For information

Legislative Council Panel on Planning, Lands and Works
174WC – Replacement and rehabilitation of water mains, stage 1 phase 2

PURPOSE

This paper briefs Members on the stage 1 phase 2 of the replacement and rehabilitation programme of aged water mains undertaken by the Water Supplies Department (WSD) as a continuation of efforts to solve the problem due to bursts and leaks of these water mains.

2. We intend to part-upgrade **174WC** to Category A, entitled "Replacement and rehabilitation of water mains, stage 1 phase 2 works in Sha Tin and Tai Wai" and at an estimated cost of about $38.7 million in money-of-the-day (MOD) prices, for replacing and rehabilitating the aged water mains in Sha Tin and Tai Wai.

BACKGROUND

3. Hong Kong's fresh water and salt water supplies are provided through a network of about 7 200 kilometres (km) of water mains. Most of these water mains are underground. About 45% of the water mains were laid more than 30 years ago. They are approaching the end of their service lives and have become increasingly difficult and costly to maintain.

4. Due to a considerable length of water mains approaching the end of their service lives, we face an increasing number of main bursts 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 engaged consultants in February 1996 to carry out an Underground Asset Management Study (the Study) to develop a comprehensive and cost-effective management plan for the water supply network. The Study recommended the replacement and rehabilitation of some 3 000 km of aged water mains in stages to prevent further deterioration of the water supply network.

5. In view of the large scale of works and the long project duration, we have planned to carry out the programme in four stages. The replacement and rehabilitation of the most critical water mains were included in stage 1 to bring about early benefits. A description of the current status of the first two stages is presented as follows -

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 implementing the early phases of the works and for engaging consultants to carry out investigation and detailed design. 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 Estimated project cost: $1,270 million	The project was part-upgraded to Category A as **178WC** for engaging consultants to carry out investigation and impact assessments. The investigation was completed and the detailed design is proceeding. The anticipated commencement and completion of the construction works will be September 2005 and March 2010 respectively.

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 Estimated project cost : $2,600 million	The project was part-upgraded to Category A as **184WC** in March 2005 for engaging consultants to carry out investigation and detailed design which are proceeding. The anticipated commencement and completion of the construction works will be January 2007 and June 2011 respectively.

6. Works under stages 3 and 4 of the programme are at the initial planning stage. To bring about earlier improvement to the supply system and minimise inconvenience to the public due to frequent main bursts, we have advanced the completion of the whole replacement and rehabilitation programme from 2020 to 2015. We will continue to review the programme taking account of prevailing constraints and the residual service life of the watermains to be replaced, with a view to completing the works within a shorter timeframe before 2015.

PROPOSAL

7. **174WC** covers the stage 1 phase 2 works of the replacement and rehabilitation programme comprising approximately 210 km of fresh water mains and 40 km of salt water mains throughout the territory, as shown in Sketch No. SK 62004/076 (**Enclosure 1**). With a view to compressing the programme, we consider that the proposed works in Sha Tin and Tai Wai under **174WC** can be expedited as the works there involve few land problems and are implemented by in-house resources. We now propose to part-upgrade **174WC** to Category A to cover the replacement and rehabilitation of water mains in Sha Tin and Tai Wai comprising –

(a) about 7 km of fresh water mains ranging from 25 millimeters (mm) to 450 mm in diameter including associated service pipes and connections; and

(b) about 4 km of salt water mains ranging from 40 mm to 400 mm in diameter including associated service pipes and connections.

8. The proposed works are scattered over areas including Sha Tin Heights, Hin Keng, Hin Tin, Tin Sam, Tai Wai and Tung Lo Wan, as shown in Sketch No. SK 62004/097/001 (**Enclosure 2**). We plan to start the construction of the proposed works in September 2005 for completion in end 2007, to be supervised by in-house resources. The construction period includes allowance for replacing or rehabilitating associated service pipes and completing service connections to households.

9. We will continue with the detailed design of the remaining part of **174WC**, which comprises the replacement and rehabilitation of about 66 km of fresh and salt water mains in Hong Kong area, about 109 km in Kowloon and about 64 km in the New Territories. We plan to start construction for the remaining part in late 2006 for completion in early 2010.

