Determining Sydney Water's Economic Level of Water Conservation

Part A: The ELWC Methodology

Version 4 – August 2025

Contents

Version Control / Change History

Version	Issue Date	Approved by	Brief description of change
1	December 2016	Michael English, A/Senior Economist	New document
2	September 2021	Michael English, Competition and Market Development Manager	Update document to include version control and change history information. Minor wording changes in Section 1 to reflect approval of the method by IPART in December 2016. Update of example input parameters in Appendix A to reflect current values as at the Issue Date.
3	August 2022	Michael English, Competition and Market Development Manager	Refresh version number for new compliance year. Update of example input parameters in Appendix A to reflect current values as at the Issue Date. No other content changes as we have not received a direction to update or change the EWLC methodology.
4	August 2025	Michael English, Competition and Licensing Manager	Refresh version number for new compliance year. Update of example input parameters in Appendix A to reflect current values as at the Issue Date. No other content changes as we have not received a direction to update or change the EWLC methodology

1 About this report

The 2015-2020 Operating Licence for Sydney Water introduced new requirements for water conservation, which are reproduced below:

> **3.2 Economic level of water conservation**
>
> 3.2.1 By 1 November 2015, Sydney Water must submit to IPART (for IPART's approval) a report outlining Sydney Water's approach to, and principles for, developing a methodology for determining its economic level of water conservation, including (at a minimum) each of the following elements of water conservation:
>
> (a) water leakage
>
> (b) water recycling; and
>
> (c) water efficiency (including demand management)
>
> 3.2.2 Once the approach and principles referred to in clause 3.2.1 are approved by IPART, Sydney Water must develop a methodology in accordance with the approach and principles.
>
> 3.2.3 By 31 December 2016, Sydney Water must obtain IPART's approval for the Methodology.

The purpose of this report is to outline Sydney Water's Economic Level of Water Conservation (ELWC) Methodology to meet the requirements of clause 3.2.2 of the Operating Licence.

Our final report consists of two parts:

- Part A, which contains the methodology approved by IPART under clause 3.2.3 of the Operating Licence.
- Part B, which is a separate paper, contains supporting material to explain aspects of the methodology, including worked examples, as well as details of our stakeholder consultation on the draft methodology.

In addition to this introductory chapter, Part A is structured as follows:

Chapter 2 summarises the key economic principles that underpin the ELWC Methodology.

Chapter 3 sets out the ELWC Methodology in detail.

Appendix A summarises the key input variables used in the ELWC Methodology and the current value of each input (as at the date of this report).

Part B is a separate paper and is structured as follows:

Chapter 1 outlines the structure of Part B.

Chapter 2 outlines the issues raised by stakeholders in response to our Draft Methodology.

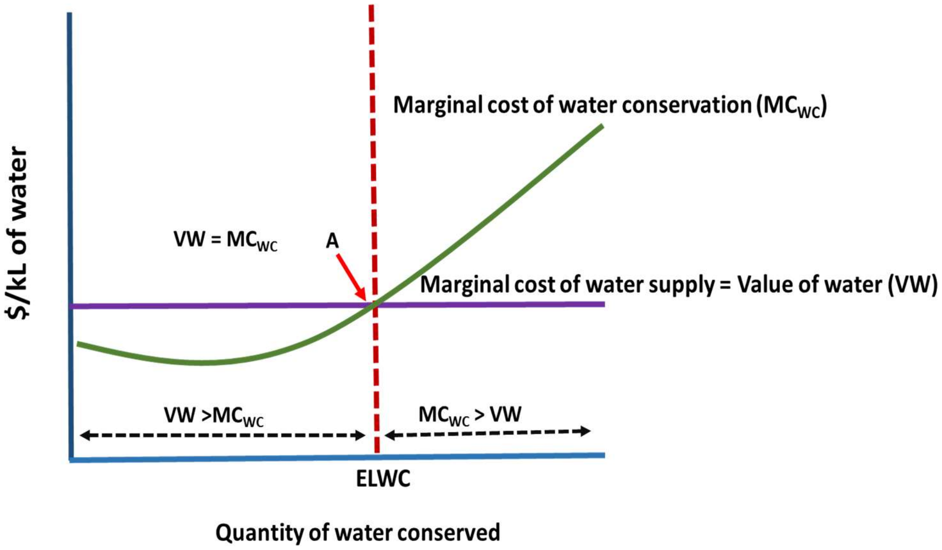
Chapter 3 explains some of the economic principles that have been used to help develop the Final Methodology, including the value of water.

Chapter 4 outlines the Final Methodology in detail, including a worked example to demonstrate how the methodology would be applied.

2 The economic approach to water conservation

Our ELWC methodology is based on a marginal value framework, where investment in water conservation could increase until the cost of saving an extra volume of water is just equal to the cost of supplying an extra volume of water. This can be explained with the assistance of **Figure 2-1**. The horizontal axis represents the volume of water saved through water conservation, while the vertical axis represents the cost per kilolitre.

