Independent Pricing and Regulatory Tribunal (IPART)

Review of Sydney Water Corporation's Asset Lives and Asset Value Estimates

Final Report

November 2007

Halcrow Pacific Pty Ltd

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Halcrow Pacific Pty Ltd

Melbourne
Level 1, 542 Station Street, Box Hill, Melbourne, VIC 3128
Tel +61 3 9899 9777 Fax +61 3 9899 1214
www.halcrow.com

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Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Prepared by	Checked by	Authorised by
1	A	Preliminary Draft Report	24/10/07	MNJ	WDW/JB	WDW
1	0	Final Draft Report	29/10/07	MNJ	WDW/JB	WDW
2	1	Draft Report with IPART comments incorporated	08/11/07	MNJ	WDW	WDW
3	2	Final Report	16/11/07	MNJ	PJC	JS

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Glossary

ABS	Acrylonitrile Butadiene Styrene
ABS Index	Statistics (ABS) Index "Output for the General Construction Industry" (Producer Price Indexes – 6427, Table 15).
AC	Asbestos Cement
AIR / SIR	Annual / Special Information Return
AwwaRF	American Water Works Association Research Foundation
CBAV	Condition Based Asset Valuation
CCTV	Closed Circuit Television
CICL	Cast Iron Cement Lined
COPI	Construction Outputs Price Index (UK)
CPI	Consumer Price Index
CSIRO	Commonwealth Science and Industrial Research Organisation
DI	Ductile Iron
DICL	Ductile Iron Cement Lined
IPART	Independent Pricing and Regulatory Tribunal
KPI	Key Performance Indicators
MEERA	Modern Engineering Equivalent Replacement Asset
MEERA (gross)	What it would cost to replace an old asset with a technically up to date new asset with the same service capability.
MEERA (net)	The depreciated value taking into account the remaining service potential of an old asset compared with a new asset
ML	Mega Litres

NPV	Net Present Value
NSW	New South Wales
Ofwat	Office of Water Services (UK)
PE	Polyethylene
PVC-u	Polyvinyl Chloride - unplasticised
RC	Reinforced Concrete
RPI	Retail Price Index
SCL	Steel Cement Lined
SPS	Sewage Pumping Station
STAMP	Sewer Trunk Asset Management Process
STP	Sewage Treatment Plant
SWC	Sydney Water
UK	United Kingdom
VC	Vitrified Clay
WPS	Water Pumping Station
WTP	Water Treatment Plant

1 Executive Summary

Halcrow has been appointed by the Tribunal to undertake an independent review of Sydney Water's estimates of its asset lives and asset values in order to assist the Tribunal in its assessment of the appropriate level of revenue required to fund Sydney Water's return on and of capital.

We carried out reviews and analysis of data and information provided by Sydney Water. This included documents related to the revaluation process, previous reports commissioned by Sydney Water to peer review the revaluation process, data produced by Sydney Water explaining movements in asset values, and the information contained within the Annual Information Return / Special Information Return (AIR/SIR) produced by Sydney Water for the Tribunal. We did not carry out an audit of cost rates and valuation calculations. Interviews were also carried out with Sydney Water staff.

CSIRO reviewed the asset lives of pipelines with specific reference to Sydney Water's asset management plans for these assets. It compared the lives assigned by Sydney Water for water and wastewater pipes to typical lives that their research and consultancy work in Australia has found. For each of the different pipe materials, sizes and soil types, CSIRO assessed whether the assigned asset lives seemed reasonable, optimistic or pessimistic based upon the current replacement criteria used by Sydney Water. It is recommended that these asset lives be revised to reflect the actual replacement practices based on Sydney Water"s KPI's for water and wastewater services. In addition we compared the asset lives with other water company's estimates. As a result we have given our opinion on appropriate asset lives for water mains and sewer mains for use by the Tribunal.

We compared Sydney Water's asset lives for the above ground system assets (treatment plants, pumping stations, reservoirs) with other water companies and found Sydney Water's asset lives to be high in comparison, however we saw no evidence to suggest Sydney Water should reduce their assumed asset lives for these assets. If an asset has been assigned an average asset live that is too long, this will be identified following a condition assessment and the remaining asset life will be adjusted accordingly. In conclusion we consider these average asset lives to be appropriate for use by the Tribunal in its assessment.

It should be noted that the annual depreciation expense for the asset does not just depend on the assumed average asset life, but also the remaining asset life calculated for assets in fair or worse condition following condition assessment.

Sydney Water values its assets at the component level and build up estimates to the asset level. The asset classes used are water mains, reservoirs, water pumping stations, water treatment plants, sewer mains, ocean outfalls, sewage pumping stations, sewage treatment works, and storm water drains. These asset classes are generally broken down to component level: civil, mechanical, electrical and electronic. Sydney Water can report asset value and asset life at the component level, and weighted asset life at the asset level. For the purposes of the Tribunal's assessment, we consider that Sydney Water's current asset classes should be used.

Our recommendations for asset lives and asset classes are shown in the following tables:

Table E.1 Recommended water asset lives and classes

Recommended Asset Category	**Component**	**Sydney Water Average Life (yrs)**	**Recommended Average Life (yrs)**
Water mains	Civil Assets *PE/PVC-u* *DICL*	 75 – 85 65 – 140	 100 – 200 30 – 150
Water pumping stations	Civil Assets	100	100
	Mechanical Assets	40	40
	Electrical Assets	30	30
	Electronic Assets	15	15
Reservoirs/tanks	Civil Assets	150	150
	Mechanical Assets	40	40
	Electrical Assets	30	30
	Electronic Assets	15	15
Water treatment plants	Civil Assets	100	100
	Mechanical Assets	40	40
	Electrical Assets	30	30
	Electronic Assets	15	15

Table E.2 Recommended wastewater asset lives and classes

Recommended Asset Category	**Component**	**Sydney Water Average Life (yrs)**	**Recommended Average Life (yrs)**
Sewer mains	Pipe *VC* *Concrete* *PE/PVC-u* *Relining*	 130 130 85 70	 50 – 150 75 – 100 100 – 150 50 - 75
	Hole	infinite	infinite
Deep Ocean Outfall Sewers	Civil Assets	100	100
	Mechanical Assets	40	25
	Electrical Assets	30	25
	Electronic Assets	15	15
Sewage pumping stations	Civil Assets	100	100
	Mechanical Assets	25	25
	Electrical Assets	25	25
	Electronic Assets	15	15
Sewage treatment plants	Civil Assets	100	100
	Mechanical Assets	25	25
	Electrical Assets	25	25
	Electronic Assets	15	15

Table E.3 Recommended stormwater asset lives and classes

Recommended Asset Category	**Component**	**Sydney Water Average Life (yrs)**	**Recommended Average Life (yrs)**
Storm drains and channels	Civil Assets	150	150

There were significant increases in asset values over the period from 2001 to 2006. These increases were mainly due to sewer mains (62%), water mains (22%) and sewage treatment plants (8%). Water mains and sewer mains were re-valued in 2001 which resulted in large increases in value (54% for water mains, 52% for sewer mains). Sydney Water has explained the reasons for the increases and the valuation was peer reviewed by Hunter Water. We consider these explanations to be reasonable. The net asset value of sewer mains also increased due the assumption that sewer 'holes' for sewers between 101 and 600mm in diameter do not depreciate which was introduced in 2003. We consider the assumption to be valid, but have suggested refinements to the method used to value the 'hole' element.

Sydney Water introduced condition based asset valuation in 2003 and asset lives were re-assessed based on their condition. As a result remaining asset lives have reduced on average. We consider the approach to asset valuation based on condition assessment to be in line with best practice, and the only area of concern we have identified is Sydney Water's methodology for valuing the 'hole' component of sewers.

We quantified the value of developer funded and contributed assets and the value of assets funded by grants/subsidies over the period from 2001 to 2006 from information reported in the AIR/SIR by Sydney Water. We found that contributed asset values reported in Tables 8.2 and 8.3 of the AIR/SIR do not include cash contributions, and appear not to include depreciation or revaluation adjustments and are therefore not fully representative. We recommend that the figures for contributions as reported in Tables 8.2 and 8.3 of the AIR/SIR should be restated by Sydney Water. Further investigation work is required to look at contributions going back several decades to get a more reliable estimate.

2 Introduction

2.1 Terms of Reference

Sydney Water has recently updated the modern engineering equivalent replacement asset values (MEERA) of its assets and is reassessing the economic lives of its assets. As a consequence of this, there is a need for the Tribunal to better understand the significant movement in reported MEERA values in the period from 2001 to 2006 and to review the period over which the Tribunal amortises Sydney Water's regulatory base.

Halcrow has been appointed to undertake an independent review of Sydney Water's estimates of asset lives and explain the movements in reported MEERA values in the period from 2001 to 2006.

The primary objectives of this review are to:

- Assess and recommend the appropriate asset lives in each asset class;
- Assess and recommend the appropriate asset classes to use;
- Provide explanations for movements in asset lives and values over the period from 2001 to 2006 and identify areas of concern; and
- Quantify the value of developer funded and contributed assets and the value of assets funded by grants/subsidies over the period from 2001 to 2006.

These objectives should be addressed separately for each of Sydney Water's regulated water, sewerage and drainage businesses.

2.2 Sydney Water's Asset Values

In Sydney Water's 2007 Submission to the Independent Pricing and Regulatory Tribunal, Sydney Water reports its estimate of the net MEERA value of the assets (the cost to replace the remaining service potential of the assets). This asset value has increased by approximately 34% between 2002 and 2007. During the same period the 'recoverable amount' value of the assets (the book value of the assets that Sydney Water reports in its annual financial statement) has actually decreased from $13.9 billion in 2001/02 to $12.0 billion in 2006/07 as shown in Table 1.1.

Table 1.1 Asset write-down in $b (reproduced from Table 2.6 of SWC Submission)

Valuation year	Net MEERA Value ($b)	Recoverable amount from cash flow ($b)	Value difference write-down	Percentage write-down
2001 – 02	18.6	13.9	-4.7	-25%
2002 – 03	19.5	11.1	-8.4	-43%
2003 – 04	21.8	11.2	-10.6	-49%
2004 – 05	23.3	10.8	-12.5	-54%
2005 – 06	24.0	10.6	-13.4	-56%
2006 – 07	24.9	12.0	-12.9	-52%

Sydney Water state a number of reasons for the difference between the net MEERA value and the recoverable amount which include:

- The fact that the regulatory asset base was set at a point in time using discounted cash flow methods rather than cost based methods
- The exclusion from the regulatory asset base of contributed assets and assets paid for by developer charges
- A difference in estimated depreciation rates arising from the use of different assessments of the life of assets
- Differences between actual capital cost increases and the indexation rate, based on the Consumer Price Index, used in the regulatory asset base to approximate these increases.

2.3 *Approach to Review*

A number of interviews were carried out with Sydney Water staff at Sydney Water's offices in Sydney between 17th September and 21st September 2007. In addition Sydney Water provided several documents related to its MEERA valuation process.

Subsequent to the interviews, we carried out a review of the Submission, the documentation provided, and the information contained within the Annual Information Return / Special Information Return (AIR/SIR) produced by Sydney Water for the Tribunal. During this review we asked Sydney Water for clarifications and additional information which it provided.

Sydney Water's asset lives were reviewed by CSIRO and compared to asset lives used by other water companies.

The methodology used by Sydney Water for valuing its system assets was assessed by reviewing Sydney Water's procedures and assumptions, by reviewing the conclusions of the peer review reports previously commissioned by Sydney Water, and by reviewing examples of the applied methodology. We did not carry out an audit of cost rates and calculations.

Movements in asset lives and values were analysed using data and commentary provided by Sydney Water. We asked Sydney Water to provide us with a breakdown of movements in asset values for each asset category between 2001 and 2006 in order for us to fully explain movements in asset values and to identify any specific areas of concern. Sydney Water were able to provide this information between 2002 and 2007 by pulling together data from different sources. This enabled us to demonstrate in the report how values changed year on year and provide explanations for them.

The level of grants and contributions was analysed using data provided in the AIR and SIR. Sydney Water provided responses to our challenges regarding the information reported in the AIR/SIR.

3 Review of Asset Valuation Methodology

3.1 Sydney Water Corporation's Methodology for System Asset Valuation

3.1.1 Asset Valuation

Under Australian Accounting Standards and NSW Treasury policy Sydney Water is required to value its physical assets at "fair value" and then test the assets for impairment by applying a cash generating unit test to determine the recoverable amount from future cash flow. The lesser of the "fair value" and the "recoverable amount" asset value is reported in the annual financial statements.

The "fair value" of assets which can be sold in an active and liquid market is determined by independent market valuations. These assets include buildings and land. For system assets (infrastructure such as water mains, sewers, treatment plants) where no market exists their "fair value" is determined as their estimated depreciated current replacement cost.

Sydney Water uses Condition Based Asset Valuation (CBAV) to value its system assets. Assets are valued based on estimates of their modern engineering equivalent replacement asset value (MEERA) and condition based assessments are used to determine the remaining useful asset lives.

System assets are re-valued every year; assets are either valued using a MEERA valuation carried out every five years, or are valued using an index valuation which adjusts the previous valuation by the Australian Bureau of Statistics (ABS) index "Output of the General Construction Industry". Condition assessments are also carried out every five years. Over the period 2001 to 2006 the ABS index increase was higher than the increase in the Consumer Price Index (CPI).

The following is Sydney Water's explanation of its approach to valuation:

"*The process used for asset valuation comprises the following steps:*

- *Data collection and comparison*
- *Establish and review methods for estimating MEERA components listed below. For example, for facilities the components are*
    - *Main process (M) (Mechanical)*

  - *Power Control* *(E)* *(Electrical)*
  - *Control* *(L)* *(Electronic)*
  - *Site and Infrastructure* *(C)* *(Civil)*
  - *Secondary Support* *(M/E)* *(Mech/Elec)*
- *Formulation and estimation of cost curves. In establishing the MEERA values, references are made to other methods used for asset valuation including:*
  - *'Order-of-Cost Estimates' used by Asset Solutions for quoting new asset costs;*
  - *Reference rates prepared by Public Works and Service and other utilities such as Hunter Water;*
  - *Valuation methods used by private consulting engineers; and*
  - *Actual asset procurement costs observed in the marketplace"*

Representative selections of assets are selected within each asset type for detailed costing. Then cost curves are prepared with the cost estimates plotted against a representative parameter such as capacity (ML) for reservoirs. The cost curves are used to calculate MEERA values for the remaining assets.

For the valuation of the sewer network the replacement cost of gravity sewers with diameters between 101 and 600mm are split into two components: the pipe and the hole. The hole component is not depreciated as Sydney Water assume it will be reused indefinitely. The sewer will be relined rather than replaced by digging a trench, therefore only the pipe component is depreciated. Rising mains and gravity sewers outside the 101 to 600mm range are assumed to be replaced by full excavation. Sydney Water also assume that the value of the hole will increase in value as development moves from greenfield site to highly urbanised.

We evaluate these assumptions in Section 3.2.2.

Easements are not re-valued and are accounted for 'at cost'. Easements are not included in the system assets class; they are reported as intangible assets.

The results of the valuations are reviewed by the NSW Audit Office annually. In addition Sydney Water commissioned three separate reviews of its valuation approach:

- April 2002 Review of Asset Valuation – Hunter Water Corporation
- April 2004 Peer Review of Asset Life Estimates – WS Atkins
- July 2005 Peer Review of MEERA Valuation – Parsons Brinckerhoff

3.1.2 Condition assessments

Sydney Water carries out condition assessments on its facilities at the maintainable unit (equipment) level, and aims to survey all its facility assets over a five year period. A specialist team is used containing personnel with civil, mechanical and electrical skills to carry out the assessments. This comprises of a desktop review of operational and maintenance history to establish operational reliability and performance of the asset, and a visual inspection of the asset on site. Following this the asset is given a condition grading (1 to 5) based on the International Infrastructure Management Manual.

Table 2.1 Condition Assessment Grading

Grade	Condition	Assessment of Likely Remaining Asset Life
1	**VERY GOOD**	**Civil:** Assets likely to perform adequately without major work for 25 years or more. **Mech/elec/electronic**: Asset likely to perform adequately with routine maintenance for 10 years or more. No work required.
2	**GOOD**	**Civil**: Minimum short-term failure risk but potential for deterioration in the long term (10 years plus) Only minor work required (if any). **Mech/elec/electronic**: Minimal short-term failure risk but potential for deterioration or reduced performance in medium term (5-10 years). Only minor work required (if any).
3	**FAIR**	**Civil**: Failure unlikely within the next 2 years but further deterioration likely within the next 10 years. **Mech/elec/electronic**: Failure unlikely within 2 years but further deterioration likely and major replacement required within next 5 years. Work required but asset still serviceable.
4	**POOR**	**Civil**: Failure likely in the short term. Likely need to replace most or all of the asset within 2 years. (5 years for pipeline assets). **Mech/elec/electronic**: Plant and components function but require a high level of maintenance to remain operational. Likely to cause a marked deterioration in performance in short term. Likely need to replace most of the asset within 2 years.

5	**VERY POOR**	**Civil**: Failed or failure imminent. Immediate need to replace most or all of asset. **Mech/elec/electronic**: Failed or failure imminent. Plant component effective life exceeded and excessive maintenance costs incurred.

The remaining service life for each asset is calculated based on the condition grade.

For condition assessments of water mains Sydney Water assesses the pipes on the basis of pipe size, material type, and soil type. According to Sydney Water's explanation of its approach "*more than 90% of water mains are buried ferrous pipes and these pipes typically deteriorate by external corrosion from surrounding soils. The rate of deterioration depends largely on the aggressivity of the soil and the asset lives are differentiated based on three soil classifications: non-aggressive, aggressive, and highly aggressive.*"

Avoid fail sewers (formally known as critical sewers) undergo regular condition assessment by either CCTV or man entry inspection.

3.2 Review of Methodology

For this report we have carried out a general review of Sydney Water's methodology but have not carried out a detailed audit of their calculations or data.

Sydney Water provided us with details of their CBAV methodology as described in the section above which we reviewed. We also reviewed the conclusions of the three peer review reports which were commissioned by Sydney Water.

3.2.1 Peer review report conclusions

Parsons Brinckerhoff concluded that "*the methodology employed for determination of MEERA values is considered to be generally appropriate and adequate for current purposes. The peer review team has identified some areas for potential improvement. The data inputs used for the valuations are considered suitable but there is a need for collection and storage of more recent data in a suitable format. The accuracy and reliability of the MEERA estimates are considered reasonable and adequate for use in preparing statutory financial reports and calculations for developer charges*". We reviewed this report in full and we concur with the majority of the recommendations. However we do not agree that "*old abandoned pipes not currently included in asset list are included with at least a nominal value to ensure that the potential reuse (e.g. to carry telecommunications etc.) of these conduits is not lost*".

WS Atkins key findings concluded "*the approach to CBAV by Sydney Water is valid and appropriate although limited by the extent and quality of information currently available…The output provides an initial assessment of asset lives linked to condition….Ongoing improvements to scope and quality of methods and asset information are needed to sustain or amend the assumed asset lives*". It recommended that "*a comprehensive action plan should be prepared and implemented to collect further data on asset condition and performance*".

Hunter Water noted that "*the findings…were that the revaluation had included a cost allowance for rock excavation that should not have been included. It is understood that the cost allowance for rock excavation has since been removed".* It concluded "*..the structure of the calculations and the approach to gathering data on various component costs is in accordance with general practice. In the current circumstances and with limited time available, the cost estimation approach adopted by Sydney Water is appropriate*".

We asked Sydney Water to demonstrate how it was incorporating recommendations for improvements to their valuation methodology. Sydney Water provided us with the list of key recommendations from the Parsons Brinckerhoff report with details on what actions Sydney Water has taken or are taking to implement the recommendations. We have reviewed these actions and their status, and from them conclude that Sydney Water is committed to improving its MEERA valuation process, in particular in relation to documentation and cost data. There is no definite timeline stated for implementing the outstanding recommendations, although a period of five years is mentioned by Sydney Water in its statement below.

Sydney Water also stated *"as set out in the folio Condition Based Asset Valuation Program, where a peer/external review has been done (eg. by Parsons Brinkerhoff), as part of the analysis the reviewers have identified improvements to the process. Many of these related to efficiency of the processes and to contextual asset management practices. We have considered these improvements and where appropriate these are being implemented as part of a cost-efficient and continuous improvement approach. Many of the areas presenting opportunities for improvement in asset management and CBAV require investment in people and supporting systems and will extend to 2009 during the current cycle of condition assessment. It is expected that incremental improvements will continue to be identified and implemented for the next five years towards full integration of the asset maintenance planning renewal and condition data, and to further 'bed down' the practice".* We consider these actions will improve the accuracy and reliability of the MEERA estimates.

Based on the peer review reports' conclusions we consider that the Tribunal can have confidence in the valuation methodology employed by Sydney Water and the data used in the cost estimating process.

3.2.2 *Sydney Water's assumption on the 'hole' component*

Since 2003 Sydney Water has assumed that the 'hole' component of gravity sewers between 101mm and 600mm in diameter does not depreciate. According to the Sewers Asset Management Plan the 'hole' actually increases in value as the development moves from greenfield site to highly urbanised due to the costing methodology used by Sydney Water. We are not aware of Sydney Water making similar adjustments for greenfield/urban sites in their pervious valuations based on the information we have reviewed.

Sydney Water provided us with relining/rehabilitation cost rates for sewers which differentiated the costs of the 'pipe' and the 'hole'. The 'hole' component cost is calculated as the total replacement cost of the pipe (digging trench and installing pipe) less the cost of relining the pipe. For pipes that are being relined for the second time there is an additional cost for removing the old liner. The value of the 'hole' component increases with the depth of the pipe reflecting the increased construction costs of deeper trenches, and ranges from 50% of the total installation cost at shallow depths to around 75% of the total installation cost for deep sewers.

In comparison the value of the 'hole' component for lined sewers which are relined for a second time ranges from 25% of the total installation cost at shallow depths to around 65% of the total installation cost for deep sewers.

Sydney Water confirmed that "*The revaluation of an underground pipeline is based on total construction of the pipe line. This includes*

- *excavation,*
- *installation of the conduit ,*
- *backfill and*
- *restoration of the site.*

The value of the hole = (total construction cost) - (cost of installing a liner or conduit). The total construction cost increases with escalation of prices with time, hence the value of the hole increases with the escalation of prices with time". By using this method of calculation, the 'hole' value will increase as the development moves from greenfield to brownfield as this will be reflected in the construction cost.

Parsons Brinkerhoff made no comment on Sydney Water's methodology for valuing the 'hole'. WS Atkins commented "*Sydney Water has split the sewer assets between the pipe and the 'hole in the ground' as this recognises that sewers will in general be relined rather than replaced. The 'hole' is not depreciated. We support this approach as is recognises that the hole is available in perpetuity and that this is maintained by structural relining*".

In the UK, and the Water Services Regulation Authority (Ofwat) states in its Regulatory Accounting Guidelines: "*one aspect of technical progress has been the development of 'no-dig' relining techniques. In extremes, this could mean that all renewals expenditure relates to relining the 'pipe' and the 'hole' does not depreciate at all. Accordingly, like land, the 'hole' element would retain its original real cost value to the business, although in the absence of this historical cost information, initial MEA* [MEERA] *costs of hole (and pipe) are to be used instead and indexed for RPI* (Retail Price Index)."

We consider the assumption that the 'hole' does not depreciate to be valid given Sydney Water's use of no-dig technology to reline sewer pipes. The value of the 'hole' should be taken as the original cost of the 'hole' when the pipe was first installed and the value should only appreciate in line with CPI to allow for cost inflation. We do not consider that the value of the 'hole' should increase following revaluation or replacement by relining.