10. Typical details of water main replacement and rehabilitation works are shown in Sketch No. SK 62004/097/002 (**Enclosure 3**). Wherever beneficial and practical, trenchless rehabilitation methods[1] will be adopted. For water main replacement works, more durable pipes would be adopted. The durability of the existing and the proposed pipe materials is provided in **Enclosure 4**.

JUSTIFICATION

11. If we do not carry out the replacement and rehabilitation as recommended in the Study, the water supply system would continue to deteriorate and both the number of pipe failures and water loss will continue to increase. To bring about earlier improvement to the supply system and minimise inconvenience to the public due to frequent main bursts and loss of precious water resources, the proposed works in Sha Tin and Tai Wai should start as soon as possible.

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[1] Rehabilitation methods are generally classified as trenchless methods (sometimes referred to as 'minimum dig' or 'reduced dig' methods). In these techniques, a new pipe is launched from a 'launching pit' and travels along the existing pipe route to a 'receiving pit' without opening up the road surface for the whole length of the pipe.

FINANCIAL IMPLICATIONS

12. We estimate the cost of the proposed works in Sha Tin and Tai Wai to be about $38.7 million in MOD prices made up as follows –

		$ million	
(a)	Water main replacement by conventional methods	28.8	
(b)	Water main rehabilitation by trenchless methods	5.9	
(c)	Environmental mitigation measures	0.5	
(d)	Contingencies	3.5	
	Total	38.7	(in MOD prices)

13. No additional recurrent expenditure will arise from completion of the proposed advance works.

ENVIRONMENTAL IMPLICATIONS

14. This is not a designated project under Environmental Impact Assessment Ordinance (Cap.499). We carried out a Preliminary Environmental Review (PER) in 2000 and concluded that the project would have no long-term environmental impact. Short-term construction impacts could be mitigated through the implementation of standard pollution control measures. For the proposed works in Sha Tin and Tai Wai, we have included about $500,000 in September 2004 prices to implement these mitigation measures and will incorporate these requirements into the works contracts for implementation.

15. We will require the contractor to submit waste management plans (WMP) for approval. The WMP would include appropriate mitigation measures to avoid, reduce, reuse and recycle construction and demolition (C&D) materials, including the allocation of areas for waste segregation. The contractor will be required to carry out on-site sorting of C&D materials to recover the inert portion, reusable and recyclable materials. We will ensure that the day-to-day operations on site comply with the approved WMP. We will control the disposal of public fill and C&D waste to designated public filling facilities and landfills respectively through a trip-ticket system. We will record the disposal, reuse and recycling of C&D materials for monitoring purposes.

16. We have taken due consideration of the need to minimise C&D materials when planning and designing the alignments of the proposed water mains. To further minimise C&D materials, we will encourage the contractor for the proposed works to use non-timber formwork and recyclable material for temporary works. We estimate that about 8 030 cubic metres (m^3) of C&D materials will be generated by the proposed advance works. Of these, about 5 910 m^3 (73.6%) will be reused on site, 2 010 m^3 (25.0%) will be reused as fill in public filling areas[2] and 110 m^3 (1.4%) will be disposed of at landfills.

17. The proposed works will not involve any tree removal or planting proposal.

TRAFFIC IMPLICATIONS

18. We have carried out a traffic impact assessment (TIA) for the proposed works. The TIA has concluded that the proposed works would not cause unacceptable traffic impact. We will implement temporary traffic arrangements to minimise impacts on traffic during construction. Furthermore, trenchless methods will be used to rehabilitate the water mains along busy roads, e.g. Che Kung Miu Road.

[2] A public filling area is a designated part of a development project that accepts public fill for reclamation purposes. Disposal of public fill in a public filling area requires a licence issued by the Director of Civil Engineering and Development.