Figure 2-1 Determination of the ELWC based on marginal costs



The horizontal straight line VW reflects the costs of supplying water, which we refer to as the value of water. The position of the curve may move up or down depending on factors like the outlook for water supplies, but is assumed to be constant at a given point in time[1].

The marginal cost of water conservation curve (MC_{WC}) shows how the unit cost of conserving water rises as we invest in additional water conservation projects. In other words, the cost to save one kilolitre of water rises as we try to save more and more water. For example, finding new participants for a program will eventually become increasingly difficult, and more costly strategies would be needed to reach new participants.

At low levels of water conservation, the cost to save an extra kilolitre of water is lower than the value of water (ie, in **Figure 2-1**, the MC_{WC} curve is below the VW curve). It therefore makes sense to invest to save water. For example, if it costs a household $2.00 a kilolitre to buy water but they can spend $1.50 a kilolitre installing an efficient showerhead to save water, the household would have a financial surplus of $0.50 for each kilolitre of water it conserves. It would therefore be rational to invest in the showerhead. In fact, the household can continue investing in water saving measures and still be better off so long as the water conservation activity (whether showerheads or some other option) costs less than $2.00 a kilolitre. When the two values are the same, total costs are minimised and we have reached the ELWC. This point is demarcated by A in **Figure 2-1**. Reducing water use any further would increase total costs – ie, the household spends more than it saves.

[1] The constant marginal value assumption reflects a benchmark level of value, based on a point in time and under specific scarcity and Metropolitan Water Plan settings. Different benchmark values can be set for projects of different lengths.

3 The ELWC methodology

3.1 Quantifying the ELWC

The ELWC represents an estimate of the amount of water that could be conserved each year, based on an economic assessment of costs and benefits across individual water conservation projects.

Consistent with our Operating Licence, the ELWC methodology must be capable of assessing costs for the following types of water conservation activities:

- water leakage;
- water recycling; and
- water efficiency (including demand management).

The ELWC, expressed as megalitres of water saved each day, is therefore quantified as follows:

$$ELWC_{SWC} = ELWC_{WL} + ELWC_{WR} + ELWC_{WE}. \quad (1)$$

Where:

Parameter	Definition	Units
$ELWC_{SWC}$	Aggregate ELWC for Sydney Water	ML / day
$ELWC_{WL}$	Sum of estimated water savings from all economically viable water leakage projects	ML / day
$ELWC_{WR}$	Sum of estimated water savings from all economically viable water recycling projects	ML / day
$ELWC_{WE}$	Sum of estimated water savings from all economically viable water efficiency projects	ML / day

A project is assessed as economically viable where the levelised cost (refer section 3.2) is less than or equal to the value of water (refer section 3.3).

If Sydney Water provides part funding of a water conservation project initiated by another party, Sydney Water's pro rata share of the total water savings from that project will be counted towards the ELWC (based on our relative contribution towards total project costs).

3.2 Estimating the Levelised Cost of Projects

The levelised cost of an individual water conservation project, expressed in dollar per kilolitre of water saved, is defined as:

$$Levelised\ cost = \frac{PV(Delivery\ Costs) - PV(Avoided\ \&Avoidable\ Costs) - PV(Externalities)}{PV(Water\ saved)} \quad (2)$$

Where:

Parameter	Definition	Units
$Levelised\ cost$	The present value of net project costs divided by the present value of water saved, measured over the life of the project	$ / kL
PV	Present value equivalent of a future stream of costs, avoided & avoidable costs, externalities, and/or water savings	$ Kilolitres
$Delivery\ Costs$	Sydney Water costs needed to deliver the project over its life, including up-front costs, on-going costs, and a share of overheads	$
$Avoided\ Costs$	Existing Sydney Water capital or operating costs that can be avoided as a result of the project, excluding variable water supply costs[2]	$
$Avoidable\ Costs$	Future Sydney Water capital or operating costs that would be needed in the absence of the project, excluding variable water supply costs and future system-wide supply augmentation measures[3]	$
$Externalities$	Costs and benefits (ie, delivery costs, avoided costs and avoidable costs) to parties other than Sydney Water due to the project, but excluding transfer payments	$
$Water\ saved$	Estimated annual water savings over the life of the project	Kilolitres

Sydney Water will also calculate a financial levelised cost that excludes externalities. However, for the purposes of the ELWC Methodology the assessment of whether or not a project is economically viable will be based on the externality-inclusive levelised cost.

The discount rate used to convert future values into their present value equivalent will be the prevailing regulated real pre-tax Weighted Average Cost of Capital (WACC) as determined by IPART in the relevant price determination period.

[2] Variable water supply costs are already captured in the value of water. Including this amount in the levelised cost of a project would represent double counting.

[3] These costs are captured in the value of water. Including these amounts in the levelised cost of a project would represent double counting.