The figures below explain the two alternative methodologies. Value increase due to inflation has not been included for ease of comparison.

Figure 2.1 Diagrammatic explanation of Sydney Water's methodology

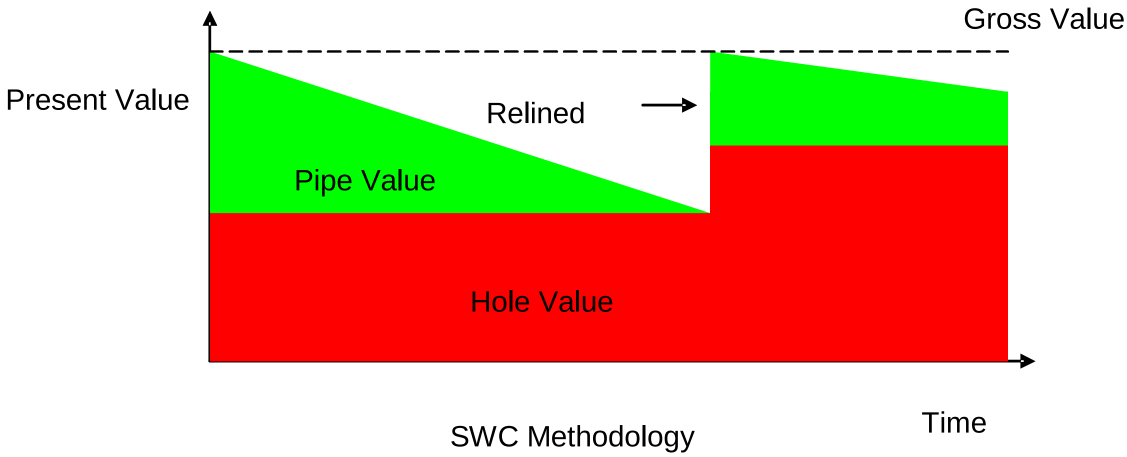
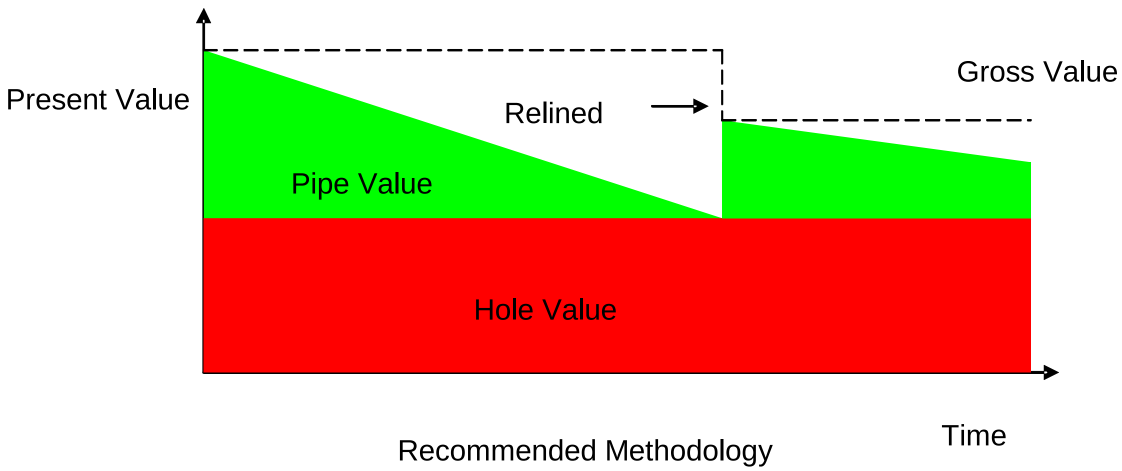


Figure 2.2 Diagrammatic explanation of recommended methodology



Some account should also be taken of sewer 'holes' which will be abandoned. This may be because not all of the 101 to 600mm sewers will be relined. Sydney Water stated that use of techniques other than relining is very rare and therefore the number of sewers which will be abandoned rather than relined is insignificant. We have not been able to ascertain a figure for this based on the information available to us.

3.2.3 *Review of valuation methodology*

Condition Based Asset Valuation is regarded as the most appropriate method for asset valuation taking into account asset condition and performance. CBAV is used by other water companies in Australia and New Zealand, and is currently being used by the England and Wales water companies for their asset valuations as part of their business planning approach. CBAV is also relevant for regulatory purposes; in considering the robustness of the asset valuations of the water companies in England and Wales, Ofwat require the companies to carry out a full assessment of the condition and performance of the asset stock, and to carry out an assessment of service risk.

We challenged Sydney Water to provide us with some examples of net MEERA calculations based on remaining asset life. Sydney Water provided us with calculations for a set of water mains, for four water pumping stations, and ten sewage pumping stations. The water mains data included information on pipe diameter, pipe material, soil type, and year laid. Based on this information an average asset life is assigned to the pipe, and the remaining asset life is calculated as the average asset life minus the age of the pipe. The net MEERA value is calculated based on straight line depreciation.

For the four water pumping stations, the MEERA value for each asset is broken down into civil, mechanical, electrical and electronic components. Each of these components has a MEERA value, the date the asset was commissioned, an average asset life, an assigned condition grade, and a calculated remaining useful life. The remaining life is based on the condition grade as detailed in Table 2.1. We noted that the condition grade assigned was based on a desk study done in 2004 and not a condition assessment on site. This gives us less confidence in the resulting remaining asset lives. Sydney Water explained "*condition assessments on-site for the Water Pumping Station (WPS) asset stock is gathered on a rolling 5-year program. It is done at a detailed equipment level*" and provided an example of the detailed assessment for one of the four pumping stations carried out subsequently in 2005.

Table 2.2 Example of remaining life calculation for water pumping station

Component	Component type	Current Age (yrs)	Expected Life (yrs)	Expected Remaining Life (yrs)	Assessed Remaining Life (yrs)	Condition Grade
WP Infrastructure	Civil	79	100	21	21	2
WP Equipment	Mechanical	11	40	29	29	2
WP Switchgear	Electrical	15	30	15	6	3
Site Power	Electrical	15	30	15	6	3
Site Control	Electronic	5	15	10	10	1
Site Infrastructure	Civil	79	100	21	21	2
Site Support Services	Mech/Elec	11	40	29	29	2

The table above shows an example of the remaining life calculation based on condition grade. The switchgear and site power asset components have been graded 'fair' condition and are given a remaining useful life of 6 years compared to the 15 years life they should have left based on an average life of 30 years. This implies that either their condition is deteriorating at a faster rate than normal or the assumed average asset life is too long.

We confirm that this remaining asset life calculation approach is consistent with the condition grading assumptions.

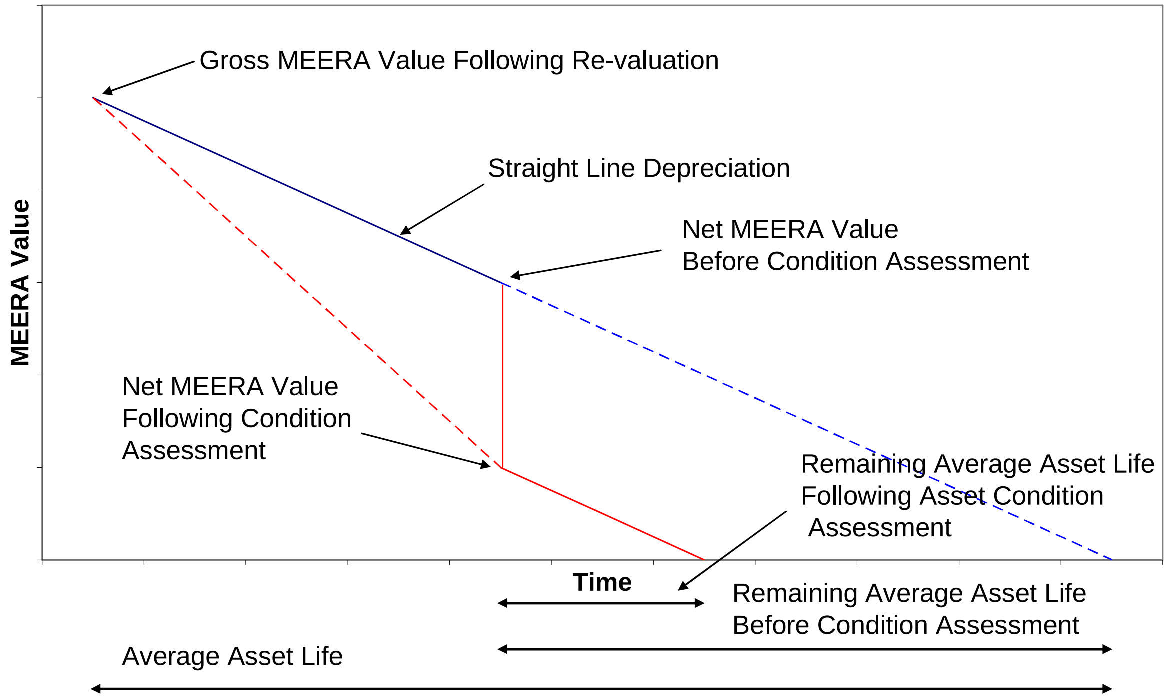
Table 2.3 Example of depreciation calculation for a water pumping station

Component	Expected Life (yrs)	Remaining Life (yrs)	2004 Gross MEERA Value	2004 accum. Depn	2004 net MEERA Value	Annual Depn. Expense
WP Infrastructure	100	21	1,269.6	1,003.0	266.6	12.7
WP Equipment	40	29	1,608.4	442.3	1,166.1	40.2
WP Switchgear	30	6	417.2	333.7	83.4	13.9
Site Power	30	6	154.3	123.5	30.9	5.1
Site Control	15	10	498.9	166.3	332.6	33.3
Site Infrastructure	100	21	22.4	17.7	4.7	0.2
Site Support Services	40	29	2.6	0.7	1.9	12.7
WPS Total		**17.9**	**3,973.4**	**2,087.2**	**1,886.2**	**105.5**

$$\text{Net Value} = \text{Gross Value} - \left(\frac{\text{Gross Value} \times (\text{Expected Life} - \text{Remaining Life})}{\text{Expected Life}} \right)$$

Using this methodology, Sydney Water can report asset lives and values at the component level, and the weighted remaining asset life at the asset level. In the example above the weighted remaining asset life of the pumping station is 17.9 years (total net MEERA value of $1,866.2 divided by the annual depreciation expense of 105.5). The graph below (Figure 2.2) shows how remaining asset life can be reduced following condition assessment.

Figure 2.3 Example of change in remaining life following CBAV



We also reviewed asset life calculations for ten sewage pumping stations. The format and calculation methodology is the same as that used for the water pumping stations. The example below shows when an asset component reaches its expected life and it is still in a serviceable condition, its asset life is extended accordingly.

Table 2.4 Example of remaining life calculation for a sewage pumping station

Component	Current Age (yrs)	Expected Life (yrs)	Remaining Life (yrs)	Condition Grade
WP Infrastructure	100	100	13	3
WP Equipment	20	25	5	3
WP Switchgear	10	25	5	3
Site Power	10	25	3	4
Site Control	10	15	2	4
Site Infrastructure	100	100	13	3
Site Support Services	20	25	5	3

We reviewed the CBAV methodology for sewage treatment plants. We saw how historic cost information is used to build cost curves at a process level and split between civil, mechanical, electrical, and electronic components. Sewage treatment plants are then valued using these curves at a process level. Sydney Water showed us the valuation for Penrith STP as an example. This plant has a relatively old treatment process, and the valuation reflected replacement with a modern equivalent process. The total value of the plant was calculated from the valuations at the component level. We also reviewed examples of sewage treatment plant condition assessments. Whilst the review did not involve detailed audit we consider that the methodology is detailed and robust, and values the sewage treatment plant assets on a modern equivalent basis.

We asked Sydney Water how sewer service life is defined and how it is this calculated in the context of avoid fail sewers (i.e. how is loss of structural integrity of the sewer defined and quantified) and how 'when years to end of service life < 2' is assessed and on what evidence is the relationship between condition, performance and service levels examined?

Sydney Water responded: "*for Avoid-Failure sewers 'years to end of service life' is loss of structural integrity of the sewer. The end of service life for concrete and brick sewers is defined as the point at which the rehabilitation changes from a non-structural to a structural repair. This is a financial definition of service as the cost can increase by up to 4 times with structural rehabilitation. For other materials it is the point at which collapse would occur causing sewage to overflow. The structural condition is assessed by CCTV (up to 1200mm dia) or through visual inspection. Data is also collected on concrete pH, depth of concrete cover of steel reinforcement and level of hydrogen sulphide gas. The sewer is given a condition grading using the Condition*

Inspection Reporting Code Australia. The condition grading is then equated to the remaining service life.

The Sewer Trunk Asset Management Process (STAMP) process integrates the hydraulic assessment with the structural assessment and uses performance indicators derived from customer or environmental requirements. The hydraulic assessment identifies the works required to meet dry and wet weather requirements; that is then overlaid by the structural assessment and an integrated plan is developed."

Sydney Water has a programme to carry out condition based asset valuations on assets every five years. In the intervening years asset values are increased based on an index valuation. The index used by Sydney Water is the Australian Bureau of Statistics (ABS) Index "Output for the General Construction Industry" (Producer Price Indexes – 6427, Table 15).

The selection of an appropriate inflation index is essential to the development of meaningful asset valuations. This has been the subject of considerable debate in the UK recently; the argument being that neither the retail price index (RPI) nor the Construction Outputs Price Index (COPI) is sufficiently representative of water company capital programs. It is considered that COPI overestimates the actual construction cost increases faced by the water companies. In the UK, Ofwat have examined the breakdown of the sub-indexes that make up COPI and intend to adopt the 'Infrastructure' sub-index of COPI as the index of national construction costs for the water industry at the 2009 review. Ofwat uses asset values reported by the water companies for current cost accounting purposes and comparative efficiency.

We consider Sydney Water's approach to asset valuation based on condition assessment to be in line with best practice. It should be noted that the annual depreciation expense for the asset does not just depend on the assumed average asset life, but also the remaining asset life calculated for assets in fair or worse condition.

4 Review of Asset Lives

4.1 General

The lifetimes predicted for individual assets within water and sewer reticulation systems are important because they significantly affect the depreciated asset values and also the future needs for asset replacement and operational costs. The Tribunal has asked for an assessment and recommendation of the appropriate asset lives to be used for each asset class to make the process of using this information as simple as possible.

Unfortunately the determination of a simple asset life is not straightforward and depends on a significant number of factors, for example pipeline asset life depends on factors such as pipe material, manufacturer and manufacture date, installation and operating conditions, maintenance and the discount rate used by the water authority. The determination of asset lives in Australia and worldwide has so far been shown to be authority specific, although some research is being carried out into developing, for example, generic failure curves for specific pipe types.

There are also a number of other important factors that need to be taken into consideration when assessing asset lives. A considerable amount of work has been carried out in Australia and elsewhere in examining the typical lifecycles of various asset groups. As a result of this research a series of "bath tub" shaped distributions have been developed to describe the failures of various asset groups. The bath tub curve describes an initial period of high failure likelihood (often due to sub standard installation, quality issues in the manufacturing process), followed by a longer more stable period of low failure likelihood and finally a period where failure becomes increasingly likely as the asset deteriorates. This is illustrated in Figure 4.1 below.

The bath tub curve is most applicable to non infrastructure assets. For infrastructure assets, deterioration can be represented by a series of curves that represent different components of failure likelihood. Deterioration curves representing failure likelihood due to installation or material are typically similar to the shape of the 'youth' stage of the bathtub curve. Random events such as third party intervention have a likelihood similar to the maturity phase whilst age related deterioration is typically similar to the gradual rising limb of the bathtub.

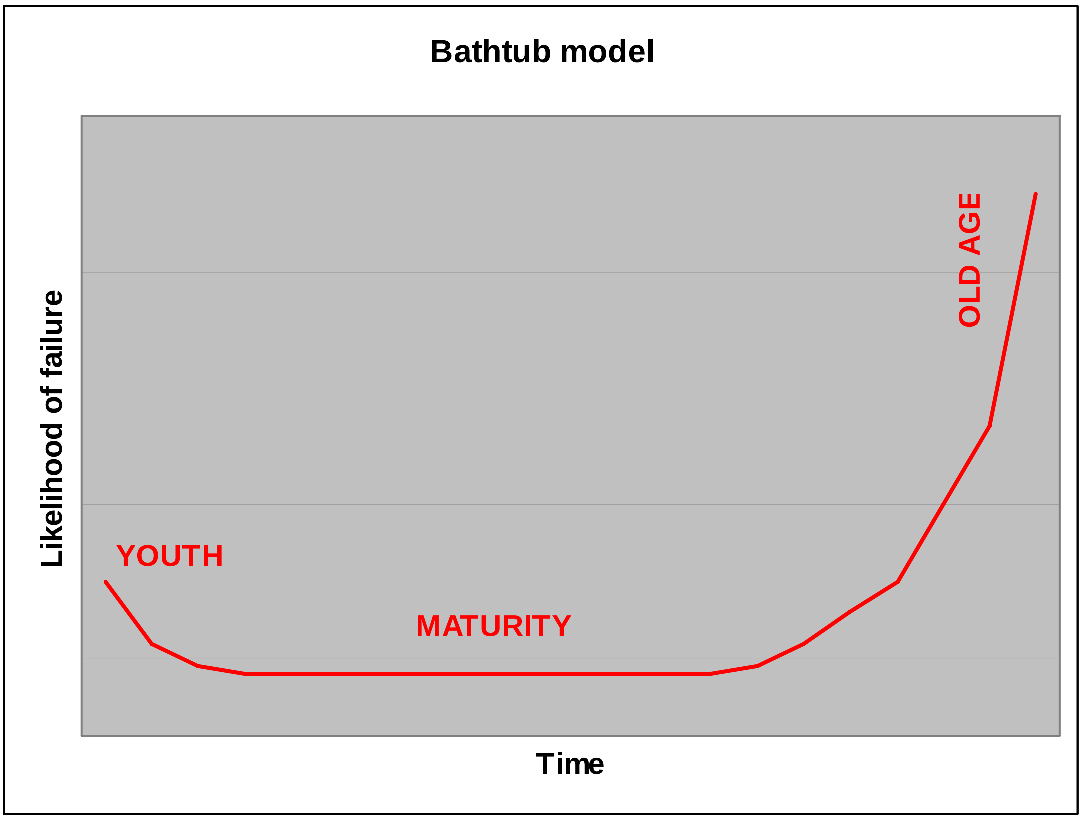


Figure 4.1 Asset Life Cycle 'Bath-tub' Curve

Using average asset lives does not reflect this pattern in that is does not recognise the high likelihood of early failure, nor the increasing likelihood that an asset will survive longer than its 'average' asset life as that asset gets older. Adopting a condition based assessment approach allows the modification of asset lives to become more representative of reality. This can also be used to improve our understanding of the appropriate average asset lives to adopt for amortisation, for the purposes of economic regulation.

In addition to this, the drivers for asset replacement also include technical obsolescence which occurs when an asset is no longer of the right type or capacity to efficiently deliver the levels of service it is required to deliver. Technical obsolescence can also occur when assets are no longer supported by manufacturers and/or spares and technical support is no longer available. Sydney Water interprets technical obsolescence as "*an asset [that] is no longer 'fit for purpose'. These assets would be replaced under the reliability driver*". Sydney Water considers that around 20% of asset replacements for sewage treatment plants and water treatment plants are due to being no longer fit for purpose.

This results in an asset being replaced before it reaches its nominal service life and this could distort the results for groups of assets, in particular complex short life assets.

Table 4.1 – Summary of Water Main Asset Life from Table 26 of Water Mains Asset Management plan -2007/08

Pipe Type	**Average Life by Soil Type**				**Standard Life**
	Not Relevant	Non Aggressive	Aggressive	Highly Aggressive	1996-2003
AC	55	n/a	n/a	n/a	90
SCL & CICL (92-374mm)	n/a	140	115	80	120
SCL (> 374mm)	n/a	140	115	85	120
DICL (<375mm)	n/a	140	115	65	120
DICL (≥375mm)	n/a	140	140	140	150
PVC-u & PE	85	n/a	n/a	n/a	75
RC	150	n/a	n/a	n/a	75

Note:-
All SCL laid post 1986 to treated as non-aggressive soils
All DICL laid post 1988 to be treated as non aggressive soils
There are a number of inaccuracies in Table 26 in that HDPE which is high density Polyethylene is described as High Density Unplasticized polyvinyl chloride and Polyethylene is described as a separate grade to HDPE. It is also doubtful that VC would be used for pressure reticulation mains

Sydney Water in determining its water pipeline asset lives uses the KANEW model which applies a modified Weibell distribution (Hertz distribution) to pipe cohorts (groups of pipes of similar characteristics). The KANEW model uses parameters such as pipe size, material, soil type, age of asset stock and failures of the pipe material to produce survival functions for each pipe cohort. These survival functions are used to assess the useful remaining life of each of these groups of pipes for investment planning, for example that 100% of the pipe cohort will survive for x years, that 50% will survive for y years and that 10% will survive for z years.

In evaluating the information provided by Sydney Water it is assumed that the information provide in Table 4.1 for Asset Lifetimes is provided by these survival functions and is the average lifetime (or time to first failure) produced by the curves. Based on the information provided in Table 4.1 it would appear that there are some deficiencies in the life distributions based on manufacturing technique alone, for example cast iron can be divided into at least two manufacturing cohorts, sand cast and spun cast and PVC-u into two these being Pre 1974 and post 1974, with the lifetimes for these cohorts being significantly different. For example the lifetime of 85 years assigned for PVC may be suitable for pre 1974 manufactured pipes, but it would be very low for pipes manufactured since this date and especially so for more recently manufactured pipes where the issues associated with poor fracture toughness have been addressed. It is thus recommended that the cohort lifetimes be modified to include the known effects of pipe manufacture and that non water mains materials such as VC be removed from the cohorts.

However lifetime of water reticulation assets depends on a much large range of factors than that based on statistical failure of pipeline failures and this is discussed in greater detail in the Section 4.2, analysing Water Mains.

Table 4.2 – Dissection of Sewer Mains and Asset Lives – From Table 6 Sewer Asset Management Plan

Pressure mains	**Asset Life (years)**
AC	55
CI, CICL, DI, SCL	85
PE, PVC-u	85

Gravity Mains	Asset Life (years)
AC	55
CI, CICL, DICL, SCL	85
PE, PVC-u, ABS	85
VC	130
Concrete	130
Structural relining	70

In the case of sewer mains, lifetime prediction is even more difficult than that of water mains because failure can be defined by four parameters: structural collapse, blockages, infiltration and exfiltration. Structural failure is normally defined as the point at which a sewer will collapse leading to an overflow, whilst for blockages the lifetime is controlled by the frequency of these occurring.

Generally for structural failures, sewer asset lifetimes are determined by undertaking a statistically valid number of CCTV samples across a network and then developing statistical curves to determine the probability of each sewer asset being in a particular condition grade and also its probability to transition from grade to grade as its condition deteriorates. As assets enter the worst grade they are deemed to reach the end of their lifetime and are scheduled for CCTV inspection to confirm they are indeed in the predicted grade.

Sydney Water inspects all its avoid fail sewers using CCTV on a 10 year cyclic or identified condition-based inspection programme. For avoid fail sewers, infiltration rates and concrete corrosion rates are analysed and used to understand deterioration trends. Other deterioration factors are not currently examined for these sewers due to lack of data. Sydney Water also has a sample of CCTV data for run to fail sewers where there has been opportunistic data collection at the sites of operational problems. These data are used to extrapolate condition and serviceability ratings for these reticulation sewers.