PUBLIC CONSULTATION

19. We consulted the Legislative Council Panel on Planning, Lands and Works (the Panel) on 8 January 2001 regarding implementation of the stage 1 phase 2 works, and received support from Members. We consulted the Panel on 25 January 2005 regarding implementation of the stage 2 works under **182WC**. In response to some Members' concern about the implementation timeframe, we undertook to make continual efforts to explore means to complete the whole replacement and rehabilitation programme within a shorter time frame before 2015.

20. We consulted the Development and Housing Committee of the Sha Tin District Council in December 2004 on the proposed works in Sha Tin and Tai Wai. The Committee supported the proposal. In line with the Committee's advice to enhance public liaison for the works, we will regularly inform the District Council and affected locals about the works progress.

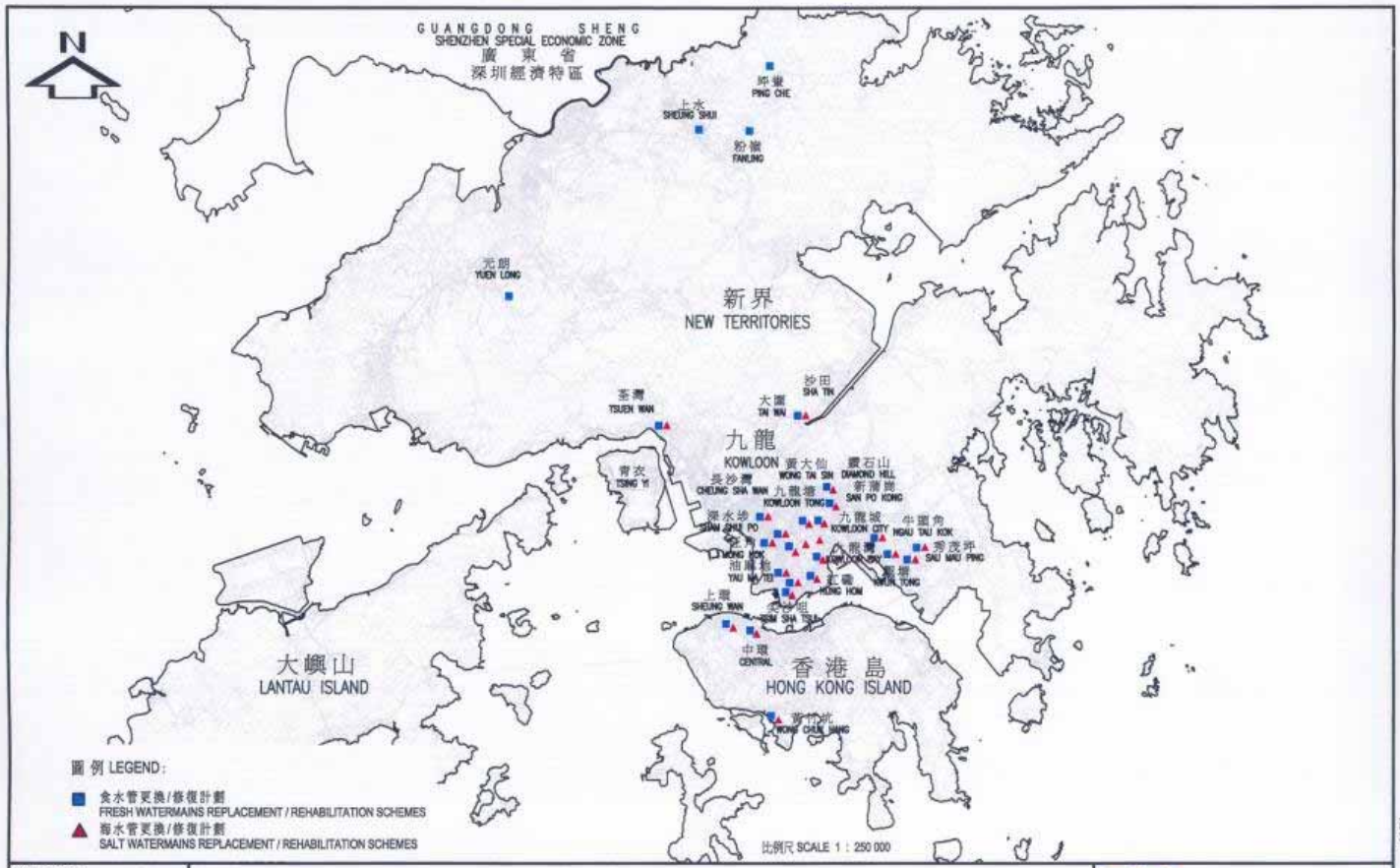
LAND ACQUISITION

21. The proposed works in Sha Tin and Tai Wai do not require any land acquisition.

WAY FORWARD

22. We intend to submit the proposed part-upgrading of **174WC** to Category A for consideration by the Public Works Subcommittee in June 2005 with a view to seeking funding approval of the Finance Committee in the same month.

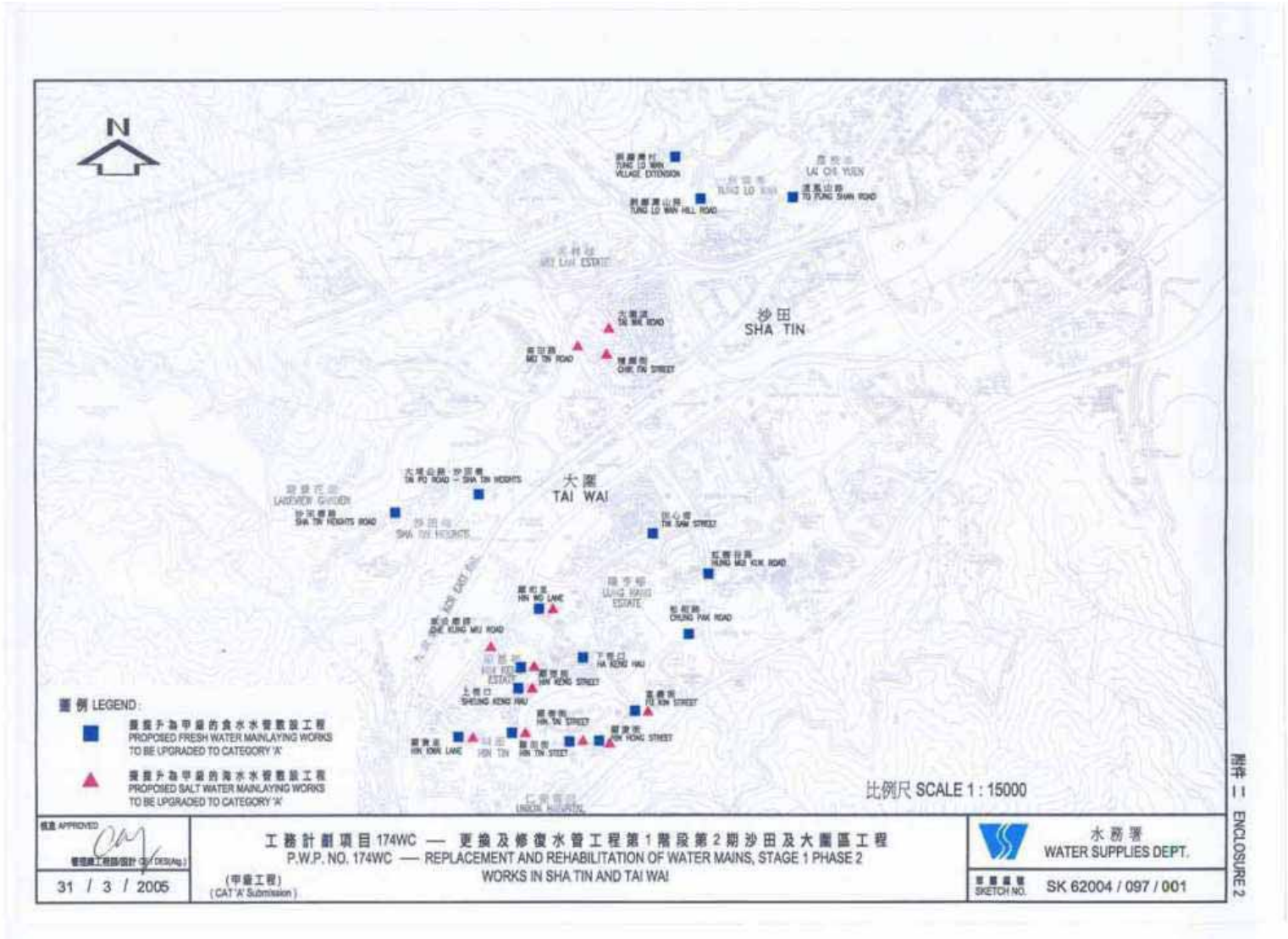
Environment, Transport and Works Bureau
May 2005

