently they are not fully accredited for the tests of 8 parameters listed in **Appendix 2**. In view of the increase in the number of tests when Stage 1 actions are implemented, it is believed that market force will enable individual laboratories to seek accreditation in order to stay in business.

5.3 Stage 2 actions

5.3.1 As Stage 2 actions will depend on how effective Stage 1 actions are, it is not possible to be specific about Stage 2 actions. However, the actions set out below are considered to be necessary at this point in time.

5.3.2 A system is to be developed for recording WSD inspection result of plumbing systems in old buildings where neither proper management nor plumbing maintenance are carried out. This recording system serves to reflect the cause of any defects and will form a basis of review on the need of legislation.

5.3.3 At present, when customers or their agents do not comply with WSD's requirement to repair the plumbing or clean the water tanks, WSD seldom takes the step to carry out the work and then recover the costs from the customers or agents. This is to avoid the potential risk of being drawn into more maintenance works at private properties during the work and the difficulty of recovering costs from the customers or agents for the work done. To overcome the hurdle of recovering costs, it is proposed that WSD be empowered by legislation to carry out the necessary repair work at the customers' costs with or without their consent for persistent non-compliance cases. Should they fail to reimburse WSD, WSD will be empowered by legislation to register by memorial in the Land Registry against the premises to which the work relates. In case it is not practical for WSD to carry out the repair work, WSD will issue letters to relevant customers advising them not to drink direct from their taps and put up warning notices until customers complete the repair work.

5.3.4 To ensure uniform practice, the Plumbing Maintenance Guide described in Section 5.1.5.2 may become mandatory with statutory power for all practitioners to follow.

6. Implementation plan

6.1 As there are a large number of actions under Stage 1, it is estimated that their implementation will take 3 years (say up to end 2004).

6.2 A review will be conducted by early 2004 on the need of the second stage where mandatory compliance of new requirements may be required as described in Section 5.3. An implementation plan is devised at **Appendix 4**.

7. Outcome of the strategy and actions

7.1 With these comprehensive strategy and actions, we should be able within 10 years:

a. to institute more stringent practices for assurance of the water quality of the public water supply system;

b. to build up confidence of customers in the water quality of the public water supply system;

c. to raise the self-initiative of customers to re-plumb and maintain their inside services;

d. to impress upon developers the need to pay due regard to the protection and preservation of drinking water quality when constructing new inside services; and

e. to enable customers to have a clear understanding of the water quality and the free choice with confidence to drink water direct from their taps.

8. Advice sought

8.1 Advice is sought from Members on the proposed strategy, actions and implementation plan outlined in Sections 5 to 6 above. On the basis of such advice, public consultation will be initiated.

Water Supplies Department
December 2001

Scale and Extent of Problems in Quality of Water in Buildings

Water supplied at the connection point of buildings complies with the WHO guidelines but after flowing through the internal plumbing of buildings suffers quality degradation. The causes of degradation are mainly rusting of the internal plumbing system or poor maintenance of the water tanks leading to discolouration or even rendering the water unsuitable for drinking. Such plumbing are owned and maintained by the consumers or their agents.

WSD's "1999 Benchmark Opinion Survey on Water Supplies Services" revealed 42% respondents (extrapolated as 980,000 accounts) regarding water quality at their taps fair but acceptable and 4% (extrapolated as 93,000 accounts) quite poor and not quite confident. Also, 63% respondents attributed yellowish and turbid water to dirt inside water tank or rust in internal piping of their buildings and 52% respondents attributed strange smell and taste water to the same cause. Yet, there are only about 1000 to 2000 water quality complaints received by WSD per year, which represents a complaint rate of less than about 0.1% of total number of accounts. There is an apparent inconsistency that 46% respondents regarded water quality not as good as they expect but only 0.1% of consumers do actually complain each year. One possible reason for this apparent inconsistency is that the majority of consumers are aware of their part to play to rectify the situation but have not yet resolved to action. This apparent inaction is probably caused by our aged culture of boiling water for drinking as a health precaution (68% respondents boil tap water and 29% filter and boil tap water and less than 0.5% drink tap water direct). In turn, poor tap water quality reinforces their belief of health risk to drink tap water direct.

There are 3 scenarios of plumbing maintenance in buildings, closely related to their ages. For buildings over 30 years old, *"a significant proportion will approach the end of their useful life within a decade or so, particularly given that many private buildings are not properly maintained and the construction standards were generally lower when they were built… These buildings have to be ultimately taken care of by redevelopment*[1]*"*. Systematic replumbing would be unlikely.