For blockages, lifetime is generally controlled by the number of blockages that occur in a system leading to dry or wet weather overflows, whilst for infiltration the levels that require attention vary from authority to authority and are generally linked to wet and dry weather overflows, rather than the performance of the wastewater treatment plants or the ability to resell the reclaimed wastewater due to contamination from salt associated with infiltration. Sydney Water does not currently take these factors into account when determining asset lifetimes.

Sydney Water currently determines the lifetimes given in Table 4.2 by using a desktop analysis based on expert opinion. It is recommended that these lifetimes be determined by the use of statistical analysis of CCTV data or on other factors and are based on Condition Assessment

We queried with Sydney Water the fact that some of the lifetimes line up with the lifetimes given in Table 4.1 for pressure pipes, whereas we would expect differences in the expected asset lives due to the very different operating conditions. Sydney Water responded that the lives are "*similar for sewers compared to watermains in highly aggressive environment(s). This aligns with our experience for metallic materials and (we) have compared with other Australian water companies life expectations*".

Sydney Water point out that for metallic pipes, factors such as operating environments, product and service pressure have been considered and have resulted in an assessment of 85 years for metallic sewer mains and 80-140 years for metallic water mains.

Furthermore, we queried the fact that for plastic pipes, the same asset life had been assigned to gravity sewers and pumped rising mains. In response Sydney Water state that for plastic pipes *the same life (of 85 years) for both reflects that these are designed for this life, taking into account the different operating conditions for water and wastewater*. We would expect to see different asset lives for plastic gravity sewers and rising mains because the operating conditions for a PVC-u and PE gravity sewer are a lot less onerous than those for a pumped rising main and thus we would expect the lifetimes should be significantly different. This is discussed in more detail in Section 4.3.1 below.

The propensity of different pipe types to blockages caused by the growth of root systems have also not been accounted for in determining lifetimes; however, we understand from Sydney Water that compared to other authorities, blockages due to root intrusion is not a major problem and that areas with a high propensity for blockages associated with certain tree types have been identified for assessment and rehabilitation. If root intrusion was an issue the lifetime of a VC or concrete system would be much shorter than PVC-u due to the ability of roots to move through the joints of the former pipe types. These issues are discussed further in the section analysing Sewer Mains.

The following sections describe, for each asset class, the methodology for assessing asset life, provide our assessment of the robustness of these methodologies and set this within the context of good practice in other Australian and UK water companies/authorities.

4.2 Water and Recycled Water Asset Lives

4.2.1 *Water Mains Asset Management*

Since July 2003 Sydney Water has determined the asset lives of water pipes based on the physical characteristics of the soil in which the pipe is laid and on the characteristics of the pipe (material, joint type, diameter, installation, pressure rating etc). Asset lives are then cross checked against historic performance data.

Sydney Water has made major advances in their asset management strategies since 2004 and now like other advanced Australian water authorities take a risk based approach and divide their water reticulation asset base into critical and non critical assets. Non critical assets are normally left to operate until failure, whilst critical assets have proactive strategies applied to them to ensure that they do not fail. In the area of ***non critical assets***, these assets have a significant failure history that can be used to predict the likelihood of future failures via the development of failure curves.

Sydney Water has chosen to use the KANEW software which develops survival functions for each pipe cohort. This is a valid statistical procedure that predicts the time frame for certain percentages of the pipe cohort to have experienced a failure. For example, 50% of the pipe cohort will survive for 80 years. This method also produces an average lifetime such as those detailed in Table 4.1 for a number of very broad pipe cohorts. Where failure data is sparse, such as for Polyethylene and newer formulations of Polyvinylchloride, statistical failure analysis using tools such as KANEW is invalid and physical probabilistic models such as those published by AwwaRF are recommended as good practice.

Whilst the lifetimes predicted using models such as KANEW are valid if we are using the number of breaks to determine lifetimes, there are a significant number of other factors that can significantly alter the lifetime. These include customer service levels, water quality events, the discount rate used, the use of advanced maintenance techniques and adjustment of the pipelines operating conditions such as pressure. Unfortunately the KANEW approach cannot currently take these parameters into account.

Sydney water has identified a number of Key Performance Indicators for its pipeline assets:

- Water Continuity – the number of properties affected by an unplanned shut-off exceeding 5 hours should not exceed 35,000±5%. The number of properties affected by a planned and warned shut-off exceeding 5 hours should not exceed 32,000±5%.
- Water Pressure – No more than 15,000 water properties shall experience a water pressure of less than 15 meters for more than a 15 minute continuous period.
- Water Quality – Water must meet the Australian Drinking Water guidelines

Whilst the reticulation water main renewals capital budget is based on the KANEW model forecast, the decision to rehabilitate individual reticulation mains is assessed based on operating cost efficiencies and impacts on these KPIs.

Regardless of the lifetimes predicted by the KANEW analysis it would be unusual for a non strategic asset, in an 'operate to failure' regime, to be refurbished or replaced until it fails one of these criteria.

Sydney Water has identified this disconnect between the lifetimes predicted by KANEW analysis and the 'actual' lifetime used in its rehabilitation/replacement strategy; in that it states "*Existing pipes are replaced when their condition reaches the end of its useful life or is no longer fit for purpose*". The lifetimes predicted by the KANEW analysis are thus not used in determining the end of an assets actual life. Currently there appears to be no feedback between the performance based lifetimes used in rehabilitation planning and the lifetimes from Kanew that are used in investment strategy development.

Non critical pipes for further assessment are identified using three criteria:

- No breaks/100kms is high - a figure of 6 breaks/kilometre in any one year is used for targeting parts of the system
- Individual assets – the number of breaks does not exceed 3 in two years.
- Dirty water events

Based on these triggers a whole of cost water main analysis is carried out. This NPV analysis of each water main, considers the best option for refurbishment or replacement, value of the asset at the end of the NPV period, operating cost savings from renewal, reduced interruption of water services, savings in rebates and the value of the water lost.

However, in a comparison of maintenance (or repair) against replacement, maintenance will generally be the preferred option when higher discount rates such as the 7% used by Sydney Water and consequently the lifetime of the pipeline will be considerably extended. It is only through the use of high penalties or externalities that the NPV analysis swings around in the favour of renewal. Pressure reduction is another option that can significantly increase asset lifetimes and this has been applied by a number of authorities around Australia who have noticed a reduction in the longitudinal splits occurring in pipes (Pressure reduction will not alter the broken backs associated with soil movement. Note also, that the benefits of pressure reduction are hard to predict, quantitatively).

Consequently the lifetimes detailed in Table 4.1 derived from statistical analysis of cohorts to produce survival functions are not the true lifetimes that apply to the Sydney Water asset base. Comparison of the pipes replaced according to the NPV analysis would give a more valid lifetime outcome as it is anticipated that the lifetimes of some assets such as PE and PVC-U would be significantly longer than those detailed in Table 4.1. It is recommended that information from this process be used to inform the lifetime determination process which is currently based on statistical analysis of failure data.

From analysis of the lifetimes determined for a range of authorities in Australia, the UK and USA, taking customer service levels and the use of pressure reduction and the discount rates used by authorities throughout Australia, an assessment of whether the current lifetimes are high, low or in the correct range are presented in Table 4.7. It must be emphasised that these indications have not been subjected to rigorous review, that they are based in some instances on limited data and that a detailed research program must be carried out to confirm the indications. It is recommended that Sydney Water review the lifetimes used in its residual value analysis based on the above discussion.

In the case of ***critical mains*** the lifetimes of the assets will be more dependent on the maintenance and pro-active management strategies that are implemented compared to non-critical mains. Sydney Water has developed a risk based methodology for managing its critical mains and targets its high risk pipes for special condition based assessment. In this discussion it will be assumed that all pipes in the high "consequence", high "probability of failure" quadrant of the failure verses probability table have been addressed to reduce the level of failure probability, so that there are few assets left in this quadrant. It is understood that there are currently 5% of assets in this quadrant, but that steps are being implemented to ensure that the risks associated with these assets are minimised.

This process would be in accordance with good asset management practice and thus the lifetimes of only those assets in the low probability, high consequence need to be addressed. Assets in the critical asset class tend to be those that have lower failure rates when compared to non-critical assets because they tend to be larger in size, have thicker walls and tend to be installed under supervised conditions. Additionally because of their criticality, the application of active protection techniques such as cathodic protection becomes more common. Consequently, because of the lower levels of failure rates the application of statistical techniques to determine lifetimes becomes questionable and the validity of the lifetimes derived from such analysis as detailed in Table 4.1 is debatable. To allow it to undertake Condition Based Asset valuation, Sydney Water characterises their assets into 5 classifications, Very Good, Good, Fair, Poor, Very Poor using KANEWS forecasts for renewal lengths. Whilst this approach may be valid for non-critical assets, its application using statistical models for critical assets can be questioned.

Sydney Water's approach is to use the asset lives provided in Table 4.1 for 'top down' high level capital investment forecasting, whilst using a 'bottom up' *'quantitative risk based Economic model to prioritise and identify individual critical water mains for proactive maintenance, investigation, condition assessment, renewal or rehabilitation'.* To facilitate this, Sydney Water has instituted a significant condition based assessment program to determine those assets that should be replaced. Condition based assessment is a much more rigorous approach and uses a range of condition assessment techniques to determine the probability of an asset failing, this when combined with the known consequence of failure, allows a risk assessment to be undertaken to determine if risk reduction needs to occur.

The need to reduce the risk below a level deemed suitable for the authority, thus becomes the driver to determine the end of an assets lifetime rather than an arbitrary life determined using statistical analysis based on limited data. Risk reduction can be achieved, through maintenance or replacement or by applying active protection techniques. In each case a valid NPV analysis should be used to determine the relative benefits of maintenance versus replacement, which could again extend the assets life depending on the discount rate used. In this respect Sydney Water's move to condition based assessment is a positive step and should be used as the driver to determine asset lives for this asset class, rather than the statistical lives determined from non-critical assets as detailed in Table 4.1. Because of the special parameters applying to this asset class, such as detailed design specifications, active corrosion protection, proactive maintenance, regular condition assessment etc, it is expected that the lifetimes detailed in Table 4.1 would be pessimistic for this asset class. It is thus recommended that the lifetimes in Table 4.1 be revised to include separate tables for both critical and non-critical mains.

4.2.2 *Comparison of water main asset lives*

Sydney Water's asset lives for water mains range from 55 to 140 years as shown in the Table 4.1. Water main asset lives can be compared with other water companies, and water main asset lives are shown in the table below. These have been taken from previous studies carried out and the water companies remain anonymous for reasons of confidentiality.

Table 4.3 Comparison of water main average life

Water Company	Water Main Asset Life (yrs)
UK Water Company A	50 to 120
UK Water Company B	40 to 125
UK Water Company C	60 to 150
UK Water Company D	80 to 150
UK Water Company E	40 to 100
UK Water Company F	100
UK Water Company G	80 to 100
UK Water Company H	40 to 100
Australian Water Company M	90
Australian Water Company N	55 to 120
Australian Water Company P	99
Australian Water Company Q	10 to 150
Australian Water Company R	95

Asset lives vary considerably between different companies. However it can be seen that Sydney Water's estimates of asset lives are at the high end. Differences between asset lives for UK water companies and Australian water companies can be attributable to climatic differences, different historical levels of investment, different approaches to capital maintenance and different mixes of assets, and the higher lives of Sydney Waters assets, compared to other authorities should be considered in this context.

4.2.3 *Comparison of above ground water asset lives*

Sydney Water determines asset lives for above ground civil, mechanical, electrical and electronic assets as follows:

Table 4.4 Asset lives for above ground water assets

Description of Asset	Asset Life (yrs)
Dams / Reservoirs (civil)	150
Mechanical assets	40
Electrical assets	30
Electronic assets	15
Treatment works (civil)	100
Pumping stations (civil)	100

Asset lives of dams and reservoirs are considered to be dependent on the type of construction. An asset life range of 100 to 150 years is reasonable for embankment dams. Concrete and other types of construction can expect a longer life expectancy but this may vary with date of construction, more recent assets benefiting from use of improved and more durable materials. As an overall average estimate 150 years is considered a reasonable estimate of asset life. The table below shows asset lives used by other water companies:

Table 4.5 Comparison of dam/reservoir asset lives

Water Company	Dam / Reservoir Asset Life (yrs)
UK Water Company A	120
UK Water Company B	125
UK Water Company C	150
UK Water Company D	250
UK Water Company E	200
UK Water Company F	150
UK Water Company G	150
UK Water Company H	200
Australian Water Company Q	200

Typical asset lives for operational structures (civil structures for water and wastewater assets) and fixed plant (mechanical/electrical assets) for UK water companies taken from their annual reports are shown in the following table for comparison:

Table 4.6 Comparison of asset lives for operational structures and fixed plant

Water Company	**Operational Structures Asset Lives (years)**	**Fixed Plant Asset Lives (years)**
Southern Water	15 to 80	10 to 40
United Utilities	5 to 80	3 to 40
Yorkshire Water	N/A	5 to 40
Anglian Water	30 to 80	12 to 40
Welsh Water	40 to 80	8 to 40
South West Water	40 to 80	20 to 40
Scottish Water	20 to 60	3 to 20

This comparison shows that Sydney Water's assumed asset life for civil structures is high compared to UK water companies, however we consider 100 yrs to be a reasonable assumption. Sydney Water's asset lives for mechanical, electrical and electronic equipment are high. Typical values used in the UK are 20 years for mechanical and electrical assets and 10 years for electronic assets. However we have seen no evidence to suggest Sydney Water should reduce their assumed asset lives for these assets. It should be noted also that water treatment plants and pumping stations assets account for only 2% of total system asset value, and any change in assumed asset life will have negligible affect on the overall value.

4.2.4 *Conclusions and recommendations on water asset lives*

The following tables summarise our opinions of Sydney Water's asset lives.

Table 4.7 – Halcrow opinion of Sydney Water's water main asset lives (plan to repair mains) asset lives.

Pipe Type	**Average Life by Soil Type**				**Standard Life**	**Halcrow estimated typical range**
	Not Relevant	Non Aggressive	Aggressive	Highly Aggressive	1996-2003	
AC	55	n/a	n/a	n/a	90	**30 - 100**
SCL & CICL (92-374mm)	n/a	140	115	80	120	**30 - 100**
SCL (> 374mm)	n/a	140	115	85	120	**50 - 150**
DICL (<375mm)	n/a	140	115	65	120	**30 - 100**
DICL (≥375mm)	n/a	140	140	140	150	**50 - 150**
PVC-u & PE	85	n/a	n/a	n/a	75	**100 - 200**
RC	150	n/a	n/a	n/a	75	**100 - 150**

Red	Appear very optimistic
Orange/Yellow	Appear somewhat optimistic
Green	Appears reasonable
Cyan	Appears somewhat pessimistic

We have suggested some typical ranges of asset lives which are based on our broad experience. However without undertaking a detailed statistical analysis (for which data is currently unavailable) it is not possible to specify precise asset lives.

Table 4.8 Halcrow opinion of Sydney Water's above ground water asset lives

Description of Asset	Asset Life (yrs)	Halcrow Opinion
Dams / Reservoirs (civil)	150	Reasonable
Mechanical assets	40	Optimistic
Electrical assets	30	Optimistic
Electronic assets	15	Reasonable
Treatment works (civil)	100	Optimistic
Pumping stations (civil)	100	Optimistic

Whilst we consider some of the asset lives to be optimistic we have seen no evidence to suggest Sydney Water should reduce their assumed asset lives for these assets. It should be noted also that water treatment plants and pumping stations assets account for only 2% of total system asset value. Therefore we recommend the use of the asset lives shown in Table 4.8.

4.3 Wastewater Asset Lives

4.3.1 Sewers Asset Management

Sewer mains can fail due to a number of performance characteristics such as structural collapse, blockages and infiltration (exfiltration is not yet an issue in Australia). The actual lifetime obtained from the asset will depend on these factors and how they impact on a range of KPI's as well as an analysis of the benefits of repair versus renewal. As for water mains, Sydney Water applies a valid risk based approach to its sewers and categorises them into "Avoid-Failure" sewers (8%) and "Plan-to-Repair" sewers (92%). Although Sydney Water pressure mains are not currently classified into these groups and are managed as Plan-To-Repair sewers, plans are being developed to manage them on a risk based approach and it is recommended that a risk based classification should be carried out in a similar way to the process that has been applied to water mains.

In the area of ***Plan-To-Repair*** sewers the assigned lifetimes of the sewers are as detailed in Table 4.2. For these assets a "Response" based strategy is applied that allows these assets to reach the end of their service life at which point they are inspected and if necessary rehabilitated or replaced. In practice the service life of each asset may be greater than those average lives given in Table 4.2, depending on its condition when inspected. Current service lives are based on results obtained from a desktop study based on expert opinion. A more valid approach that Sydney Water may consider for determining asset lives uses condition grades based on limited CCTV analysis, where the asset is classified into a condition grade based on the Sewer Inspection reporting Code. Depending on the grading system used this can vary from 3 to 5 condition grades. For example the current WSAA code this has a 3 level condition grading system where condition grade 3 has a peak score >60 and a mean score >1.5.

If CCTV analysis of a statistically valid sample is carried out, statistical curves can be determined for the probability of each sewer asset being in a particular condition grade and also its probability to transition from grade to grade (its rate of deterioration). Currently Sydney Water do not model sewer deterioration explicitly as it does not feel it has sufficient data from repeat inspection programmes to develop meaningful deterioration rates. Sydney Water do however use data on factors such as concrete corrosion and infiltration to investigate trends and forecast condition and performance.

Many authorities use the transition of a pipe into the top grade as being an indicator it is at the end of its useful life and then flag it for inspection to confirm its actual condition grade. Based upon repeated CCTV inspections Sydney Water can build up a database that allows asset lifetimes to be determined. It is recommended that instead of Sydney Water using an expert panel to determine the lifetimes given in Table 4.2, the adoption of a valid scientific technique based on CCTV inspections would provide a more rigorous methodology for determining a sewer asset entering a condition grade and thus give a valid lifetime for each asset cohort.

Sydney Water currently does not use the lifetimes detailed in Table 4.2 for informing its inspection program, instead it states that "*collapse or failure to meet performance standards (ie repeat chokes) being the point of end-of-service-life*". It uses a number of KPI's to indicate that sewer assets are no longer fit for purpose, these are:

Investigate when

- Tree root chokes exceed 3 in 5 years
- Wet weather overflows are causing overflows within homes
- Repeat dry or wet weather overflows on private property cause customer outrage
- High frequency that a wet weather overflow reaches a waterway
- Leakage from a pressure main is detected.

Based on these triggers a lifecycle cost analysis is carried out. This NPV analysis which is similar to that carried out for water assets and considers similar factors determines the viability of maintenance versus renewal. Consequently if maintenance is the preferred option the asset lifetime could be significantly extended. It is recommended that the output from this analysis should be used to significantly inform the process for determining asset lifetimes.

For ***Avoid-Failure*** assets Sydney Water uses Condition Based Assessment based on either CCTV for non man-entry sewers or engineers for man-entry sewers to determine the end of service life and then uses this value to initiate action using a risk based matrix.. A range of factors are taken into consideration when determining condition grade, including:

- Asset performance - Corrosion and silt management
- Environmental Impact – dry and wet weather overflows
- Customer Impact – Loss of service, repeated systems failures, overflows inside homes.

It is anticipated that every sewer will be assessed once ever 10 years. Based on this assessment sewer assets are given a residual service life depending upon the condition grade received:

- Condition Grade 1 – 10 years plus
- Condition Grade 2 – 5 years
- Condition Grade 3 – 3-5 years
- Condition Grade 4 – 2 years
- Condition Grade 5 – 0 years

Sydney Water has chosen to initiate action based upon a 5x5 risk matrix when

- Years to end of service life <2 years or when years to end of service life is 2-5 years and cost is >$1.0 Mil. In this case years to end-of-service-life is loss of structural integrity.

This risk analysis provides a basis for managing risks, planning timely cost effective repairs or replacements, and for prioritizing of works programs. The 5x5 risk matrix has years to end of service on one side of the risk matrix, so consequently any asset nearing the end-of-service as defined in Table 4.2, with a value exceeding $50,000 automatically goes into the "High Risk" category and are allocated for risk mitigation involving inspection repair, rehabilitation or replacement as soon as possible. Again this process could be used to inform and refine the lifetimes detailed in Table 4.2 and again like Critical Water mains it is recommended that a separate table be established for lifetimes associated with Avoid-Failure assets.

We challenged Sydney Water as to why pumping mains are assumed to have the same asset life as sewers with the same material. Sydney Water responded; *"pressure mains are mostly CICL/DICL, with a small amount of plastic pipe in recent years. The main failure mode for iron pressure mains is corrosion from the outside, which is dependant on the soil conditions. This is the same as for the gravity iron mains. The failure rates for pressure/ gravity iron mains are similar. This is the basis of the assumption that service life of pressure mains is the same as the gravity sewers. In recently years, there were 3 failures on gravity iron mains immediately downstream of the pressure section. The failure mode was hydrogen sulphide corrosion from the inside. These sections are a relatively small percentage of the total length of iron mains and the life was not reduced for this type of failure".*

4.3.2 Comparison of sewer mains asset lives

Sydney Water's asset lives for sewers and pumping (or rising) mains range from 55 to 130 years as shown in Table 4.2.

Sewer and pumping main asset lives can be compared with other water companies:

Table 4.9 Comparison of sewer asset lives

Water Company	**Sewer Asset Life (years)**
UK Water Company A	50 to 120
UK Water Company B	40 to 125
UK Water Company C	60 to 150
UK Water Company D	150 to 200
UK Water Company E	40 to 100
UK Water Company F	200
UK Water Company G	60 to 150
UK Water Company H	40 to 100
Australian Water Company M	80
Australian Water Company N	55 to 130
Australian Water Company P	99
Australian Water Company Q	10 to 150
Australian Water Company R	90

As can be seen from the table, sewer asset lives vary considerably between water companies. In the UK sewers have in the main only been installed in significant quantity post 1860. There are thus few sewer assets that can have reached an average life expectancy of 150 years. In the same period some sewers have required replacement, evidence that significantly shorter asset life can be experienced.

4.3.3 *Comparison of above ground wastewater asset lives*

Sydney Water determines asset lives for above ground wastewater civil, mechanical, electrical and electronic assets as follows:

Table 4.10 Asset lives for above ground wastewater assets

Description of Asset	Asset Life (yrs)
Civil structures (treatment plants, pumping stations)	100
Mechanical assets (treatment plants, pumping stations)	25
Electrical assets (treatment plants, pumping stations)	25
Electronic assets (treatment plants, pumping stations)	15

Mechanical and electrical asset lives are less then the equivalent water mechanical and electrical lives, reflecting the more corrosive nature of sewage. These values are more in line with the average mechanical and electrical asset lives used by UK water companies. Sydney Water state in their Sewage Treatment Plant Asset Class Plan "*level of renewals was determined by extensive exercise using expected working lives and asset conditions. For STPs it has been found that the planned level of renewals for mech/electrical/electronic assets represent roughly 4% of their MEERA value, in other works M/E/EI assets are planned to be renewed in 25 years cycle.*"

4.3.4 *Comparison of ocean outfalls asset lives*

Sydney Water determines asset lives for deep ocean outfalls civil, mechanical, electrical and electronic assets as follows:

Table 4.11 Deep ocean outfall sewers asset lives

Description of Asset	Asset Life (yrs)
Civil structures (submarine outfall)	100
Mechanical assets (submarine outfall) from 2004	40
Electrical assets (submarine outfall) from 2004	30
Electronic assets (submarine outfall) from 2004	15

Mechanical and electrical asset lives are higher than those assumed for other wastewater assets, and are the same as those assumed for water mechanical and electrical assets. We consider these asset lives should be the same as wastewater mechanical and electrical assets.