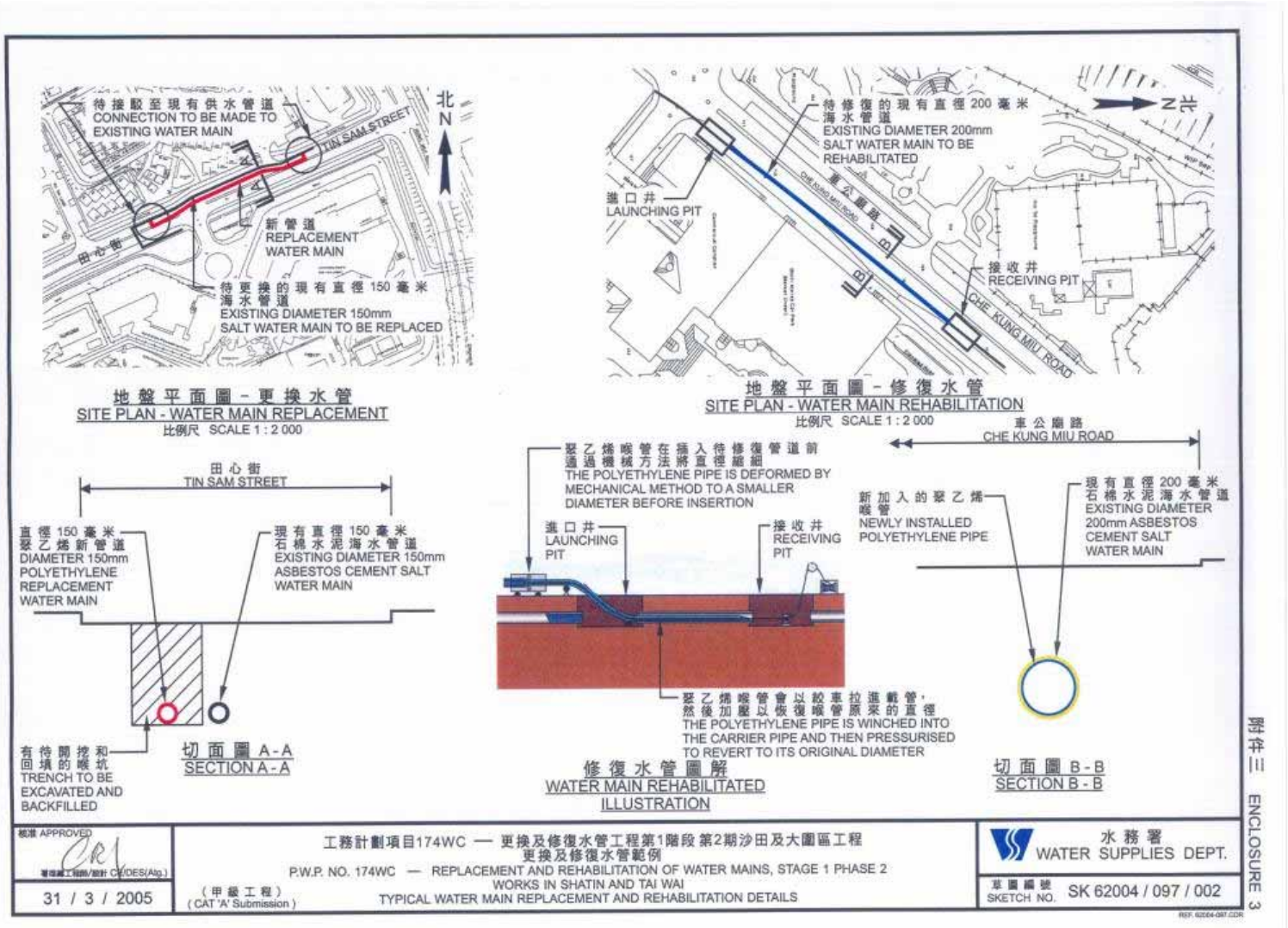


核准 APPROVED 署理總工程師/設計 CE / DEB(Atg.) 31 / 3 / 2005	工務計劃項目174WC ---- 更換及修復水管工程第1階段第2期 P.W.P. NO. 174WC ---- REPLACEMENT AND REHABILITATION OF WATER MAINS, STAGE 1 PHASE 2 （甲級工程） (CAT 'A' Submission)	水務署 WATER SUPPLIES DEPT. 草圖編號 SKETCH NO. SK 62004 / 076

REF. 62004 - 076.DWG

附件 — ENCLOSURE 1


N
沙田
SHA TIN
大圍
TAI WAI
SHA TIN HEIGHTS
TAI WAI
LEGEND :
PROPOSED FRESH WATER MAIN LAYING WORKS TO BE UPGRADED TO CATEGORY 'A'
PROPOSED SALT WATER MAIN LAYING WORKS TO BE UPGRADED TO CATEGORY 'A'
比例尺 SCALE 1 : 15000
APPROVED
31 / 3 / 2005
工務計劃項目174WC — 更換及修復水管工程第1階段第2期沙田及大圍區工程
P.W.P. NO. 174WC — REPLACEMENT AND REHABILITATION OF WATER MAINS, STAGE 1 PHASE 2 WORKS IN SHA TIN AND TAI WAI
(甲級工程)
(CAT 'A' Submission)
水務署
WATER SUPPLIES DEPT.
SKETCH NO. SK 62004 / 097 / 001
附件 II ENCLOSURE 2


待接駁至現有供水管道
CONNECTION TO BE MADE TO EXISTING WATER MAIN
TIN SAM STREET
北 N
新管道
REPLACEMENT WATER MAIN
待更換的現有直徑150毫米海水管道
EXISTING DIAMETER 150mm SALT WATER MAIN TO BE REPLACED
地盤平面圖 - 更換水管
SITE PLAN - WATER MAIN REPLACEMENT
比例尺 SCALE 1 : 2 000
田心街
TIN SAM STREET
直徑150毫米聚乙烯新管道
DIAMETER 150mm POLYETHYLENE REPLACEMENT WATER MAIN
現有直徑150毫米石棉水泥海水管道