On the other hand, new buildings with plumbing proposals submitted after Dec 1995, that is, those completed around 1996 or later, are required to use corrosion-resistant pipe materials and therefore the problem of discolouration should be quite remote. Also, most new building management offices have been carrying out regular cleaning of water tanks as a routine.

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[1] "Urban Renewal in Hong Kong" by Planning, Environmental and Lands Bureau

There are around 33,000 buildings falling within the range of 5 and 29 years old. From experience, buildings with middle class owners are properly taken care of, including regular cleaning of water tanks and replumbing if necessary. Only those buildings without proper maintenance currently will form the core of the problem to be dealt with. As roughly estimated from information provided from Home Affairs Department, there are around 3300 Owners' Corporation (OC) formed in this age group and each OC may cover more than one building (with a wild guess of 3 on average). It is very roughly estimated that around 33000-3x3300, say 23,000 buildings, may not have taken full care of their plumbing systems.

Appendix 2 to
ACQWS Paper No. 9

Testing of water samples includes the following parameters analysed to the accuracy indicated:

Analysis Parameters	**Accuracy Required**	**Estimated Cost on Individual Test Item based on market price (HK$)**
Chemical		
pH	0.1	110
Colour	1^{o} Hazen	250
Turbidity	0.1 NTU	140
Conductivity	1 μS/cm	130
Free Residual Chlorine (measured at site)	0.1 mg/l	260
Iron	0.01 mg/l	230
Bacteriological		
Presumptive E. coli Count/100 ml		400
Total Coliform Count/100 ml		400
Total		1920

Costs and Affordability

(A) Cost of Buildings Complying with the Cleaning and Sterilisation of Water Tanks Quarterly as Currently Advised by WSD

Cleaning and sterilisation of water tanks is a widely employed routine in the market and the estimated costs is in the range of $900-$1,200 per cleaning and sterilisation per tank.

The **estimated cost already involved in the existing practice** for an owner in a building with 90 flats and 2 water tanks for potable supply = $[(900 x 4) /90] to $[(1200 x 4) /90] = **$40 to $53 per flat per year**.

(B) Cost of Buildings Having Already Complied with the Cleaning and Sterilisation of Water Tanks Quarterly to Adopt New Requirements on Annual Checking of the Plumbing System and Submission of Inspection and Testing Reports

Inspection and testing are not currently carried out in most private buildings. The guesstimate costs are in the range of $1600-$2500 per inspection and testing cost in accordance with Appendix 2 is around $1920 per tank per building.

The **estimated cost** for an owner in a building with 90 flats and 2 water tanks for potable supply = $[(1600 + 1920 x 2) /90] to $[(2500 + 1920 x 2) /90] = **$60 to $70 per flat per year**.

(C) Cost of Buildings to Adopt the Cleaning and Sterilisation of Water Tanks Quarterly and New Requirements on Annual Checking of the Plumbing System and Submission of Inspection and Testing Reports

The **estimated cost** for an owner in a building with 90 flats and 2 water tanks for potable supply = $[(900 x 4 + 1600 + 1920 x 2) /90] to $[(1200 x 4 + 2500 + 1920 x 2) /90] = **$100 to $124 per flat per year**.

(D) Cost of Replumbing

(1) Replumbing together with Other Building Renovation Work

Replumbing is usually carried out together with other major renovation work in the building. Assuming the costs of mobilisation, scaffolding are absorbed by the renovation work, the cost of replumbing a communal system is in the range of $1,700-$5,000 per flat (see page 3) depending on the length of pipe and the pipe materials used. The replumbing cost for the fresh water inside service of each

individual unit also depends on the length of plumbing and the extent the plumbing is to be covered by decoration. Such replumbing may cost $2,000-$5,000 for an apartment unit of 700 sq. ft. gross floor area.

Therefore, for an owner of a flat of 700 sq. ft. gross floor area in a building with 90 flats, **the annualised costs** for replumbing (say at an interest rate of 4% p.a. for an expected life of 25 years, the annualisation factor is 0.0615) = $[(1700+2000) x 0.0615] to $[(5000+5000) x 0.0615] = **$228 to $615 per flat per year.**

(2) Replumbing not together with Other Building Renovation Work

When replumbing is not carried out together with other major renovation work, the costs of mobilisation insurance and scaffolding have to be borne by replumbing. The additional cost is around $6,000 per flat (see page 4) on top of the costs mentioned in (1).