Table 4.12 Comparison of outfall asset lives

Water Company	Outfall Asset Life (years)
UK Water Company E	40 to 100
UK Water Company F	60
UK Water Company G	80
Australian Water Company Q	40 to 100

Compared to some other water companies Sydney Water's asset life estimate for outfalls (civil structure) is at the high end, but we consider 100 years to be reasonable when compared to the average lives assigned for sewers.

4.3.5 *Conclusions and recommendations for wastewater asset lives*

The following tables summarise our opinions of Sydney Water's asset lives.

Table 4.13 – Halcrow opinion of Sydney Water's sewer mains asset lives (plan to repair sewers) and recommended asset lives

Pipe Type	Average Asset Life (years)	Halcrow Estimated Typical Range (years)
Pressure mains		
AC	55	**30 - 85**
CI, CICL, DI, SCL	85	**30 - 100**
PE, PVC-u	85	**100 - 150**
Gravity Sewers		
AC	55	**30 - 100**
CI, CICL, DICL, SCL	85	**30 - 100**
PE, PVC-u, ABS	85	**100 - 150**
VC	130	**50 - 150**

Concrete	130	**75 - 100**
Structural relining	70	**50 - 75**

(red)	Appear very optimistic
(yellow)	Appear somewhat optimistic
(green)	Appears reasonable
(cyan)	Appears somewhat pessimistic

We have suggested some typical ranges of asset lives which are based on our broad experience. However without undertaking a detailed statistical analysis (for which data is currently unavailable) it is not possible to specify precise asset lives.

Table 4.14 Halcrow opinion of Sydney Water's above ground wastewater asset lives

Description of Asset	**Average Asset Life (yrs)**		**Halcrow Opinion**
	Sydney Water	**Recomm-ended**	
Civil structures (treatment plants, pumping stations)	100	**100**	Optimistic
Mechanical assets (treatment plants, pumping stations)	25	**25**	Reasonable
Electrical assets (treatment plants, pumping stations)	25	**25**	Reasonable
Electronic assets (treatment plants, pumping stations)	15	**15**	Reasonable
Civil structures (submarine outfall)	100	**100**	Optimistic
Mechanical assets (submarine outfall) from 2004	40	**25**	Very Optimistic
Electrical assets (submarine outfall) from 2004	30	**25**	Optimistic
Electronic assets (submarine outfall) from 2004	15	**15**	Reasonable

4.4 Stormwater Asset Lives

Sydney Water determines asset lives for stormwater assets as follows:

Table 4.15 Stormwater asset lives

Description of Asset	Asset Life (yrs)
Stormwater drains	150
Stormwater storage pits	150

Stormwater assets are predominately made of concrete. Stormwater is less corrosive than sewage, therefore an assumed asset life of 150 years is reasonable when compared to 130 years assumed for a concrete sewer pipe. It should be noted that Sydney Water has recently identified some concerns regarding life of stormwater assets in tidal areas (increased exposure of wet/dry cycles in climate change) and intend to investigate this. It is recommended that average asset lives of stormwater drains are reassessed following this investigation.

Stormwater storage pits (or basins) are either of earth or concrete construction. These are comparable to water reservoirs which also have an average asset life of 150 years which we consider to be appropriate.

5 Review of Asset Classes

5.1 General

Sydney Water determines asset classes as: assets held for sale, market land and buildings, leasehold property, system land, system assets, water metres, plant and equipment, computer equipment, work in progress, computer software, acquisitions in progress and easements. The system assets (water mains, sewers, wastewater treatment works etc.) account for around 92% of the net replacement cost of the assets, and we have concentrated our review on these assets.

Sydney Water classifies its system assets based on asset type and further subdivides the assets into components. These asset categories are discussed in more detail below.

A good asset classification system should break down the assets into an asset hierarchy. An example of an asset hierarchy is:

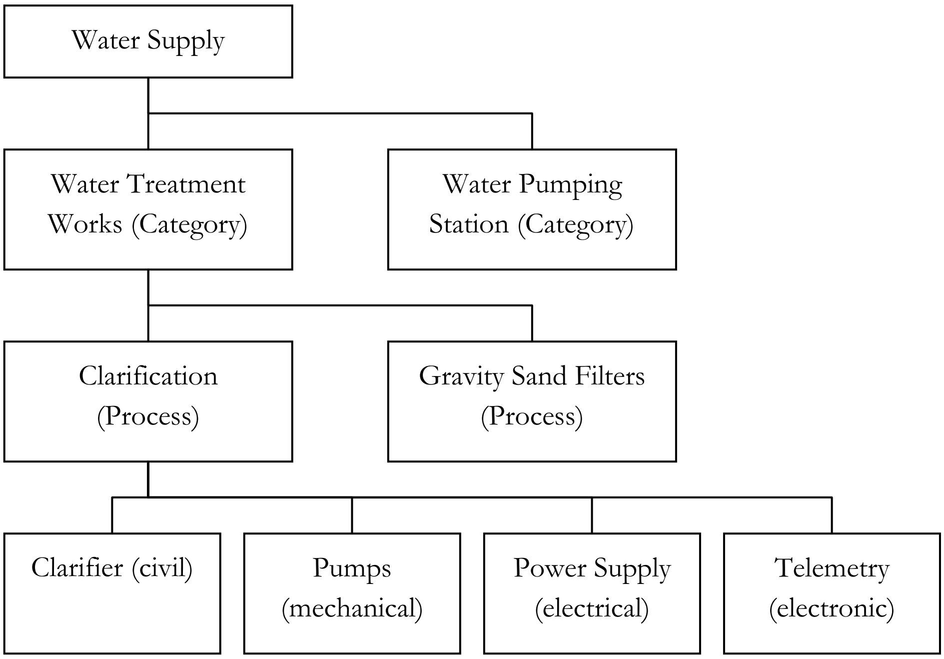


Figure 5.1 Example of Asset Hierarchy

This allows cost estimates to be built up from the component level to obtain a more accurate cost estimate of the category asset.

5.2 *Water and Recycled Water Asset Categories*

Sydney Water currently uses the following asset categories, broken down into component levels:

Table 5.1 Water Asset Categories

Asset Category Group	**Sub-class**	**Component Level**
Water Mains	n/a	Material / Soil Type
Water Pumping Stations	Potable Recycled	Civil Mechanical Electrical Electronic
Dams / Reservoirs	Dams Reservoirs Reservoirs - Underground (Since 2000) Reservoirs - Roofing (Since 2000) Reservoirs - Break Pressure Tank (Since 2000) Reservoirs – recycled water	Civil Mechanical Electrical Electronic
Water Treatment Plants	n/a	Civil Mechanical Electrical Electronic

We consider that the categorisation of water mains according to material type is appropriate and adequately reflects the different asset lives that are attributable to different material types. We have seen evidence of water pumping stations broken down in civil, mechanical, electrical and electronic component levels which we consider to be appropriate component levels. We believe that water treatment plants should be categorised firstly at the process level, then at the component level. Examples of process levels are: siteworks, fine screens, clarification, filtration, and chlorination.

5.3 *Wastewater Asset Categories*

Sydney Water currently uses the following asset categories, broken down into component levels:

Table 5.2 Wastewater Asset Categories

Asset Category Group	Sub-Class / Process	Component Level
Sewer Mains	Gravity sewers Rising Mains	Material / Diameter
Deep Ocean Sewer Outfalls	Submarine Outfalls	Civil Mechanical Electrical Electronic
Sewage Pumping Stations		Civil Mechanical Electrical Electronic
Sewage Treatment Works	Siteworks Preliminary Treatment Sewage Pumping Primary Treatment Secondary Treatment Tertiary Treatment Dosing and Disinfection Sludge Processing Odour Control	Civil Mechanical Electrical Electronic

As for the water mains, we consider the breakdown of gravity sewers and rising mains into components based on material and diameter to be appropriate. Sydney Water also differentiates the 'hole' component of 101 to 600mm diameter sewers in their Fixed Assets Register.

We have seen evidence of sewage pumping station valuations broken down into civil, mechanical, electrical and electronic components. This approach is consistent with the approach to water pumping stations. We have also reviewed the build up of sewage treatment plants costs from component level to process level.

We are aware that Sydney Water has replaced 'avoid fail sewers' which are in grade 3 or fair condition before the end of their useful asset life. An example is the SWSOOS. This effectively shortens their useful asset life. Sydney Water could consider creating separate categories for 'avoid fail sewers' and 'plan to repair sewers' to more accurately reflect their useful asset lives.

5.4 Stormwater Asset Categories

Sydney Water lists the following asset categories for stormwater assets in its fixed asset register:

- Stormwater Drains
- Stormwater Storage Pits
- Pumping Stations - Stormwater
- Treatment Plant - Stormwater

These categories are not currently broken down into component levels although this is now being reviewed by Sydney Water. However it should be noted that stormwater drains are the most significant assets in the stormwater category, with other structures accounting for around 3.5% of total asset value.

6 Review of Movements in Asset Lives and Values

6.1 General

The net MEERA values of Sydney Water's assets have increased significantly between 2001 and 2006. As can be seen from the table below the largest increases are attributed to the system assets. The review of the changes in asset values will concentrate on this asset class and is discussed in more detail in the following sections.

The gross MEERA value is what it would cost to replace an old asset with a technically up to date new asset with the same service capability. The net MEERA value is the depreciated value taking into account the remaining service potential of an old asset compared with a new asset. MEERA values reported in this chapter are inclusive of grants and contributions.

Table 6.1 Net MEERA Asset Values ($ million)

Net MEERA value on 1st July	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
System assets	16,041.1	16,747.7	17,988.5	19,749.7	21,689.9	22,307.2
Easements	136.7	261.3	261.5	259.9	14.0	14.4
System land	308.4	321.5	370.0	427.8	479.2	521.2
Market land & bldgs, leasehold land and property held for sale	309.2	282.7	276.8	429.8	392.4	494.6
Other assets (water meters, plant and equip. and computer and software)	96.6	94.3	128.6	110.2	106.4	96.4
Work In Progress (intangibles)	0.0	0.0	0.0	0.0	0.0	41.0
Adjustments	10.7	0.2	0.2	0.0	0.0	0.0
Sub Total net MEERA Value	**16,902.7**	**17,707.7**	**19,025.6**	**20,977.4**	**22,681.9**	**23,474.8**
Work in Progress	648.8	895.3	685.0	797.9	653.0	597.6
Total net MEERA Asset Value	**17,551.5**	**18,603.0**	**19,710.6**	**21,775.3**	**23,334.9**	**24,072.4**

It should be noted that the MEERA values reported in Table 6.1 are values for the 1st July of each year, whereas the MEERA values reported in the following tables are for the 30th June each year. Therefore the values reported for the 'system assets' in Table 6.1 will not match the disaggregated figures provided in the tables in this chapter.

Sydney Water explained the increase in net asset value of market land and buildings, leasehold land and property held for sale between 2003 and 2004 as follows: "*The increase of 55% in Market Land and Buildings resulted from the delayed completion of the 3 yearly independent market valuation of this asset class as at 1 July 2003. The valuation changes were entered into the Fixed Assets Register during the 2003/04 year*".

Up until 2004 easements were reported at their replacement cost. From 2005 they were accounted for 'at cost'.

Movement in net asset values between one year and the next can be attributed to:

- Depreciation – depreciation charge based on asset life
- Asset additions – new assets added to the fixed asset register including contributed assets
- Asset disposals – assets abandoned
- Revaluation – revaluation either a comprehensive MEERA valuation (carried out on a five yearly cycle) or in intervening years based on an index valuation. The index used by Sydney Water is the Australian Bureau of Statistics (ABS) Index "Output for the General Construction Industry" (Producer Price Indexes – 6427, Table 15).
- Other – other movements, such as due to asset reclassification

We asked Sydney Water to provide us with a breakdown of movements in asset values for each asset category between 2001 and 2006 in order for us to fully explain changes in asset values and to identify any specific areas of concern.

Sydney Water was able to provide this information for 2002 to 2007. The MEERA values reported are for the end of the financial year (value at 30th June) whereas the values reported in Table 6.0 are for the beginning of the financial year (value at 1st July).

Sydney Water explain their methodology for providing the information as follows: "*Sydney Water's financial systems focus on accounting for movements in the book or financial value of its assets. Financial value is the impaired value, ie, depreciated current replacement cost adjusted down to its 'recoverable amount'. Additionally, financial reporting of infrastructure / system assets is carried at the system asset level, that is, all the asset groups in the attached spreadsheets added together as one asset class called 'system assets'. As there is only one General Ledger Account for system assets, dissections have been carried out using data from the Fixed Assets Register. As a result, timing differences will exist between the general ledger and the Fixed Assets Register due to general ledger accrual journals. End of year differences have been apportioned across the asset groups. The method used was to;*

- *Take the 30 June year end dataset from the Fixed Assets Register, reverse the impairment, and apportion any non valuation accruals across asset category groups.*
- *Take additions reports for each year and dissect additions into asset category groups.*
- *Take disposal reports for each year, dissect into asset category groups and then reverse the impairment percentage applied for each financial year.*
- *Take year depreciation reports for each year, dissect into asset category groups and reverse the impairment percentage applied for each financial year*
- *Obtain the revaluation adjustment for each year by deduction given the above calculated values were already known.*

Depreciation expense will generally exclude any general ledger accruals raised in a given year and will at times include depreciation brought to account in a given year which relates to a previous year. Where considered appropriate, differences between the Fixed Assets Register and General Ledger were allocated across the category groups.

Average remaining life has been calculated by dividing the net depreciated replacement cost at the end of the year by the depreciation expense for the year. This ignores any assets that may have been entered into the Fixed Assets Register at the end of the year where the depreciation charge for the year maybe for only one or two months (not a full year).

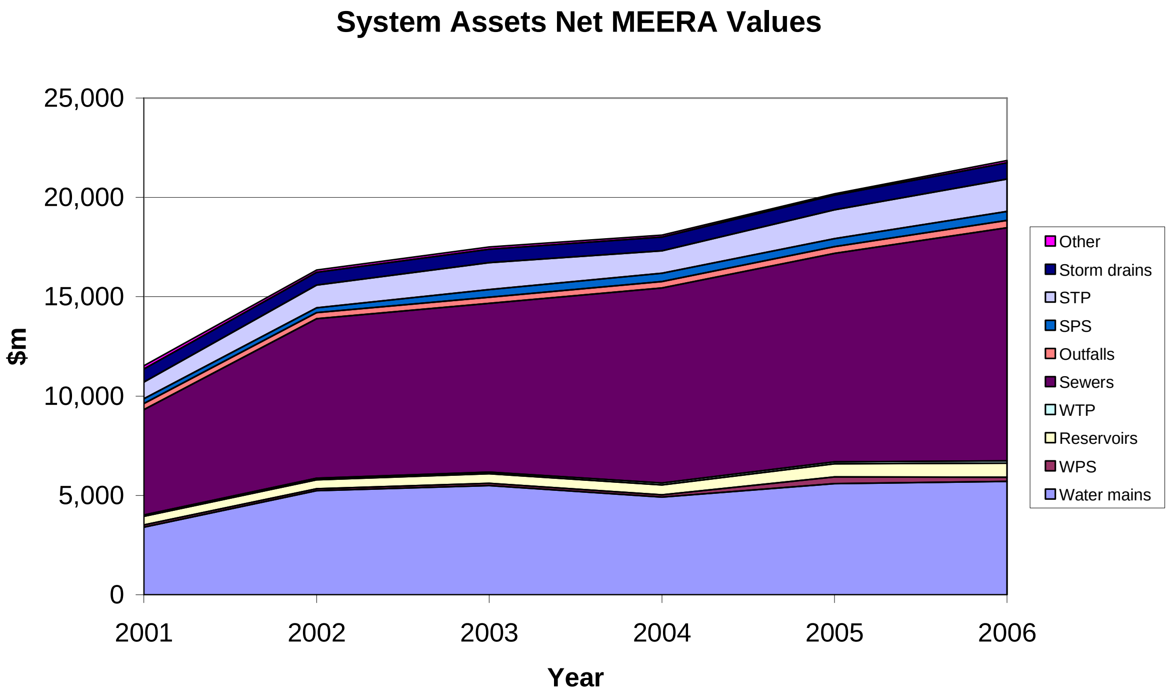
The movement schedules commence from 30 June 2002. Up to 30 June 2002, Gross (Replacement) Cost values were not maintained, they were netted off with the yearly accumulated depreciation as part of the annual revaluation as at 1 July each year. As at 1 July 2002, system asset values were 'grossed up' in order to comply with NSW Treasury guidelines that required the gross value to be maintained and not 'netted off' with the yearly depreciation charge.

The movement schedule balances do not tie up with the six year summary previously provided to Halcrow. The MEERA (depreciated current replacement cost) values provided in that summary were as at 1 July each year and incorporated the ABS index (or other revaluation adjustments) at the beginning of the financial year. The movement schedules attached show movements from the end of each financial to the end of the next financial year."

Sydney Water explained that for 2002/03 "*remaining life has been calculated excluding the apportionment of depreciation accrued*". This correction results in a remaining asset life which is consistent with that calculated for subsequent years.

6.2 *Movements in System Asset Lives and Values*

The total movement in system asset net values between 2001 and 2006 is shown in the graph below.



Movements in net MEERA values for sewer mains account for 62% of the total movement in asset values. Water mains account for 22% and sewage treatment plants for 8%.

Table 6.2 System assets average remaining life (years)

	2002/03	2003/04	2004/05	2005/06
Av. Remaining life	75.9	69.0	66.7	66.1

The table above shows how the average remaining life of the system assets has changed over time. Analysis and explanations for these movements in asset values and lives is provided in the following sections.

6.3 Movements in Water and Recycled Water Asset Lives and Values

Table 6.3 Water assets MEERA values

MEERA value at 30th June	2001	2002	2003	2004	2005	2006
Water mains net MEERA value	3402	5225.7	5492.6	4911.4	5290.7	5711.3
Water mains gross MEERA value			8246.0	8058.1	8712.2	9479.4
Water pumping station net MEERA value	103.1	109.2	116.3	121.1	333.1	194.6
Water pumping station gross MEERA value			210.3	227.7	610.2	415.8
Reservoirs net MEERA value	433.6	446.2	490.4	495.0	665.5	716.3
Reservoirs gross MEERA value			693.0	698.5	1093.5	1184.9
Water treatment plant net MEERA value	75.5	81.1	82.9	86.4	99.4	109.5
Water treatment plant gross MEERA value			101.0	115.2	151.3	174.6
Total water net MEERA value	**4,014.2**	**5862.3**	**6182.2**	**5613.9**	**6388.7**	**6731.7**
Total water gross MEERA value			**9250.3**	**9099.5**	**10567.2**	**11254.7**

The table above summarises MEERA values for water assets. The movements in MEERA values between 2002 and 2006 are discussed in more detail for each asset category in the sections below. The significant increase in water mains value between 2001 and 2002 is due to a revaluation. Sydney Water. The reasons given by Sydney Water for the increase in MEERA replacement costs for water mains and sewer mains values were:

- *world oil prices significantly increased the price of plastic pipes;*
- *charges levied by local councils for restoring the bitumen road surface (where necessary) have gone up more than the inflationary index;*
- *pipe installation / construction costs used in the previous 1996 valuation were gathered during a recessionary period, whereas the economic climate approaching the July 2001 revaluation was less recessionary; and,*
- *the previous valuation used Public Works Department standards and historical rates which caused the cost per metre of pipelaying to be less than would have been the case had Sydney Water's more experience based standards been applied.*

Additionally, the index applied for valuations during the intervening years between 1996 and 2001 were not reflective of the changes in construction costs; the index was changed for future annual asset valuations.

Hunter Water was commissioned by Sydney Water to review the specific issues associated with the revaluation of the water mains and sewers in 2001. The review was primarily concerned with the valuation methodology, but Hunter Water also made some comments on the revaluation figures. Hunter Water compared Sydney Water's pipelaying rates with its own pipelaying rates and found Sydney Water's rates to be higher.

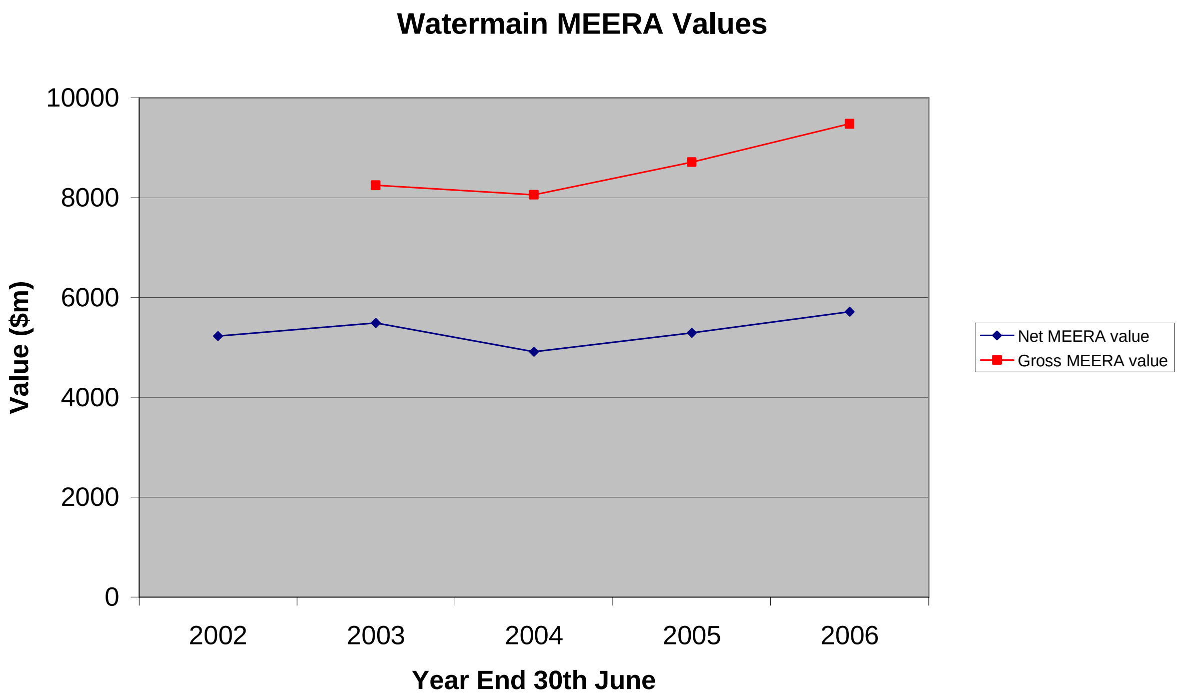
Hunter Water found that Sydney Water's revaluation had included a cost for rock excavation that should not have been included. It noted that "*Sydney Water had more stringent standards over some aspects of pipelaying and restoration activities than are adopted elsewhere in New South Wales. This helps explain some of the differences between Sydney Water's pipe costs and those elsewhere in the State*". Parsons Brinckerhoff confirmed these findings. Hunter Water conclude "*the details of cost estimates were examined for the dominant sizes of watermains and sewermains….the structure of the calculations and the approach to gathering data on various component cost is in accordance with general practice*". Hunter Water also state "*Sydney Water also supplied a few data on pipelaying rates obtained from market contracts for its backlog sewerage schemes…These rates are significant as they relate directly to Sydney Water's standards and practices for pipelaying. The rates varied up and down but were generally in line with the rates generated in the cost estimation approach*".

We asked Sydney Water whether the rock excavation rate is a significant factor in the valuation. Sydney Water stated that it was not and had been removed from the 2001 valuation. We saw an example of the rates build up used at the time and confirm that the rock excavation rate was not significant.