EXISTING DIAMETER 150mm ASBESTOS CEMENT SALT WATER MAIN
有待開挖和回填的喉坑
TRENCH TO BE EXCAVATED AND BACKFILLED
切面圖 A-A
SECTION A-A
待修復的現有直徑200毫米海水管道
EXISTING DIAMETER 200mm SALT WATER MAIN TO BE REHABILITATED
乙二
進口井
LAUNCHING PIT
車公廟路
CHE KUNG MIU ROAD
接收井
RECEIVING PIT
地盤平面圖 - 修復水管
SITE PLAN - WATER MAIN REHABILITATION
比例尺 SCALE 1 : 2 000
聚乙烯喉管在插入待修復管道前通過機械方法將直徑縮細
THE POLYETHYLENE PIPE IS DEFORMED BY MECHANICAL METHOD TO A SMALLER DIAMETER BEFORE INSERTION
進口井 LAUNCHING PIT
接收井 RECEIVING PIT
聚乙烯喉管會以絞車拉進載管，然後加壓以恢復喉管原來的直徑
THE POLYETHYLENE PIPE IS WINCHED INTO THE CARRIER PIPE AND THEN PRESSURISED TO REVERT TO ITS ORIGINAL DIAMETER
修復水管圖解
WATER MAIN REHABILITATED ILLUSTRATION
車公廟路
CHE KUNG MIU ROAD
新加入的聚乙烯喉管
NEWLY INSTALLED POLYETHYLENE PIPE
現有直徑200毫米石棉水泥海水管道
EXISTING DIAMETER 200mm ASBESTOS CEMENT SALT WATER MAIN
切面圖 B-B
SECTION B-B
核准 APPROVED
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工務計劃項目174WC — 更換及修復水管工程第1階段第2期沙田及大圍區工程
更換及修復水管範例
P.W.P. NO. 174WC — REPLACEMENT AND REHABILITATION OF WATER MAINS, STAGE 1 PHASE 2
WORKS IN SHATIN AND TAI WAI
TYPICAL WATER MAIN REPLACEMENT AND REHABILITATION DETAILS
（甲級工程）
(CAT 'A' Submission)
水務署
WATER SUPPLIES DEPT.
草圖編號 SKETCH NO. SK 62004 / 097 / 002
附件三 ENCLOSURE 3