Therefore, for an owner of a flat of 700 sq. ft. gross floor area in a building with 90 flats, **the annualised costs** for mobilisation insurance, scaffolding and replumbing (say at an interest rate of 4% p.a. for an expected life of 25 years, the annualisation factor is 0.0615) = $[(6000+1700+2000) x 0.0615] to $[(6000+5000+5000) x 0.0615] = **$597 to $984 per flat per year.**

(E) Affordability

The average Gross National Products per capita in 2000 was $189,566 per annum. The average annual household expenditure in 1999/2000 was $261,564. The average annual expenditure for the second lowest quartile expenditure group included $4632 for management fees and other housing charges and $72 for materials for house maintenance whereas for the third lowest quartile expenditure group included $7668 for management fees and other housing charges and $96 or materials for house maintenance[1]. Therefore, the increase in expenditure is considered minimal for the $80 to $97 incurred in full compliance of a new requirements on annual cleaning and sterilisation of water tanks, checking of the plumbing system and submission of inspection reports.

When compared to the average annual household expenditure of $261,564 in 1999/2000, the annualised costs of replumbing in the range of $228 to $615 represent 0.09% to 0.2% of annual expenditure and therefore are also minimal. The annualised costs of mobilisation, insurance, scaffolding and replumbing in the range of $597 to $984 represent 0.2% to 0.4% of annual expenditure and therefore are still minimal.

[1] 1999/2000 Household Expenditure Survey and the Rebasing of the Consumer Price Indices by Census and Statistics Department

Building Safety Loan Scheme - 2001
Summary of Replumbing Cost of Communal Fresh Water Supply System

Area of Building	**Replumbing Date**	**Total No. of Units**	**Total Replumbing Cost** (Note 2)	**Average Replumbing Cost Per Unit** (Note 3)
Tai Kok Tsui	Oct. 2001	91	$401,880	$4,416
Wong Tai Sin	Oct. 2001	280	$1,161,000	$4,146
North Point	Oct. 2001	66	$158,279	$2,398
Lai Chi Kok	Sept. 2001	105	$391,914	$3,733
Yau Ma Tei	Sept. 2001	36	$102,000	$2,833
Tai Kok Tsui	Sept. 2001	270	$446,746	$1,655
Mong Kok	Sept. 2001	42	$73,713	$1,755
Mong Kok	Sept. 2001	42	$84,016	$2,000
Ho Man Tin	Sept. 2001	68	$343,000	$5,044

Notes:

2. As replumbing works are usually carried out as part of the comprehensive repair works of a building, the total replumbing costs shown above do not include the costs of mobilisation, scaffolding and contingency, etc.

3. The average replumbing cost per unit shown above is derived by dividing the total replumbing cost by the total number of units. This is the average cost to be borne by each unit for replumbing works of the communal fresh water supply system, i.e. from water supply inlet at the building boundary up to the water meter positions of each unit. **The replumbing cost for the fresh water inside service of each individual unit is not included.** For an apartment unit of 700 sq. ft. gross floor area, the estimated replumbing cost for the fresh water inside service (starting after the water meter position) will be in the range of $2,000 to $5,000 depending on the location of the water meter position of that particular apartment.

Building Safety Loan Scheme - 2001

Summary of Mobilisation, Insurance and Scaffolding Cost of Communal Fresh Water Supply System

Area of Building	Replumbing Date	Total No. of Units	No. of Floors	Total Mobilisation, Insurance & Scaffolding Cost (Note 4)	Average Mobilisation, Insurance & Scaffolding Cost Per Unit (Note 5)
Tai Kok Tsui	Oct. 2001	91	23/F	$633,000	$6,956
Wong Tai Sin	Oct. 2001	280	25/F	$1,164,000	$4,157
North Point	Oct. 2001	66	23/F	$627,486	$9,507
Lai Chi Kok	Sept. 2001	105	15/F	$431,038	$4,105
Yau Ma Tei	Sept. 2001	36	8/F	$178,000	$4,944
Tai Kok Tsui	Sept. 2001	270	8/F	$1,040,211	$3,852
Mong Kok	Sept. 2001	42	13/F	$234,244	$5,577
Mong Kok	Sept. 2001	42	13/F	$269,213	$6,409
Ho Man Tin	Sept. 2001	68	20/F	$775,400	$11,402

Notes:

4. As a rule of thumb, the average scaffolding cost per unit will increase as the height of building (i.e. number of floors) goes higher. However, for the same building height, the average unit cost will decrease for larger no. of units on the same floor in the building. The scaffolding cost will also be different for ‘detached’, ‘semi-detached’ and ‘town house’ type buildings.
5. If we cross out the highest and lowest average mobilisation, insurance and scaffolding cost per unit, the mean of the average cost per unit will be $5,950 say $6,000.