Sydney Water showed us historical pipelaying rates from 1994 to 2000. The rates had been inflated year on year using the original composite index. Actual pipelaying rates for 2001 were compared to the inflated rates and found to be around 50% higher for PVC-u pipes, and between 12% to 45% higher for ductile iron pipes.

Based on the Hunter Water comments and the information provided to us by Sydney Water, we consider the explanations for the significant increase in water main value in 2001 to be reasonable.

6.3.1 Movements in water main asset lives and values



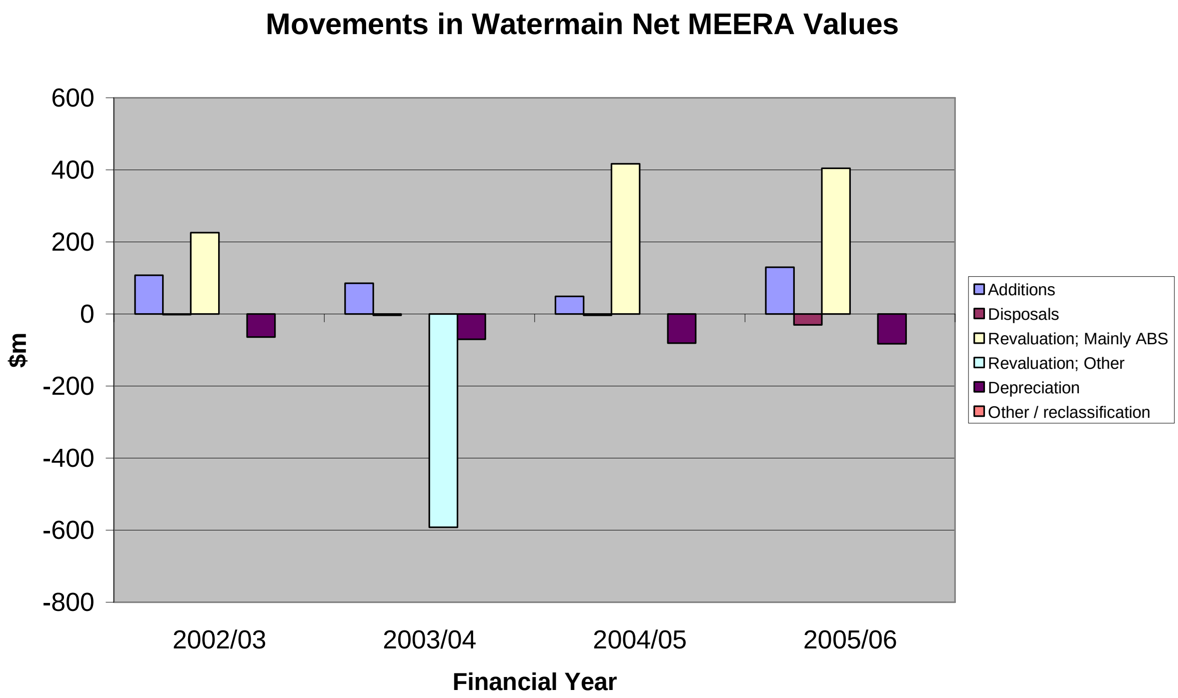


Table 6.4 Movements in net MEERA values water mains ($m)

	2002/03	2003/04	2004/05	2005/06
Additions	107	85.3	48.5	130.0
Disposals	-2.0	-4.1	-4.0	-30.8
Revaluation; Mainly ABS	225.9	0	416.3	404.0
Revaluation; Other	0	-591.8	0	0
Depreciation	-64.0	-70.6	-81.4	-82.7
Other / reclassification	0	0	0	0

Water mains were re-valued in 2001 and were re-valued again in 2005/06. The latest revaluation is reflected in the 2006/07 net MEERA asset value which is $5,504.9m. This is a reduction from the 2005/06 value of $5,711.3m. If the revaluation is not taken into account and the 2005/06 value is inflated by the ABS rate of 4% instead, the net asset value for 2006/07 would have been around $5,962m. This implies that the water mains were overvalued by around 7-8% before the revaluation. Sydney Water explained that the reduction in value was partly due to the cost of installation of u-PVC pipes increasing at a lower rate than the ABS index over the last five years, as well as corrective adjustments to tunnels.

Sydney Water explained the movement due to revaluation in 2003/04 as "*the valuation as at 1 July 2003 focused on condition-based assessments. Reductions in the estimated service life / future economic benefit were reflected in the values of system assets. Water main values decreased as a result of dissecting water mains into distribution networks with non aggressive soils, aggressive soils and highly aggressive soils*". This resulted in a decrease in gross MEERA value.

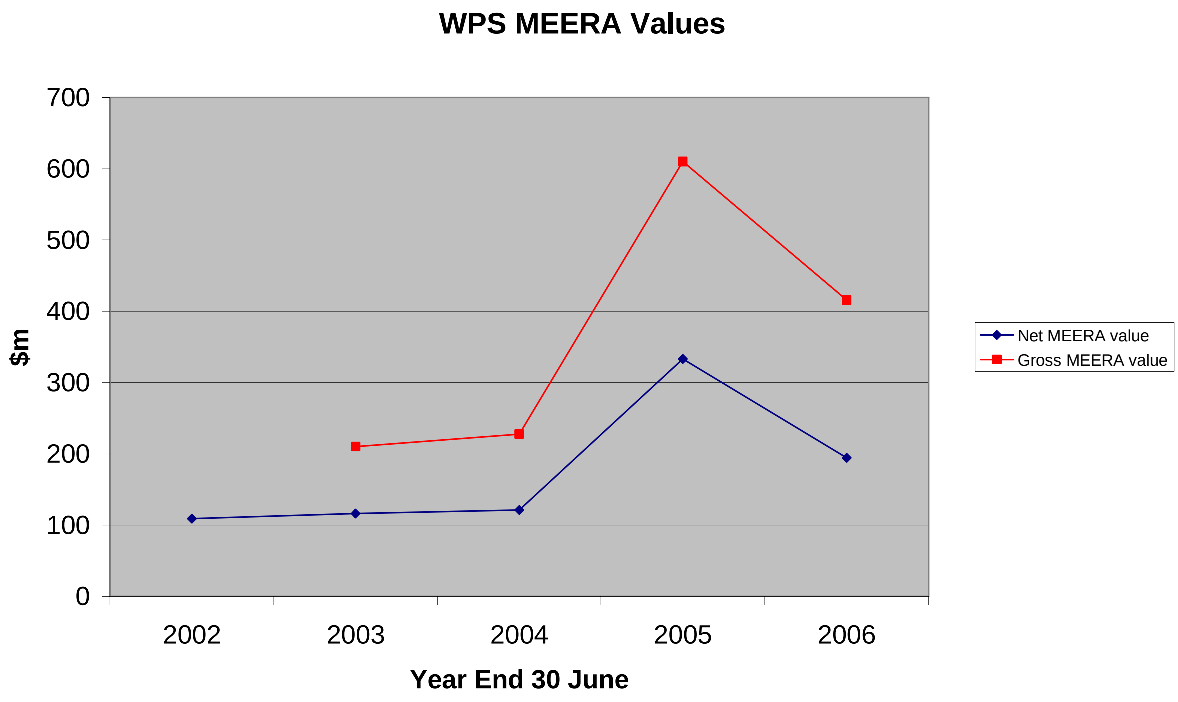
The revaluation increases for 2004/05 and 2005/06 are in line with the ABS index.

Since the reassessment of asset lives, Sydney Water state that "c*hanges to the water main asset lives determined as at 1 July 2003 have been relatively minor. The only change, on advice from Asset Management Division, relates to the reduction in asset life relating to steel cement lined (SCL) mains laid prior to 1941. These mains have been deteriorating faster than the lives initially set in 2003 and they are in the process of being revalued and reloaded into the Fixed Assets Register*". These changes in asset lives are reflected in changes to average remaining life of the water mains as shown in the table below.

Table 6.5 Water mains average remaining life (years)

	2002/03	2003/04	2004/05	2005/06
Av. Remaining life	80.0	69.6	68.7	68.8

6.3.2 Movements in water pumping station asset lives and values.



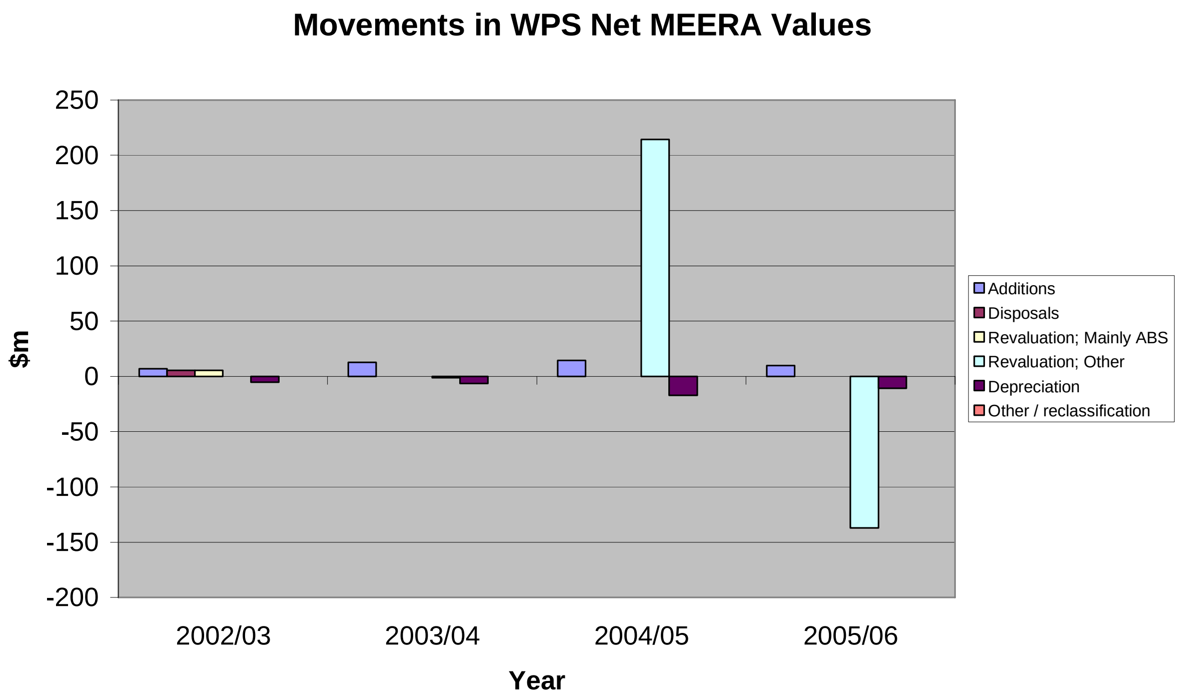


Table 6.6 Movements in net MEERA values water pumping station ($m)

	2002/03	2003/04	2004/05	2005/06
Additions	7.0	12.6	14.6	9.7
Disposals	0	0	0	-0.4
Revaluation; Mainly ABS	5.4	0	0	0
Revaluation; Other	0	-1.3	214.4	-137.1
Depreciation	-5.3	-6.5	-17.0	-10.7
Other / reclassification	0	0	0	0

Asset lives of pumping station assets were re-assessed in 2003 as part of the condition, but this has had minimal effect on the asset value for 2003/04. The water pumping stations were re-valued in 2004 and this is reflected in the figures for 2004/05.

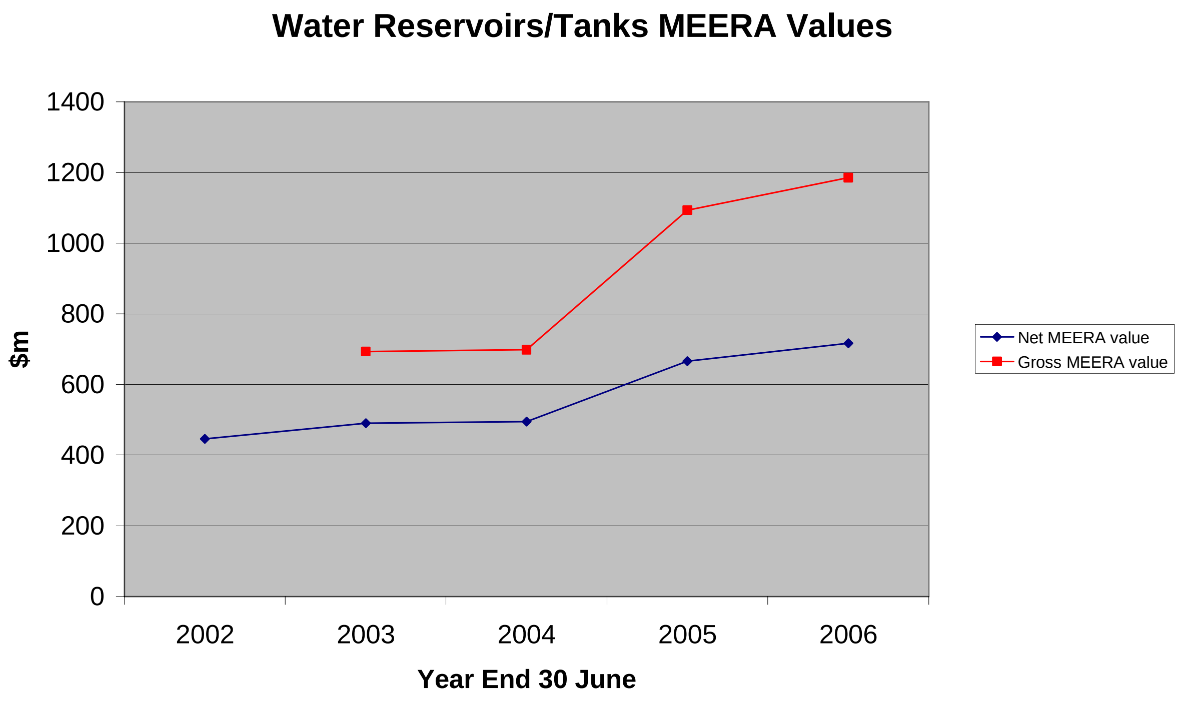
Sydney Water stated that "*a valuation error on WP0239 was entered into the Fixed Assets Register as part of the 1 July 2004 valuation of above ground assets. The Net Depreciated MEERA value entered into the Fixed Assets Register was $205.6 million instead of $47.5 million. A note was shown in the movement schedule with the valuation for the 2005/06 year that it included a correction in respect of WP0239 for the previous year*". This explains the sharp increase in gross MEERA value in 2004/05 and subsequent reduction in 2005/06.

There have not been any significant changes in remaining asset life over the period as shown in the table below.

Table 6.7 Water pumping stations average remaining life (years)

	2002/03	2003/04	2004/05	2005/06
Av. Remaining life	21.9	18.6	19.6	18.1

6.3.3 *Movements in reservoirs asset lives and values*



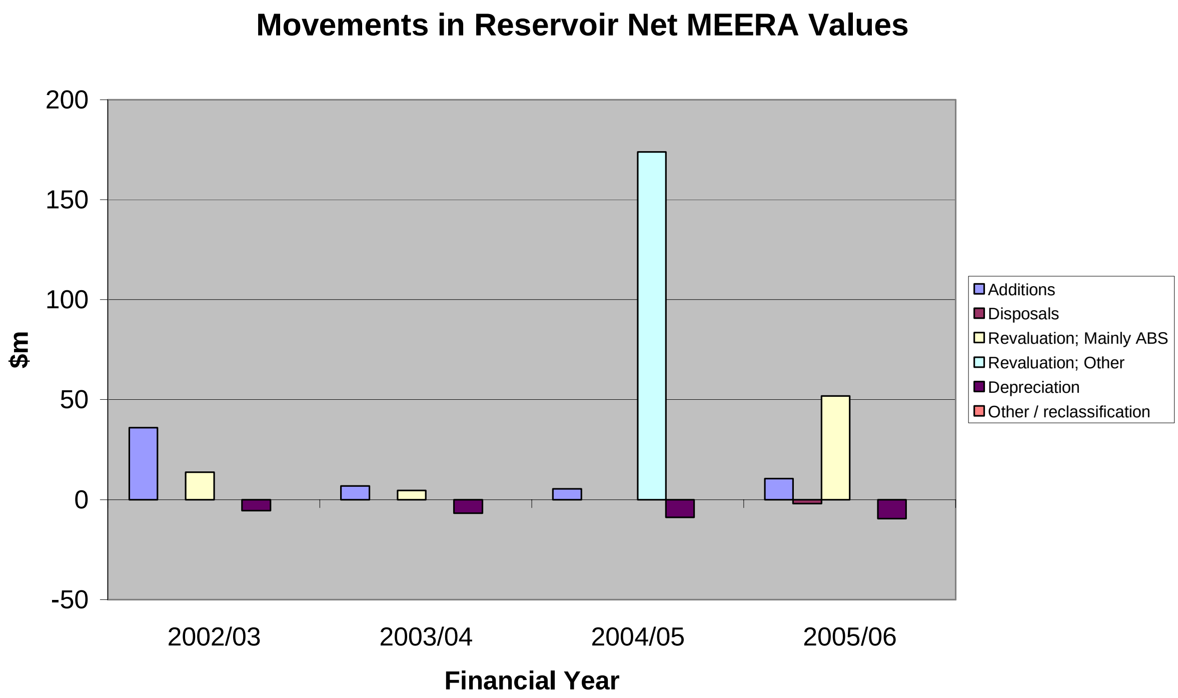


Table 6.8 Movements in net MEERA values water reservoirs/tanks ($m)

	2002/03	2003/04	2004/05	2005/06
Additions	36	6.8	5.4	10.5
Disposals	0	0	0	-2
Revaluation; Mainly ABS	13.7	4.6	0	51.9
Revaluation; Other	0	0	173.9	0
Depreciation	-5.5	-6.8	-8.8	-9.6
Other / reclassification	0	0	0	0

Sydney Water re-valued reservoirs in 2003/04 and that revaluation is reflected in the movements for 2004/05.

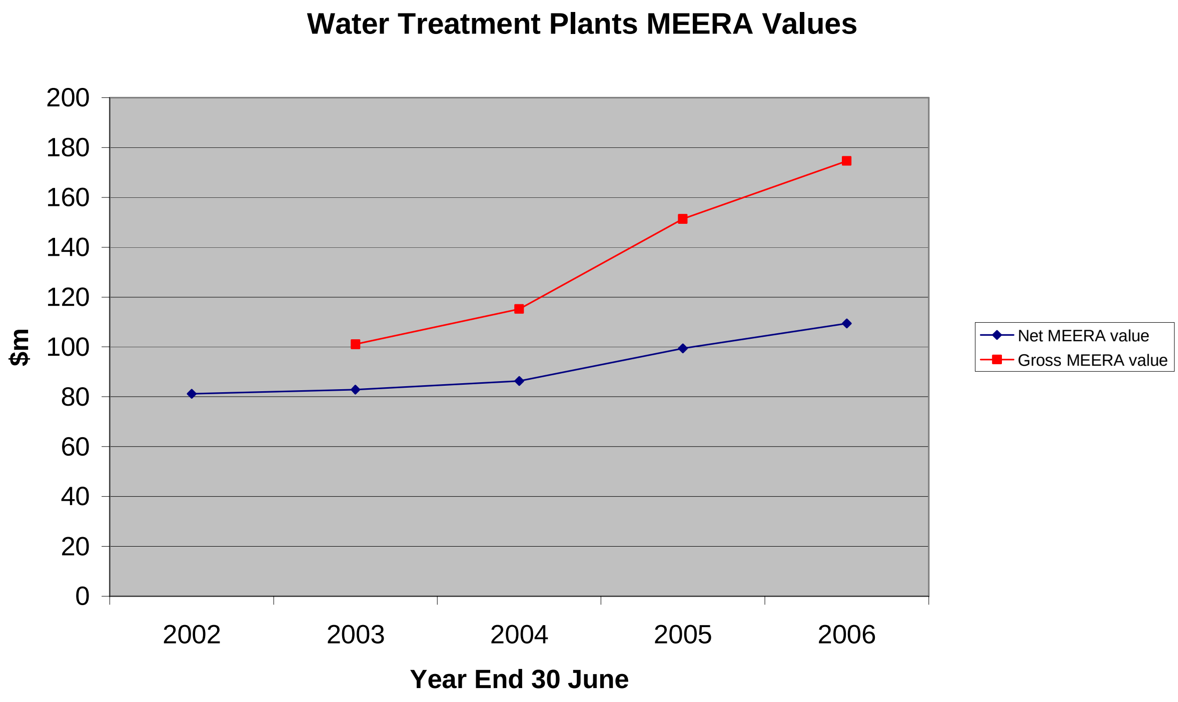
A re-assessment of average remaining asset life was carried out in 2002/03 as can be seen in the table below.

Table 6.9 Water reservoirs average remaining life (years)

	2002/03	2003/04	2004/05	2005/06
Av. Remaining life	89.2	72.8	75.6	74.3

The revaluation shown in 2005/06 reflects an ABS indexation rate of 7.6%.

6.3.4 *Movements in water treatment plant asset lives and values*



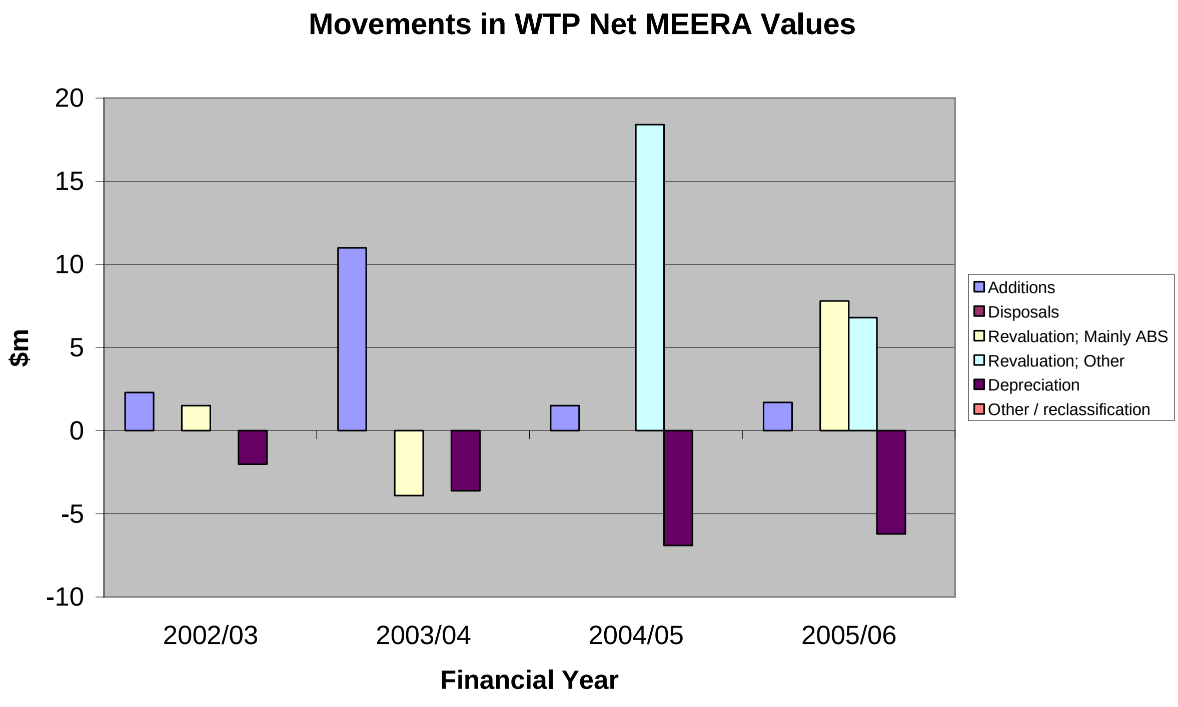


Table 6.10 Movements in net MEERA values ($m) water treatment plants

	2002/03	2003/04	2004/05	2005/06
Additions	2.3	11.0	1.5	1.7
Disposals	0	0	0	0
Revaluation; Mainly ABS	1.5	-3.9	0	7.8
Revaluation; Other	0	0	18.4	6.8
Depreciation	-2.0	-3.6	-6.9	-6.2
Other / reclassification	0	0	0	0

Sydney Water re-valued water treatment plants in 2003/04 and that revaluation is reflected in the movements for 2004/05. There were significant asset additions in 2003/04.