Enclosure 4

174WC – Replacement and rehabilitation of water mains, stage 1 phase 2
Durability of Existing and Proposed Pipe Materials

Age Distribution of Existing Water Mains

The age distribution of the existing water mains in Hong Kong is as follows –

Age (year)	>50	30-50	20-30	10-20	<10
Percentage	16	29	16	15	24

Service Life of Existing Pipe Materials

2. There are different pipe materials being used in our water supply network. The service life of a water main will vary with the ground condition and the water it carries. For fresh water mains, the service life is around 50 years for mild steel and ductile iron pipes. Galvanised iron pipes were widely used in the 50's and 60's which have screw joints subject to external corrosion and hence a shorter service life of about 30 years.

3. For salt water mains, because of the corrosive action of the salt water, the service life is comparatively shorter. In the case of pipe materials used in older days such as cast iron and asbestos cement, the service life could be as short as 20 years.

Proposed Pipe Materials

4. With the advancement in technology, there are more durable pipes with longer service life available in the market. Pending completion of the detailed design, the following pipe materials may be used for the replacement works of the project –

Enclosure 4

Pipe Diameter	Existing pipe materials	Pipe materials to be used for the replacement works
700 mm and above	Mild steel (with bituminous lining)	Mild steel (with concrete or epoxy lining)
300 mm to 600 mm	Cast iron and asbestos cement	Ductile iron (with cement mortar lining)
Below 300 mm	Cast iron, asbestos cement, galvanised iron and unplasticised polyvinyl chloride	Polyethylene

Main Characteristics of Proposed Pipe Materials

5. The main characteristics of the pipe materials stated at above are as follows –

Pipe Material	Main Characteristics
Mild steel	(a) Widely used throughout the world for large diameter pipes. (b) Most commonly jointed by welding. Durability of these pipes depends on effectiveness of the external and internal protection to the pipes. (c) Epoxy lining or concrete lining exhibits better corrosion resistance than bituminous lining.
Ductile iron	(a) Mostly used for medium size water mains. (b) Push-in rubber ring joint is the most commonly used type of jointing. (c) Well-protected against corrosion with a cement mortar lining.

Enclosure 4

Pipe Material	Main Characteristics
Polyethylene	(a) Widely used nowadays for small diameter water mains. There is an increasing tendency for these pipes to be used for larger water mains. (b) Butt-welded or electro-fusion joints are usually used for jointing. (c) Exhibits good corrosion resistance.

Service life of Proposed Pipe Materials

6. With the use of more corrosion resistant protective lining, we expect that the typical service life of mild steel and ductile iron pipes be increased from 50 years to about 60 years for fresh water mains.

7. For salt water mains, the typical service life of ductile iron pipes is estimated to be about 40 years. Polyethylene pipes have good resistance to corrosion and have a life expectance of about 50 years. This would greatly elongate the replacement and rehabilitation cycle of water mains.

Pipe Materials Used in other Countries

8. The pipe materials stated above have proven to be durable and suitable and are widely used in Japan, the United States, the United Kingdom and other European countries for comparable projects. Mild steel, ductile iron and polyethylene pipes are predominantly used for large, medium and small diameter water mains respectively in these countries.