The revaluation shown in 2005/06 includes an increase in line with the ABS indexation rate of 7.6% and the 'Revaluation Other' figure is due to a revaluation correction.

A re-assessment of average remaining asset life was carried out in 2002/03 as can be seen in the table below. However the movement from 39 years to 24 years between 2003 and 2004 is considerable. It is our understanding that average asset lives did not change; this implies that there was a significant write-down of asset life. Sydney Water confirmed that this was the case.

Table 6.11 Water treatment plants average remaining life (years)

	2002/03	2003/04	2004/05	2005/06
Av. Remaining life	39.0	24.0	14.4	17.6

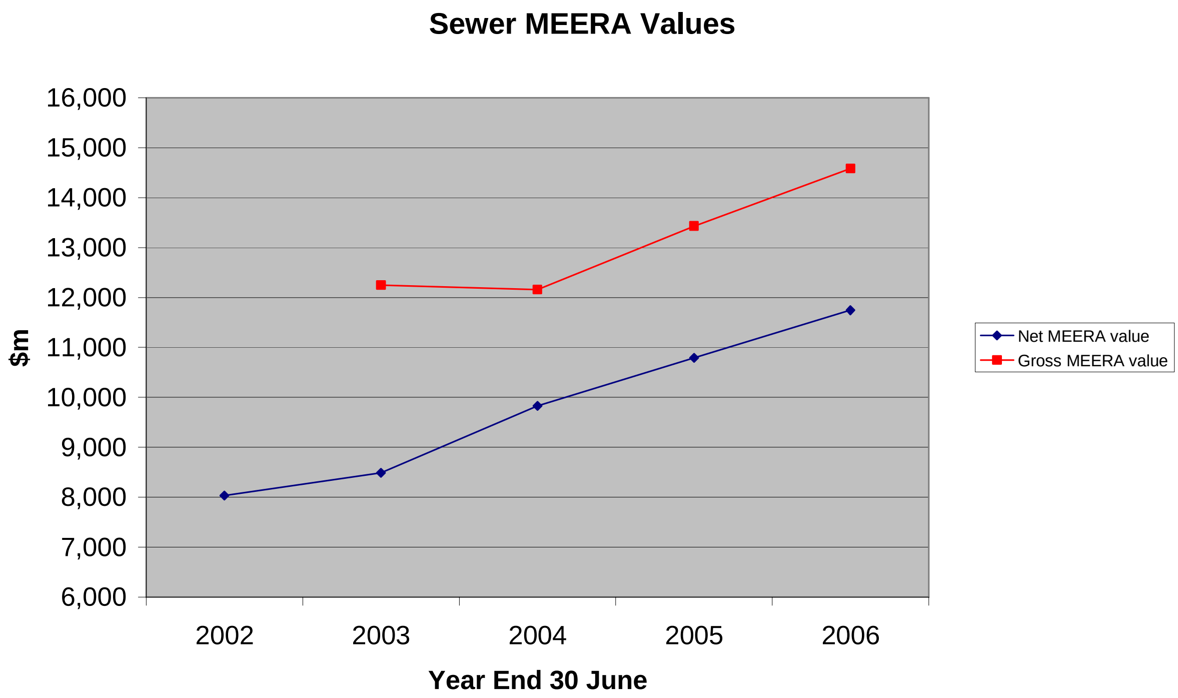
6.4 Movements in Wastewater Assets Lives and Values

Table 6.12 Wastewater assets MEERA values

MEERA value at 30th June	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Sewers net MEERA value	5,294.7	8,032.6	8,484.5	9,827.2	10,791.9	11,742.4
Sewers gross MEERA value			12,249.9	12,159.5	13,428.8	14,583.6
Outfalls net MEERA value	302.8	298.9	305.7	310.2	332.7	372.0
Outfalls gross MEERA value			353.3	363.6	393.5	445.1
SPS net MEERA value	240.1	237.8	395.5	417.0	397.6	437.8
SPS gross MEERA value			558.9	626.5	697.2	754.8
STP net MEERA value	851.3	1,148.0	1,336.2	1,128.0	1,454.0	1,632.5
STP gross MEERA value			1,726.9	1,743.2	2,324.2	2,906.3
Total net MEERA value	**6,688.9**	**9,717.3**	**10,521.9**	**11,682.4**	**12,976.2**	**14,184.7**
Total gross MEERA value			**14,889.0**	**14,892.8**	**16,843.7**	**18,689.8**

The table above summarises MEERA values for water assets. The movements in MEERA values between 2002 and 2006 are discussed in more detail for each asset category in the sections below. The significant increase in sewer mains value between 2001 and 2002 is due to a revaluation. Sydney Water. The reasons given by Sydney Water for the increase in MEERA replacement costs for the sewer mains values are the same as those for the water mains as reported in section 6.3.

6.4.1 *Movements in sewer mains asset lives and values*



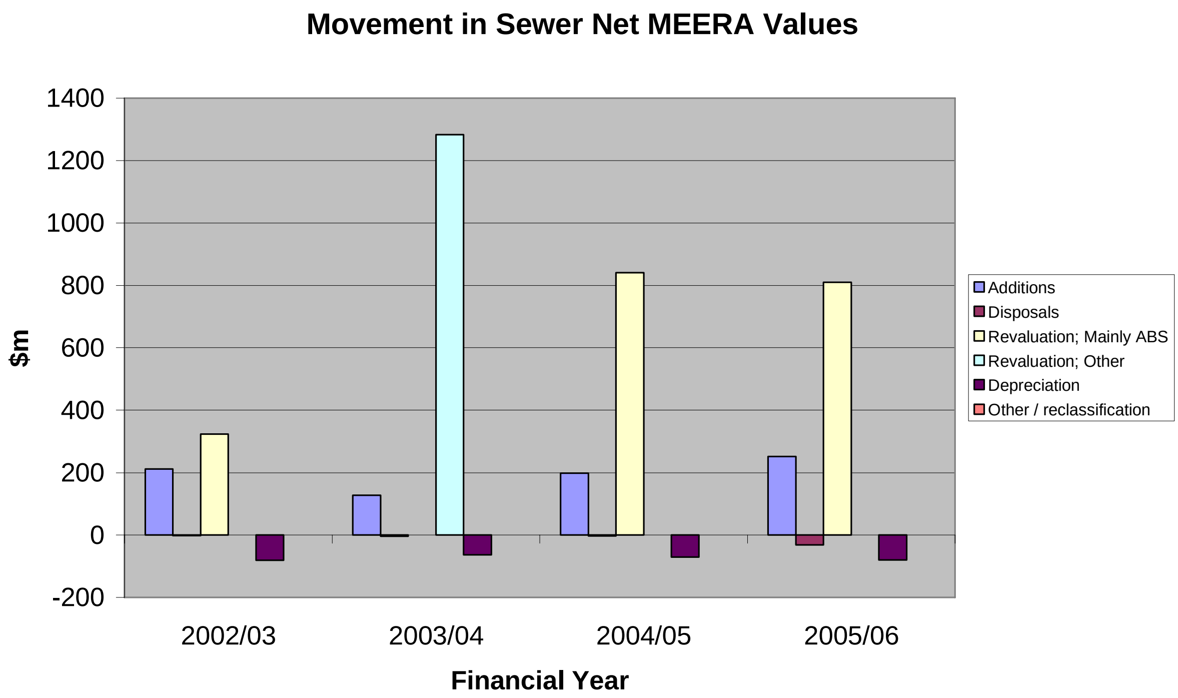


Table 6.13 Movements in net MEERA values ($m) sewer mains

	2002/03	2003/04	2004/05	2005/06
Additions	211.0	127.5	197.5	251
Disposals	-2.0	-4.1	-2.7	-31.4
Revaluation; Mainly ABS	323.6	0	537.5	1113.2
Revaluation; Other	0	1282.9	0	0
Depreciation	-80.7	-63.6	-70.5	-79.4
Other / reclassification	0	0	0	0

Sewer mains values have increased by the largest amount compared to all the other system assets. The significant re-valuation increase shown in 2003/04 is partly due to the re-assessment of average asset life, and the assumption that the 'hole' component of the sewer does not depreciate. Sydney Water explains the changes "*Asset lives of sewer mains were last assessed as at 1 July 2003. The major changes were the reduction in asset life of vitreous clay mains to 130 years (previously 150 years) and the increase in PVC-u, PE, ABS mains to 85 (from various lives ranging from 50 to 75 years). Sewer mains increased in value significantly due to a dissection of sewer gravity mains in the diameter range 101mm to 601mm between the 'hole'/cavity and the pipe/conduit. As the 'hole' does not depreciate (as it can be used over and over again), the value of sewer mains increased significantly*".

Table 6.14 Value of 'hole' component

	2002/03	2003/04	2004/05	2005/06
Hole value	0	4,370.0	4,744.1	5,148.1
Pipe net value	8,484.5	5,457.2	5,744.9	6,594.3

The value of the 'hole' increases at a rate slightly above the ABS index (8.6% between 2004 and 2005 compared to ABS index rate of 8.2%, and 8.5% between 2005 and 2006 compared to ABS rate of 7.6%). Sydney Water explained this is probably due to additions.

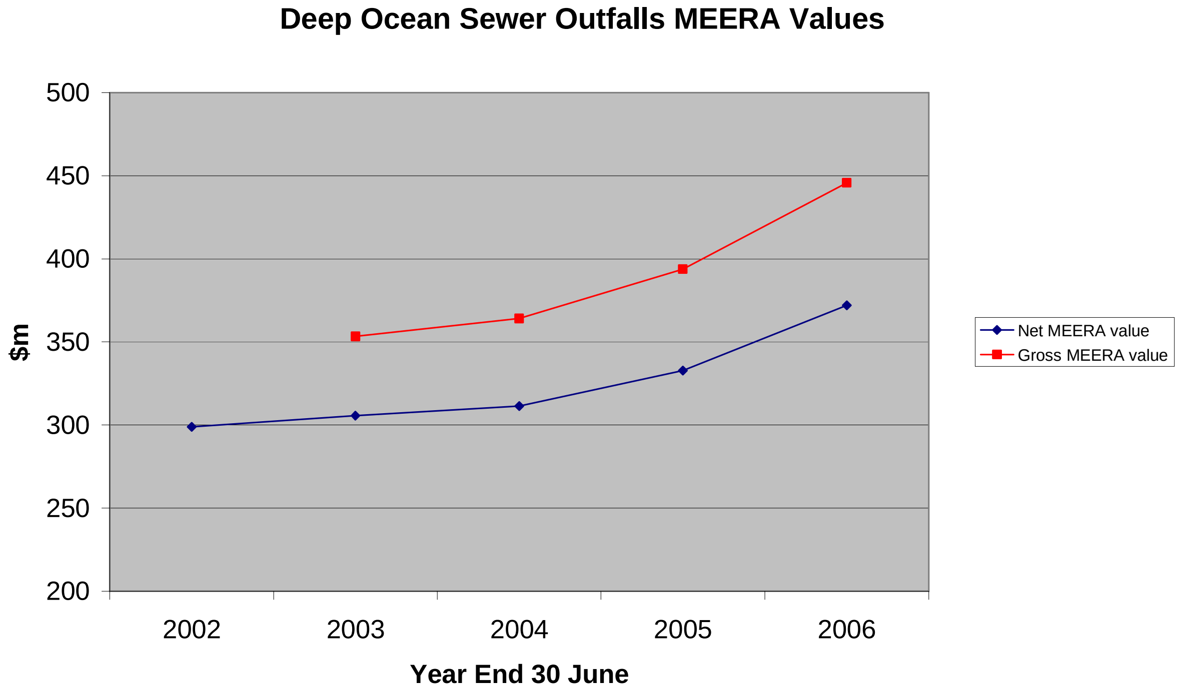
The revaluations shown in 2004/05 and 2005/06 are in line with the ABS index.

The changes in asset lives are reflected in the table below. The remaining lives shown from 2003/04 reflect the remaining life of the 'pipe' component only. The assumption that the 'hole' does not depreciate does not affect the average remaining life as the depreciation expense relates only to the 'pipe' and the net value of only the 'pipe' is used in the calculation.

Table 6.15 Sewer mains average remaining life (years)

	2002/03	2003/04	2004/05	2005/06
Av. Remaining life	99.0	85.8	85.8	82.7

6.4.2 *Movements in deep ocean sewer outfalls asset lives and values*



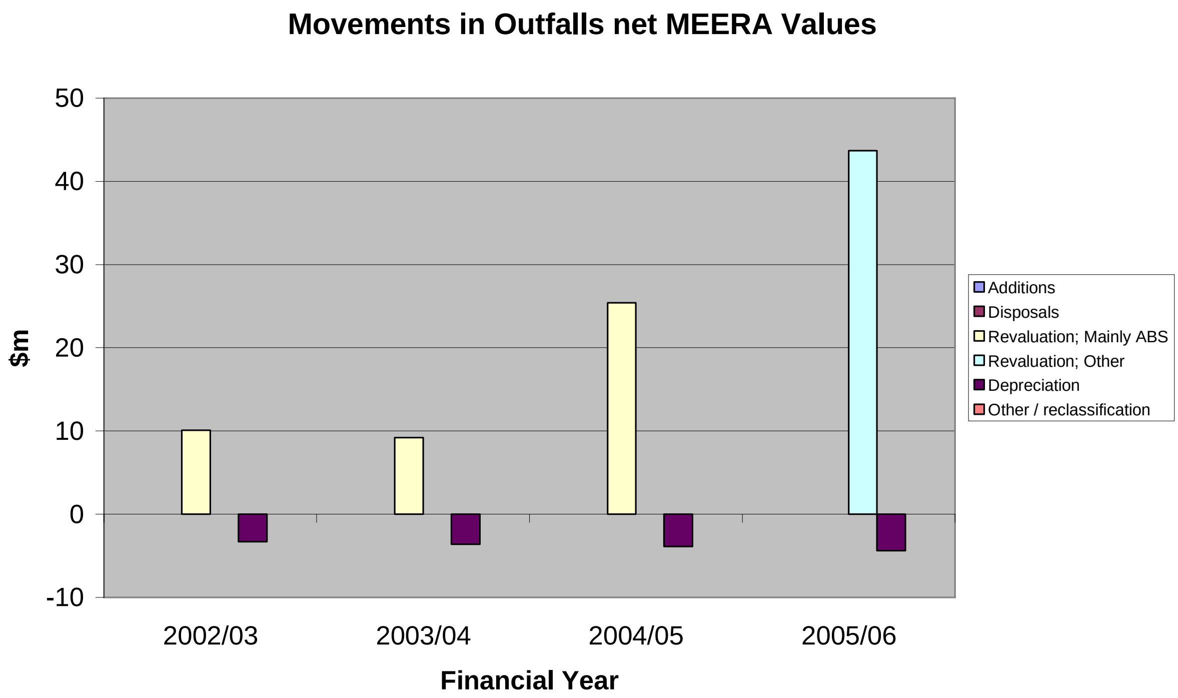


Table 6.16 Movements in net MEERA values ($m) ocean outfalls

	2002/03	2003/04	2004/05	2005/06
Additions	0	0	0	0
Disposals	0	0	0	0
Revaluation; Mainly ABS	10.1	9.2	25.4	0
Revaluation; Other	0	0	0	43.7
Depreciation	-3.3	-3.6	-3.9	-4.4
Other / reclassification	0	0	0	0

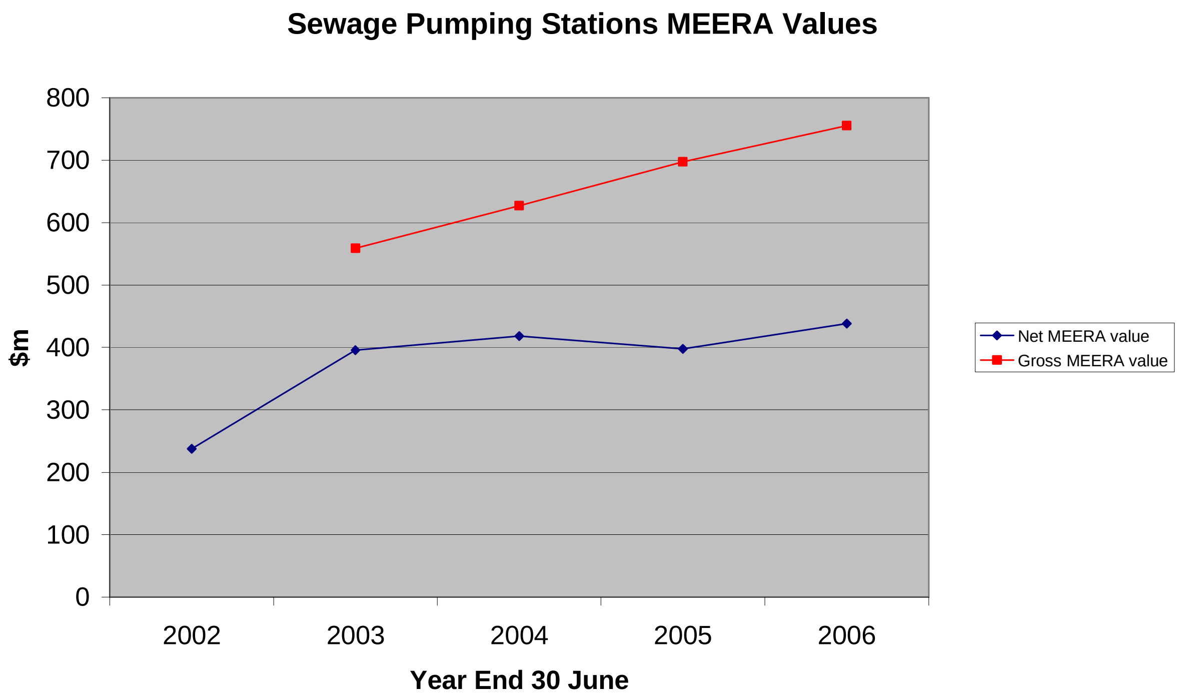
Movements in asset values of deep ocean outfall sewers are wholly attributed to revaluations and depreciation. Sydney Water re-valued the outfalls in 2004/05 and that revaluation is reflected in 2005/06. Other revaluations are attributable to increase in line with ABS index. Sydney Water comment "*the valuation as at 1 July 2004 included comprehensive valuations of the deep ocean outfalls at North Head, Bondi and Malabar. The increase in MEERA depreciated replacement cost was 12% which was an additional 4.4% over and above the ABS index for the year of 7.6%.*"

Table 6.17 Ocean outfalls average remaining life (years)

	2002/03	2003/04	2004/05	2005/06
Av. Remaining life	87.1	86.5	85.3	84.4

There has been no significant change in the average remaining asset lives for outfalls between 2003 and 2006.

6.4.3 Movements in sewage pumping stations asset lives and values



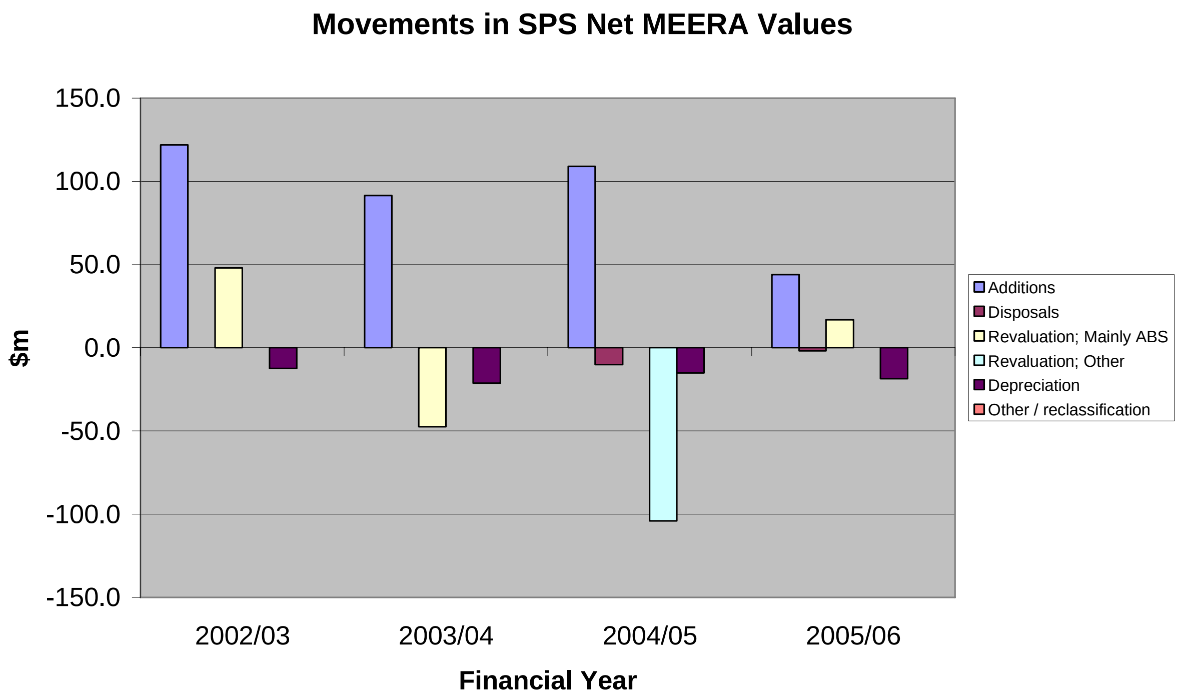


Table 6.18 Movements in net MEERA values ($m) sewage pumping stations

	2002/03	2003/04	2004/05	2005/06
Additions	122.0	91.5	108.9	44.0
Disposals	0	0	-10	-1.8
Revaluation; Mainly ABS	48.1	-47.4	0	16.8
Revaluation; Other	0	0	-104.0	0
Depreciation	-12.4	-21.4	-15.2	-18.5
Other / reclassification	0	0	0	0

A significant proportion of the movements in values are due to additions. Sydney Water re-assessed asset lives in 2002/03. Sydney Water explain "v*aluations of complex / facility assets, ie treatment plants, pumping stations and reservoirs varied in accordance with condition. Generally, the mechanical and electrical components of sewer facilities were written down prompting a general change in the 'default' depreciation rates for these components. Sewage pumping stations increased in value by 44% (despite the reductions in the service life of mechanical and electrical components) due to the large capital investment under the Sewerfix Program.*"

Sewage pumping stations were re-valued in 2003/04. Sydney Water explain "*the valuation as at 1 July 2004 included comprehensive valuations of above-ground facility assets (WPS, WTPS, WS [Reservoir / tanks], SPS and STPs). The valuations showed increases in all of the above facility assets except sewage pumping stations. The reason for the overall decrease in value for SPS's was the capitalised renewal expenditure carried out under the Sewerfix program.. This program involved modifications, alterations and upgrades to the specifications of approximately 170 pumping stations (out of a total of 650) as at 1 July 2004. Capital works of this nature, that involve modifying and adjusting the existing structures and/or equipment had caused the total capital cost of these pumping stations to be greater than the MEERA cost of building a modern, new pumping station on a "greenfields" site basis. The MEERA value for pumping stations was derived on a "greenfields" site basis*".

Table 6.19 Sewage pumping station average remaining life (years)

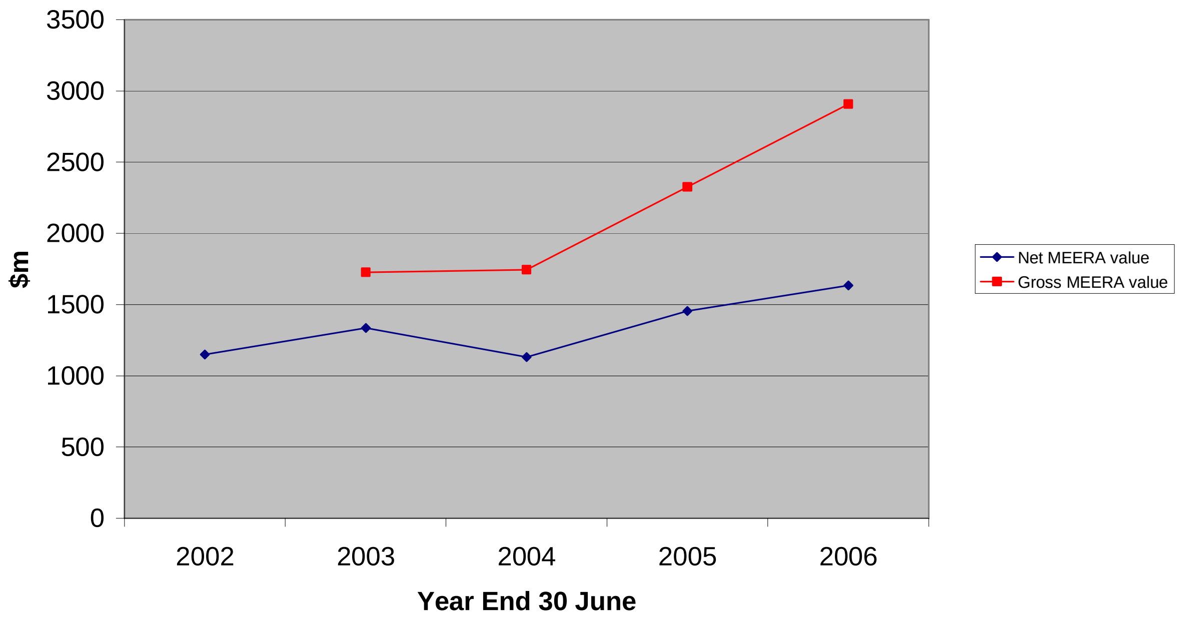
	2002/03	2003/04	2004/05	2005/06
Av. Remaining life	30.0	19.5	26.2	23.6

Changes in average remaining life are shown in the table above. We would expect to see a reduction in remaining life in 2003/04 following the write-down of mechanical & electrical asset lives. However the depreciation amount appears high in comparison with other years and the remaining life appears to be too low.

Sydney Water explained "*asset lives were reduced significantly as part of the Condition Based Asset Valuation as at 1 July 03. Subsequent expenditure during 2003/04 and 2004/05 has diluted this reduction particularly given some additions have been entered with the old depreciation rates (these are currently being corrected)*".

6.4.4 *Movements in sewage treatment plant asset lives and values*

Sewage Treatment Plants MEERA Values



Movements in STP Net MEERA Values

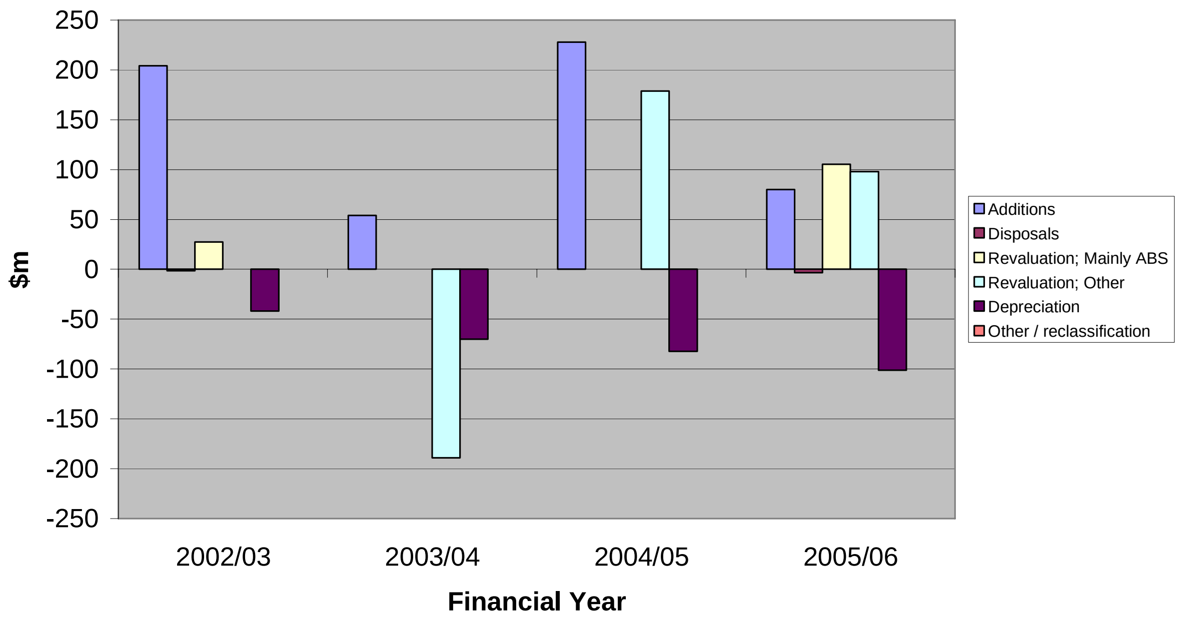


Table 6.20 Movements in net MEERA values ($m) sewage treatment plants

	2002/03	2003/04	2004/05	2005/06
Additions	204	54	228	80
Disposals	-1.3	0	0	-3.3
Revaluation; Mainly ABS	27.4	0	0	105.3
Revaluation; Other	0	-188.9	178.7	98.1
Depreciation	-41.9	-70.3	-82.4	-101.2
Other / reclassification	0	0	0	0

The asset lives of sewage treatment plant components were re-assessed in 2002/03 and are reflected in the 2003/04 figures. Assets were re-valued in 2003/04.

For 2002/03 Sydney Water state "*the increase in sewage treatment plant (STP) values was due to commissioning new STP capital works, eg North Head Pump Reliability, Safety Upgrade and additions to North Head STP related to the NorthSide Containment Tunnel, WestHornsby STP and Hornsby Heights STP Nutrient Removal works, etc.*"

The revaluation amount in 2005/06 is in line with the ABS index rate. The Revaluation Other figure of $98.1m is due to a valuation correction.

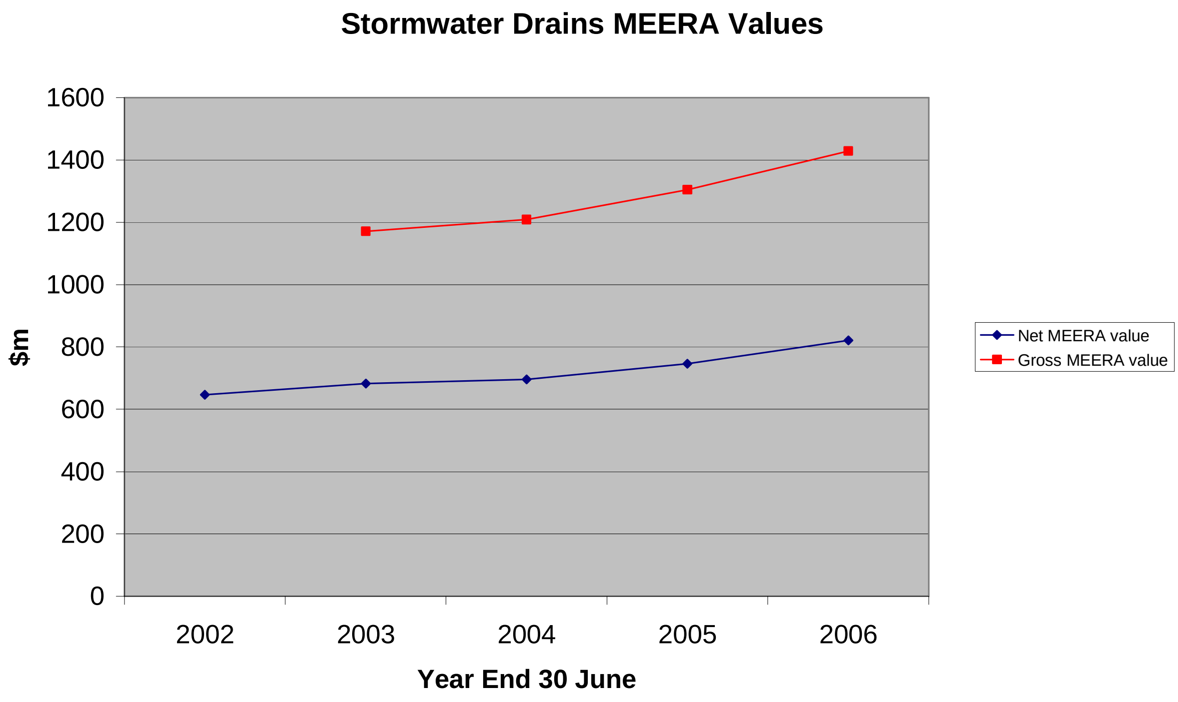
Changes in average remaining life are shown in the table below:

Table 6.21 Sewage treatment plants average remaining life (years)

	2002/03	2003/04	2004/05	2005/06
Av. Remaining life	30.0	16.0	17.6	16.1

The reduction in remaining asset life between 2002/03 and 2003/04 is attributable to the reassessment of average asset lives when the mechanical and electrical components of sewer facilities were written down. However the reduction in weighted remaining life of around 45% appears high when average asset lives of mechanical components were changed from 40 years to 25 years (37.5% reduction), and electrical components from 30 years to 25 years (17% reduction). Sydney Water explained the reasons for this are similar to the explanations given for remaining life changes for sewage pumping stations and that the assets have been written down. We reviewed the spreadsheet associated with the revaluations and consider the explanation to be reasonable.

6.5 Movements in Stormwater Asset Lives and Values



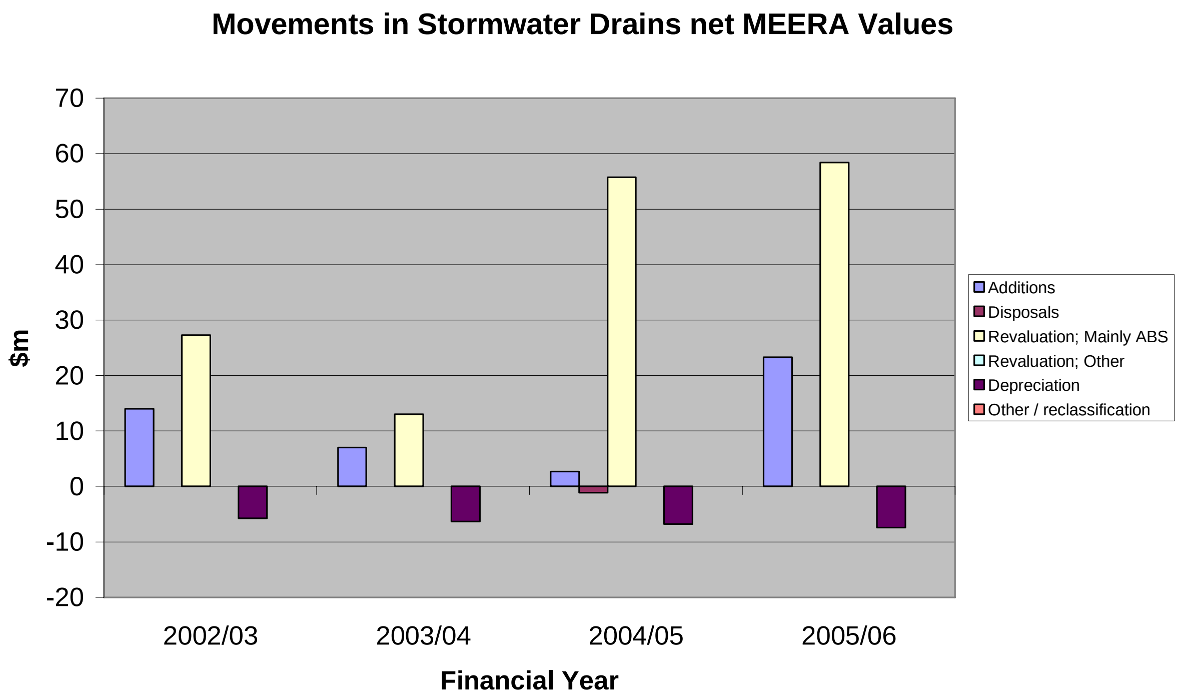


Table 6.22 Stormwater MEERA values ($m)

MEERA value at 30th June	2001	2002	2003	2004	2005	2006
Storm drain and storage pits net MEERA value	652.5	646.6	682.2	695.9	746.4	820.7
Storm drain and storage pits gross MEERA value			1171.1	1208.4	1304.8	1428.6

Table 6.23 Movements in net MEERA values ($m) storm drains and storage pits

	2002/03	2003/04	2004/05	2005/06
Additions	14.0	7.0	2.7	23.3
Disposals	0	0	-1.1	0
Revaluation; Mainly ABS	27.3	13.0	55.7	58.4
Revaluation; Other	0	0	0	0
Depreciation	-5.7	-6.3	-6.8	-7.4
Other / reclassification	0	0	0	0

Storm drains were re-valued in 2001 and were most recently re-valued in 2005/06. The latest revaluation will be shown in the 2006/07 figures. Revaluations in the intervening years are based on the ABS index.

Changes in average remaining life are shown in the table below:

Table 6.24 Storm water drains and storage pits average remaining life (years)

	2002/03	2003/04	2004/05	2005/06
Av. Remaining life	111.3	110.5	109.8	110.5

There have been no significant changes in average remaining asset lives for stormwater drains between 2003 and 2006.

6.5.1 *Summary*

Movements in net asset values for water mains account for 22% of the total increase in system asset values. Water main net MEERA values increased by around 68% between 2001 and 2006. This increase was mainly due to a re-valuation in 2001 (net asset value increased by 54%). Sydney Water has explained what it believes to be the reasons for this increase in value: increases in plastic pipe costs, additional costs associated with pipe laying, more stringent standards for pipe laying, and the fact that the index applied for valuations during the intervening years between 1996 and 2001 were not reflective of the changes in construction costs; the index was changed for future annual asset valuations. Hunter Water peer reviewed the methodology and some of the pipelaying rates and concluded that Sydney Water's approach was in accordance with general practice. Based on the Hunter Water comments and the information provided to us by Sydney Water, we consider the explanations for the significant increase in water main value in 2001 to be reasonable. This revaluation accounts for a significant proportion of the 68% increase in value. However it should be noted that the re-valuation in 2005/06 indicates that the water mains were overvalued by around 7-8% before the re-valuation.

Movement in sewer mains asset values account for 62% of the total system net asset movements between 2001 and 2006. Sewer main net asset values increased by around 122% over the same period. The main factors attributable to the increase are the revaluation carried out in 2001 (52% increase), and the assumption that sewer 'holes' for sewers between 101 and 600mm in diameter do not depreciate which was introduced in 2003. The explanation for the revaluation increase in 2001 is the same as that discussed for the water mains. We consider the explanations for the significant increase in sewer main value in 2001 and subsequent increase following the introduction of the 'hole' assumption to be reasonable.

The re-assessment of asset lives in 2003 is reflected in the average remaining life calculated for each of the water assets. This was less significant for water pumping stations, but average remaining life for water treatment plants fell from 39 years in 2003 to 24 years in 2004. However given the relatively small asset value of water treatment plants this change is not considered material.

Movements in sewage treatment plant asset values account for around 8% of the overall increase in system asset net asset value. The increase in sewage treatment plant asset values are mainly attributable to additions and a revaluation in 2004.

Movements in stormwater drain net asset values are primarily due to revaluations using the ABS index.

7 Grants and Contributions

7.1 *General*

Sydney Water receives contributions from a number of sources:

- developer charges – covers part of the cost of servicing growth development
- government grants/contributions – mainly comprise social programme reimbursements from the NSW Government and reimbursements from the Department of Energy, Utilities and Sustainability (DEUS) Water Savings Fund for demand management initiatives
- assets provided at no cost – assets constructed by another body such as a developer or the government and handed over to Sydney Water

Contributions can be received as either cash contributions to cover part of Sydney Water's capital expenditure or asset contributions where a free asset is handed over to Sydney Water.

The MEERA values reported in Chapter 6 included grants and contributions. Sydney Water commented that "*the MEERA asset valuation does not distinguish the source of funds used to procure the asset. The valuation is only used to determine the replacement value.*"

We asked Sydney Water to explain their methodology for capitalising contributed assets, and Sydney Water responded: "*contributed assets are recognised when Sydney Water acknowledges installation/construction of the asset in accordance with standards, and we accept transfer from the developer or other government entity handing over the asset. The cost of constructing/installing the asset is obtained from the developer and this amount is taken as the fair value of the asset on handover to Sydney Water. This value is taken up as income and is recognised as the cost of the asset in Sydney Water's Fixed Assets Register. Each year the amount of assets handed over as contributed assets 'free of charge' and taken up as income, is reconciled to the amount taken up as new asset additions in the Fixed Assets Register. Each year Sydney Water ensures that the amount taken up as income equals the amount recognised as assets contributed 'free of charge'.*"

Table 7.1 Capital Contributions (from AIR/SIR Table 10.8)

Financial year ending 30 June		**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Contributions from Developer	$000	50,938	60,295	56,446	46,688	43,779	49,800
Other Contributions by NSW Govt	$000	-30,718	2,938	2,316	1,423	-128	1,863
Contributions from Other Bodies	$000	28	180	35	35	76	911
Contributions from Misc Works	$000	0	-1	0	-53	2	0
Assets provided at no cost	$000	111,691	117,805	108,483	57,513	56,119	56,036
Total Capital Contributions	**$000**	**131,940**	**181,217**	**167,280**	**105,605**	**99,846**	**108,610**

The table above shows capital contributions received by Sydney Water between 2001 and 2006 and the figures are taken from the Annual and Special Information Returns (AIR/SIR) produced by Sydney Water for IPART. Contributions to Water, Wastewater and Stormwater assets are also reported.

Table 7.2 Contributed Assets (from AIR/SIR Table 8.2)

Financial year ending 30 June		**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Contributed Assets (depreciated)	$000	579,026	708,531	817,014	863,636	893,113	949,149
Contributed Assets (gross)	$000	687,583	817,088	925,571	983,083	1,035,490	1,091,526
Movement in value (depreciated)	$000		129,505	108,483	46,623	29,477	56,036
Movement in value (gross)	$000		129,505	108,483	57,512	52,407	56,036

The figures shown in the table above are Sydney Water's estimates of total contributed asset value. Contributions form approximately 4% of the total depreciated replacement asset value, and 3.5% of the total gross asset value. The figures only reflect values of free assets handed over, they do not include cash contributions used to pay for assets.

As can be seen from the movements in value, gross and depreciated contributed asset value increases due to new contributions but no allowance is made for ABS inflation or revaluation. For depreciated asset values in 2002, 2003 and 2006 no allowance has been made for depreciation.

Table 7.3 Assumed Proportion of Contributed Assets

Financial year ending 30 June		2001	2002	2003	2004	2005	2006
Total depreciated replacement cost	$m	13,104	17,595	19,002	20,295	22,097	23,522
Total gross replacement cost	$m	18,235	17,276	18,337	23,901	27,157	27,822
Proportion of contributed assets - net	%	4.4%	4.0%	4.3%	4.3%	4.0%	4.0%
Proportion of contributed assets - gross	%	3.7%	3.4%	3.4%	3.5%	3.3%	3.3%

We tested the validity of the level of contributed assets assumed by Sydney Water by comparing recent capital expenditure on new assets with the value of assets contributed by developers. Information on capital expenditure on new assets was only available from 2004.

Table 7.4 Comparison of Contributed Assets with New Assets

Financial year ending 30 June		2004	2005	2006	2007
Total contributions - cash	$000	48,092	43,700	52,574	50,690
Total contributions - assets	$000	57,513	56,146	56,036	107,713
Total contributions – cash & assets	$000	105,605	99,846	108,610	158,403
Total expenditure - new assets	$000	329,798	207,084	272,731	372,558
Proportion of cash contributions	%	15%	21%	19%	14%
Total new assets and contributed assets	$000	387,311	263,230	328,767	480,271
Proportion of contributed assets	%	15%	21%	17%	22%

This comparison shows that the proportion of contributed assets range from 15% to 22% of the total new and contributed assets, but Sydney Water's estimates of contributed assets show a drop from 3.7% to 3.3% as a proportion of the total gross asset replacement cost. Sydney Water has not included an inflation factor in its reported gross contributed asset values, whereas the total asset replacement cost is inflated each year. We asked Sydney Water to provide an explanation for this.

Sydney Water responded: "t*he depreciated and gross replacement cost of property, plant & equipment (Table 8.2 AIR) includes all of Sydney Water's infrastructure. Contributed assets however, have only become a relatively recent part of the Corporation's business with annual contributions exceeding $10 million for the first time in the early 1980s. The total value of contributed assets is therefore very small compared to the total value of Sydney Water's assets. This is represented in the 4% as calculated by Halcrow.*

Contributed assets have averaged about $70 million a year over the last four years. Compared with the expenditure on new assets, contributed assets have been between 15-20% of new asset values a year. The annual share of contributed works is expected to fall over the determination period as Sydney Water's expenditure on new assets increases significantly while contributed assets are forecast to remain consistent.

As the value of new assets created each year is small compared to total existing asset values, figures is a single year will not impact the overall asset composition. Therefore, despite contributed assets being between 15-20% of new assets values in recent years, this has not had a significant impact on the overall composition (4%).

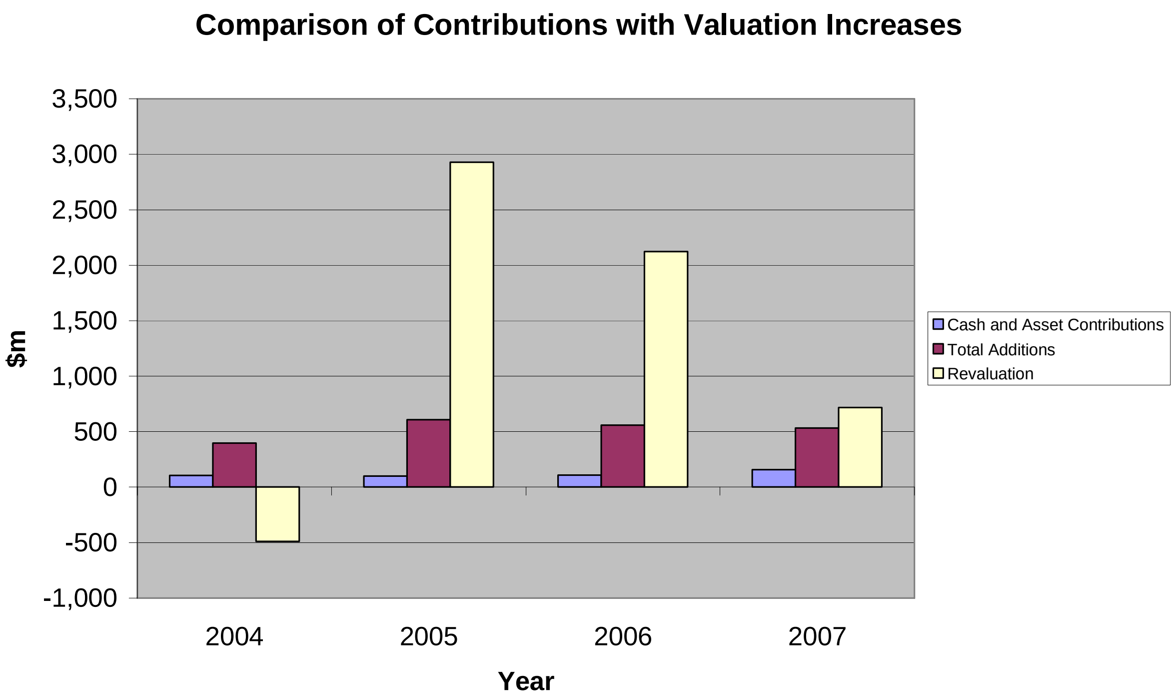
It is important to note that the information in Tables 9.3 and 10.8 is based on actual/forecast capital expenditure and contributed asset values. Conversely, the figures included in Table 8.2 are subject to annual revaluations. In addition, the information in Table 8.2 also includes disposals. Therefore the information in Table 8.2 does not provide a direct comparison with information in Tables 9.3 and 10.8.

Both sets of information are correct in their own right. But they convey different information about Sydney Water's existing and future asset profiles."

We agree that as contributed assets are a relatively recent addition to the asset stock their value may be small compared to the total asset value, and that as the annual increase in total asset value due to ABS revaluation or CBAV revaluation is greater than the value of contributed assets (as shown in Figure 7.1 below), the overall proportion of contributed assets as shown in Table 7.3 will decrease.

However we do not consider that the figures reported by Sydney Water in Table 8.2 of the AIR/SIR (shown in Table 7.2 of this report) fully reflect the movements in value of contributed assets received between 2001 and 2006 as the values do not appear to be depreciated or re-valued. We are unable to confirm the contributed asset values reported in 2001 based on the information available to us. We recommend that Sydney Water review these figures are try to produce a more representative estimate of net and gross contributed asset value.

Figure 7.1 Comparison of Contributions with Valuation Increases



We challenged Sydney Water on how contributions were allocated to asset classes and Sydney Water responded: "*Asset lives for contributed assets are determined in the same way as assets constructed and installed by Sydney Water. Contributed assets are not separated from other assets, ie they are added to assets installed by Sydney Water and are treated/depreciated in the same way*". We noted that contributed asset values are not split into asset categories (such as water mains, sewer mains etc) in the AIR/SIR Table 8.3, but are assigned to the unallocated category. We challenged Sydney Water on this, and Sydney Water responded: "*the AIR template only calls for <u>an estimate</u> of contributed assets. The section of the AIR for the details of contributed assets has never been dissected by category, only three bulk amounts have been reported in the "unallocated" line applicable to water, waste water and stormwater. Past practice has not required Sydney Water to dissect this item*".

7.2 *Water and Recycled Water Assets Grants and Contributions*

We reviewed the figures reported by Sydney Water in the AIR/SIR for contributed water assets. Contributions are reported in the Profit & Loss Table (AIR/SIR Table 7.1) and also in the Depreciated and Gross Replacement Cost of Contributed Assets Table (AIR/SIR Table 8.3).

The contributions reported by Sydney Water for water assets and recycled water assets are shown in the tables below. From 2001 to 2004 Sydney Water only reported water assets. There are no free recycled water assets reported by Sydney Water.

Table 7.5 Water Assets Capital Contributions (from AIR/SIR Table 7.1)

Financial year ending 30 June		2001	2002	2003	2004	2005	2006
Contributions (cash)	$000	29,000	24,118	22,592	18,668	12,117	14,676
Contributions (free assets)	$000	50,000	47,122	43,393	23,005	22,458	22,414
Total Capital Contributions	**$000**	**79,000**	**71,240**	**65,985**	**41,672**	**34,576**	**37,091**

Table 7.6 Recycled Water Assets Capital Contributions (from AIR/SIR Table 7.2)

Financial year ending 30 June		2001	2002	2003	2004	2005	2006
Contributions (cash)	$000	0	0	0	0	1,204	1,788
Contributions (free assets)	$000	0	0	0	0	0	0
Total Capital Contributions	**$000**	**0**	**0**	**0**	**0**	**1,204**	**1,788**

Table 7.7 Water Assets Contributed Asset Values (from AIR/SIR Table 8.3)

Financial year ending 30 June		2001	2002	2003	2004	2005	2006
Contributed Assets (depreciated)	$000	234,488	286,290	323,189	338,946	352,289	375,383
Contributed Assets (gross)	$000	278,621	330,423	371,711	391,840	410,007	433,101
Change in gross contributed asset	$000		51,802	41,288	20,129	18,167	23,094

The values in Table 7.7 above are estimated values, do not appear to be subject to re-valuation, and do not include cash contributions. As such they do not provide an accurate reflection of contributed water asset values. We consider that Sydney Water should review their figures and try to produce a better estimate of contributed asset values.

7.3 Wastewater Assets Grants and Contributions

The contributions reported by Sydney Water for wastewater assets are shown in the tables below.

Table 7.8 Wastewater Assets Capital Contributions (from AIR/SIR Table 7.3)

Financial year ending 30 June		2001	2002	2003	2004	2005	2006
Contributions (cash)	$000	30,157	39,294	36,205	29,424	27,222	31,104
Contributions (free assets)	$000	61,691	70,683	65,090	34,508	33,688	33,622
Total Capital Contributions	**$000**	**91,848**	**109,977**	**101,295**	**63,932**	**60,910**	**64,725**

Table 7.9 Wastewater Assets Contributed Asset Values (from AIR/SIR Table 8.3)

Financial year ending 30 June		2001	2002	2003	2004	2005	2006
Contributed Assets (depreciated)	$000	339,599	417,302	473,863	504,852	531,361	563,955
Contributed Assets (gross)	$000	402,810	480,513	543,473	580,856	614,596	647,190
Change in gross contributed assets	$000		77,703	62,960	37,383	33,740	32,594

The values in Table 7.9 above are estimated values, do not appear to be subject to re-valuation, and do not include cash contributions. As such they do not provide an accurate reflection of contributed wastewater asset values. As we stated for the water assets we consider that Sydney Water should review their figures and try to produce a better estimate of contributed asset values.

7.4 Stormwater Assets Grants and Contributions

There were no reported grants or contributions for storm water assets in the period 2001 to 2004.

Table 7.10 Stormwater Assets Capital Contributions (from AIR/SIR Table 7.4)

Financial year ending 30 June		2001	2002	2003	2004	2005	2006
Contributions (cash)	$000	0	0	0	0	2,145	3,376
Contributions (free assets)	$000	0	0	0	0	0	0
Total Capital Contributions	**$000**	**0**	**0**	**0**	**0**	**2,145**	**3,376**

In Table 8.3 of the AIR/SIR stormwater assets are calculated as a residual once water, recycled water and wastewater are accounted for.

Table 7.11 Stormwater Assets Contributed Asset Values (from AIR/SIR Table 8.3)

Financial year ending 30 June		**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Contributed Assets (depreciated)	$000	4,939	4,939	19,962	19,839	9,463	9,811
Contributed Assets (gross)	$000	6,152	6,152	10,386	10,386	10,887	11,235
Change in gross contributed assets	$000		0	4,234	0	501	348

As can be seen from the table above there are changes in gross asset value in even though there are no reported non-cash contributions. In 2003 and 2004 the depreciated asset value is greater than the gross value which cannot be correct. This is because these figures are calculated rather than inputted in the spreadsheet.

As a result we consider the figures for stormwater contributed assets as reported by Sydney Water in Table 8.3 of the AIR/SIR are not fully representative of actual values.

8 Conclusions

8.1 Sydney Water Corporation's Asset Valuation Methodology

Based on our review of Sydney Water's condition based asset valuation methodology we consider the approach to asset valuation based on condition assessment to be in line with best practice. The methodology has been peer reviewed by three different organisations, and whilst scope for improvement was identified, they concluded that the methodology is appropriate and the MEERA estimates to be reasonable. Based on the peer review reports' conclusions we consider that the Tribunal can have confidence in the valuation methodology employed by Sydney Water and the data used in the cost estimating process. Sydney has implemented, or is in the process of implementing recommendations from the Parsons Brinckerhoff report.

We consider the assumption that the 'hole' does not depreciate to be valid given Sydney Water's use of no-dig technology to reline sewer pipes. The value of the 'hole' should be taken as the original cost of the 'hole' when the pipe was first installed and the value should only appreciate in line with CPI to allow for cost inflation. . Where historical cost information does not exist then we recommend Sydney Water calculates the initial MEERA costs of the 'hole' and the 'pipe' instead. This means that the cost using a trench excavation should be estimated if that was the likely method used to install the original pipe. The 'hole' component value would be calculated as the total cost of the installation less the cost of the 'pipe' component. Sydney Water's methodology re-values the cost of the 'hole' as well as the 'pipe' which means that the total value of the 'hole' and the 'pipe' is the same whether the pipe is installed using a trench excavation or using a no-dig relining technique.

Some account should also be taken of sewer 'holes' which will be abandoned. This may be because not all of the 101 to 600mm sewers will be relined.

We do not consider that the value of the 'hole' should increase following revaluation or replacement by relining. Sydney Water stated that use of techniques other than relining is very rare and therefore the number of sewers which will be abandoned rather than relined is insignificant. However we have not been able to ascertain a figure for this based on the information available to us.

In the UK, Ofwat have examined the breakdown of the sub-indexes that make up the Construction Outputs Price Index (COPI) and intend to adopt the 'Infrastructure' sub-index of COPI as the index of national construction costs for the water industry at the 2009 review.

8.2 Asset Lives

8.2.1 *Water Asset Lives*

Sydney Water has implemented a valid approach to the assessment of its water assets by dividing them into critical and non-critical assets. For non-critical assets it uses valid statistical analysis techniques to determine the survival functions of its assets based upon failure criteria.

However, Sydney Water does not use these statistical functions to determine when it actually replaces pipelines, and thus the actual asset life, using instead a range of Key Performance Indicators (KPI) based on pressure, water continuity and water quality. There thus appears to be a disconnect between the lifetimes based on the statistical analysis and those based on KPI's. It is recommended that Sydney Water reappraise the lifetimes of its assets based on the information available from the replacement program based on these KPI's.

For newer materials such as PE and PVC the lifetimes allocated appear to be very low, probably because the analysis is based on a small amount of available failure data.

For critical water assets the use of lifetimes based on statistical data is generally not valid due to the lower levels of failure data available for these asset classes. Sydney Water has implemented a valid risk analysis approach based on condition assessment and this should be utilised to a greater extent for determining the asset lives of these critical assets.

Based on the special parameters associated with these asset types, such as thicker walls, active corrosion protection, supervised installation, regular condition monitoring and active maintenance, it is expected that asset lives for these types of assets will be longer than those for non-critical assets that are left to operate to failure. It is recommended that a separate lifetime table be established for this class of asset, which tend to be high value assets.

We have suggested some typical ranges of water main asset lives which are based on our broad experience. However without undertaking a detailed statistical analysis (for which data is currently unavailable) it is not possible to specify precise asset lives.

We consider Sydney Water's average asset live of 150 years for reservoirs to be reasonable. Regarding the asset lives of the civil, mechanical, electrical and electronic components of the other water assets, whilst they appear high in comparison with other water companies we have seen no evidence to suggest Sydney Water should reduce their assumed asset lives for these assets. In conclusion we consider Sydney Water's average asset lives to be acceptable.

8.2.2 Wastewater Asset Lives

In the case of Sewer assets Sydney Water has again implemented a valid strategy in dividing these assets into "Plan-To-Repair" and "Avoid-Failure" assets.

For "Plan-to Repair" assets Sydney Water uses expert opinion to determine the life of its assets cohorts and it is recommended that Sydney Water consider using a valid statistical approach based on CCTV analysis that would allow it to determine the lifetime for each of its asset classes. However, it should be pointed out that the asset lifetime is not used in any decision making process for asset replacement, with the decision to intervene being made based on performance against a number of KPI's. Consideration should therefore be given to utilising this information on when assets are actually replaced to provide valuable feedback into the process of determining asset lives.

Based on analysis of a number of water utilities, the lifetimes used by Sydney Water would appear to under estimate the lifetimes of assets especially for newer materials such as PE and PVC-U.

For Avoid-Failure assets an expert panel again is used to determine asset lifetimes and again these lifetimes are not used in the decision making process to determine when assests are renewed or repaired. For these assets condition assessment is used as a trigger to initiate action to repair or renew. For these types of assets the interventional strategy would be expected to extend their lives significantly beyond the figures given in Table 4.2. Again consideration should be given to utilising the information on when assets are actually replaced to provide valuable feedback into the process of determining asset lives.

We have suggested some typical ranges of sewer main asset lives which are based on our broad experience. However without undertaking a detailed statistical analysis (for which data is currently unavailable) it is not possible to specify precise asset lives.

The asset lives of the other wastewater assets (treatment plants, outfalls and pumping stations) appear high in comparison with other water companies. However we have seen no evidence to suggest Sydney Water should reduce their assumed asset lives for these assets (apart from the mechanical and electrical components for outfalls which will have a negligible effect). In conclusion we consider Sydney Water's average asset lives to be acceptable.

8.2.3 *Stormwater Asset Lives*

We consider that an average asset life of 150 years is appropriate for stormwater drains and storage pits.

8.3 *Asset Classes*

We have seen evidence as to how Sydney Water classifies its system assets based on asset type and further subdivides the assets into components, including the subdivision of sewage treatment plant assets. We consider this approach to be appropriate.

We believe that water treatment plants should be categorised firstly at the process level, then at the component level using a similar asset hierarchy as sewage treatment plants. Sydney Water could consider creating separate categories for 'avoid fail' assets and 'plan to repair' or 'run to fail' assets to more accurately reflect their useful asset lives and improve assessment of remaining asset life following condition assessment.

For the purposes of the Tribunal's review, we consider that Sydney Water's current asset classes should be used. These classes can be broken down to component level if required for a more detailed analysis.

8.4 *Movements in Asset Lives and Values*

8.4.1 *Water assets*

Sydney Water has provided explanations for the movement in asset values for their system assets between 2001 and 2006.

Movements in net asset values for water mains account for 22% of the total increase in system asset values. Water main net MEERA values increased by around 68% between 2001 and 2006. This increase was mainly due to a re-valuation in 2001. Sydney Water has explained what it believes to be the reasons for this increase in value, and Hunter Water peer reviewed the methodology and some of the pipelaying rates. Hunter Water concluded that Sydney Water's approach was in accordance with general practice.

The Hunter Water review was not a detailed audit of the valuation calculations and cost rates used, however it did find that rates used for a sample of contracts were generally in line with those used in the estimation, and explained Sydney Water's higher rates were partly due to more stringent standards.

We consider Sydney Water's explanations for the increase in value of the water mains and sewers to be reasonable and based on Hunter Water's review conclude that Sydney Water's revised asset values for water mains and sewers in 2002/03 were produced in accordance with best practice. Based on the Hunter Water comments and the information provided to us by Sydney Water, we consider the explanations for the significant increase in water main value in 2001 to be reasonable. This revaluation accounts for a significant proportion of the 68% increase in value. However it should be noted that the re-valuation in 2005/06 indicates that the water mains were overvalued by around 7-8% before the re-valuation.

The re-assessment of asset lives in 2003 is reflected in the average remaining life calculated for each of the water assets. This was less significant for water pumping stations, but average remaining life for water treatment plants fell from 39 years in 2003 to 24 years in 2004. However given the relatively small asset value of water treatment plants this change is not considered material.

The valuation increases attributed to indexation reflect the ABS index rate.

8.4.2 *Wastewater assets*

Movement in sewer mains asset values account for 62% of the total system net asset movements between 2001 and 2006. Sewer main net asset values increased by around 122% over the same period.

The main factors attributable to the increase are the revaluation carried out in 2001, and the assumption that sewer 'holes' for sewers between 101 and 600mm in diameter do not depreciate which was introduced in 2003.

The explanation for the revaluation increase in 2001 is the same as that discussed for the water mains in section 8.4.1. We conclude Sydney Water's explanations for the increase are reasonable, that the valuation was produced in accordance with best practice, and the subsequent increase following the introduction of the 'hole' assumption is reasonable.

We have discussed the sewer 'hole' assumption in section 8.1. We consider the assumption to be valid, but have suggested refinements to the method used to value the 'hole' element.

We identified that the value of the 'hole' has increased at a rate slightly above the ABS index between 2004 and 2006. Sydney Water explained this was most likely due to new additions.

Movements in asset values of deep ocean outfall sewers are wholly attributed to revaluations using the ABS index and depreciation.

For sewage pumping stations a significant proportion of the movements in net asset values are due to additions. The revaluation carried out in 2004 resulted in an increase in asset value due to capital investment under the "Sewerfix Program" even after the write down of mechanical and electrical components following condition assessment.

Movements in sewage treatment plant asset values account for around 8% of the overall increase in system asset net asset value. The increase in sewage treatment plant asset values are mainly attributable to additions and a revaluation in 2004.

Remaining asset lives reduced for all the assets in 2003/04 following asset condition assessments and re-assessment of average asset lives.

The significant reduction in average asset life for sewage treatment plants from 30 years in 2002/03 to 16.1 years 2003/04 is attributable to the reassessment of asset lives of mechanical and electrical components of sewer facilities and the subsequent write down following condition assessment.

8.4.3 *Stormwater assets*

Movements in stormwater drain net asset values are primarily due to revaluations using the ABS index. Average asset lives for stormwater drains did not vary significantly between 2001 and 2006.

8.5 Grants and Contributions

The values of gross contributed assets and depreciated contributed assets reported by Sydney Water in the AIR/SIR are estimates and do not include cash contributions used to pay for assets.

Sydney Water does not revalue contributed assets separately. Contributed assets are included in the CBAV programme along with all the other assets and are not separated from the other assets.

We agree that as contributed assets are a relatively recent addition to the asset stock their value may be small compared to the total asset value, and that as the annual increase in total asset value due to ABS revaluation or CBAV revaluation is greater than the value of contributed assets, the overall proportion of contributed assets as shown in Table 7.3 will decrease.

However we do not consider that the values for gross and depreciated contributed assets as reported by Sydney Water in Table 8.2 of the AIR/SIR (shown in Table 7.2 of this report) fully reflect the movements in value of contributed assets received between 2001 and 2006 as the values do not appear to be depreciated or re-valued. We are unable to confirm the contributed asset values reported in 2001 based on the information available to us.

We consider the figures for stormwater contributed assets as reported by Sydney Water in Table 8.3 of the AIR/SIR are not fully representative of actual values as they are calculated rather than input.

Further investigation work is required to look at contributions going back several decades to get a more reliable estimates of contributed asset values (gross and net) for water, wastewater and stormwater assets.

8.6 Sydney Water's Information and Data

Sydney Water has been diligent in responding to our information requests, and have provided explanations and additional information to the best of their ability.

9 Recommendations

9.1 Asset Lives and Asset Classes

9.1.1 Water asset lives

As data is obtained on the replacement schedule for assets based on the KPI's, the lifetime for different asset cohorts should be modified to reflect these extended lives. Additionally, in some cases the cohorts identified do not take manufacturing changes into account, for example the introduction of vacuum extrusion for PVC-u, which produced a vastly superior product

For newer materials such as PE and PVC, the use of physical/probabilistic models such as those published by AwwaRF should be investigated for determining more realistic lifetimes.

It is recommended that for critical water assets, the current lifetimes used should be revised based on the current condition based assessment analysis being undertaken by Sydney Water and that a separate lifetime table should be established for this asset class.

9.1.2 Wastewater asset lives

For "plan to repair assets" it is recommended that the information from a valid statistical approach should be used to determine lifetimes, rather than an expert panel. Additionally the information from the replacement program based upon KPI's should be used to inform the asset lifetime determination process.

The current lifetimes appear to be based on structural failures and consideration should be given to including additional factors such as blockages and infiltration, factors addressed in the KPI's, but not in the lifetime determination process.

The process for determining lifetimes for Avoid-Failure assets is based on valid condition based assessment procedures. This process should be used to determine a valid range of lifetimes for these assets in addition to those for Plan-to-Repair assets.

9.1.3 Asset lives and classes

The recommended asset lives and classes for use by the Tribunal are presented in the following tables.

Table 9.1 Recommended water asset lives and classes

Recommended Asset Category	**Component**	**Sydney Water Average Life (yrs)**	**Recommended Average Life (yrs)**
Water mains	Civil Assets *PE/PVC-u* *DICL*	 75 – 85 65 – 140	 100 – 200 30 – 150
Water pumping stations	Civil Assets	100	100
	Mechanical Assets	40	40
	Electrical Assets	30	30
	Electronic Assets	15	15
Reservoirs/tanks	Civil Assets	150	150
	Mechanical Assets	40	40
	Electrical Assets	30	30
	Electronic Assets	15	15
Water treatment plants	Civil Assets	100	100
	Mechanical Assets	40	40
	Electrical Assets	30	30
	Electronic Assets	15	15

Table 9.2 Recommended wastewater asset lives and classes

Recommended Asset Category	Component	Sydney Water Average Life (yrs)	Recommended Average Life (yrs)
Sewer mains	Pipe *VC* *Concrete* *PE/PVC-u* *Relining*	 130 130 85 70	 50 – 150 75 – 100 100 – 150 50 - 75
	Hole	infinite	infinite
Deep Ocean Outfall Sewers	Civil Assets	100	100
	Mechanical Assets	40	25
	Electrical Assets	30	25
	Electronic Assets	15	15
Sewage pumping stations	Civil Assets	100	100
	Mechanical Assets	25	25
	Electrical Assets	25	25
	Electronic Assets	15	15
Sewage treatment plants	Civil Assets	100	100
	Mechanical Assets	25	25
	Electrical Assets	25	25
	Electronic Assets	15	15

Table 9.3 Recommended stormwater asset lives and classes

Recommended Asset Category	Component	Sydney Water Average Life (yrs)	Recommended Average Life (yrs)
Storm drains and channels	Civil Assets	150	150

9.2 Movements in Asset Lives and Values

We recommend that Sydney Water follows the Ofwat guidelines in the treatment of sewer 'holes'. The 'hole' element would retain its original real cost value to the business and would not depreciate. In the absence of this historical cost information, initial MEERA costs of the 'hole' (and pipe) should be used instead and indexed accordingly. The 'hole' should not increase in value in line with land value increases, and an allowance should be made for 'holes' that will be abandoned.

9.3 Contributions

The figures for contributions as reported in Tables 8.2 and 8.3 of the AIR/SIR should be restated by Sydney Water. Further investigation work is required to look at contributions going back several decades to get a more reliable estimate. Reported contributions should include cash contributions as well as gifted assets, and reported contributed asset values should include re-valuation and depreciation adjustments.

Following the discovery of other discrepancies in the AIR/SIR we recommend that future returns are audited by a qualified consultant. This would be in line with the practice in the UK where water company's annual returns to Ofwat are audited by an independent Reporter appointed by the water company. The consultant would work with Sydney Water to assist the corporation to improve the accuracy of the reported figures, and would also give the Tribunal more confidence in the reliability and accuracy of the information contained within the returns.

Halcrow Pacific Pty Ltd

Melbourne
Level 1, 542 Station Street, Box Hill, Melbourne, VIC 3128
Tel +61 3 9899 9777 Fax +61 3 9899 1214

Sydney
Level 22, 68 Pitt Street, Sydney, NSW 2000
Tel +61 2 9250 9900 Fax +61 2 9241 2228

Brisbane
Suite 758, 320 Adelaide Street, Brisbane, QLD, 4000
Tel +61 7 3010 9272

www.halcrow.com