3.3 Estimating the value of water

The life of the project is set by the total length of time that water conservation benefits are expected to be realised from the project investment, not the length of project funding. The relevant value of water to apply depends on the life of a project, as follows:

Life of project	Value of water
5 years or less	Short-run
6 – 19 years	Intermediate
20 years or more	Long-run

3.3.1 The short-run value of water

$$VW_{SR} = Direct\ water\ supply\ cost + Drought\ response + Scarcity\ value + Externalities \quad (3)$$

Where:

Parameter	Definition	Units
VW_{SR}	The short-run value of water. It represents the benefit to Sydney Water and the community that would occur from conserving an additional kilolitre of water	$ / kL
$Direct\ water\ supply\ cost$	Sydney Water costs for the supply of an additional kilolitre of water. Refer to equation 4	$ / kL
$Drought\ response$	The cost of planning and constructing permanent or temporary water supply measures initiated under the current Metropolitan Water Plan. Refer to equation 6	$ / kL
$Scarcity\ value$	The social costs (welfare losses) that occur as a result of reducing water use by one kilolitre during a period of water scarcity. Refer to equation 7	$ / kL
$Externalities$	Non-scarcity social costs due to the supply of an additional kilolitre of water, but excluding transfer payments	$ / kL

Direct water supply cost

$$Direct\ water\ supply\ cost_{CDL} = \sum_{d=0}^{100} P_d \times (BW_d + WT_d + WD_d + SHT_d + SDP_d) \qquad (4)$$

Where:

Parameter	Definition	Units
P_d	The probability of dam storage level 'd' occurring over the next five years, given the current dam storage level	%
BW_d	The variable cost of purchasing one additional kilolitre of bulk water from WaterNSW at dam level 'd'	$ / kL
WT_d	The variable cost of treating one additional kilolitre of bulk water at dam level 'd'	$ / kL
WD_d	The variable cost of distributing one additional kilolitre of treated water to customers at dam level 'd'	$ / kL
SHT_d	The variable cost of supplying one additional kilolitre of water from the Shoalhaven transfer scheme at dam level 'd'. Refer to equation 5	$ / kL
SDP_d	The variable cost of supplying one additional kilolitre of water from Sydney Desalination Plant at dam level 'd'	$ / kL
d	The dam storage level measured across all Metropolitan water storage dams	%

The variable cost of suppling an additional kilolitre of water from the Shoalhaven transfer scheme (SHT) is given by equation (5), as follows:

$$SHT_d = (EE_P \times RRP_{OP} \times kL_{SHT}) \div kL_{SHT} \qquad (5)$$

Where:

Parameter	Definition	Units
EE_P	The average energy efficiency of pumping water via the Shoalhaven transfer scheme	MWh / kL
RRP_{OP}	The forecast value of the regional reference price for NSW in the National Electricity Market for off-peak electricity purchases (2200 hours to 0700 hours)	$ / MWh
kL_{SHT}	The total volume of water supplied from the Shoalhaven transfer scheme each day	kL
d	As defined above in equation 4.	–

Drought response measures triggered under the Metropolitan Water Plan

$$DRM_i = P_{DRMi} \times (DR_K + DR_{OM}) \div kL_{DR} \qquad (6)$$

Where:

Parameter	Definition	Units
DRM_i	The cost of planning or constructing the 'ith' water supply measure initiated under the current Metropolitan Water Plan	$ / kL
P_{DRMi}	The probability of drought response measure 'i' being triggered under the current Metropolitan Water Plan over the next five years	
DR_K	The present value of capital costs needed to implement a drought response measure triggered under the current Metropolitan Water Plan	$
DR_{OM}	The present value of additional operating and maintenance costs of a drought response measure triggered under the current Metropolitan Water Plan	$
kL_{DR}	The present value of total volume of water supplied by a drought response measure triggered under the current Metropolitan Water Plan	kL

Scarcity value

$$Scarcity\ value = \sum_{d=0}^{100} P_d \times (SCL1_d + SCL2_d + SCL3_d) \qquad (7)$$

Where:

Parameter	Definition	Units
$SCL1_d$	The social cost of reducing water use by one kilolitre as a result of level 1 water restrictions at dam level 'd'	$ / kL
$SCL2_d$	The social cost of reducing water use by one additional kilolitre as a result of level 2 water restrictions at dam level 'd'	$ / kL
$SCL3_d$	The social cost of reducing water use by one additional kilolitre as a result of level 3 water restrictions at dam level 'd'	$ / kL
d	As defined above in equation (4)	–

The ability to estimate social costs will necessarily depend on the availability of robust source data. Depending on the specific data source, different methods and assumptions may be needed to derive estimates of social costs in the required units (ie, $ per kilolitre). The specific methods and assumptions used will be explained in our annual Water Conservation Report, and do not form part of the ELWC Methodology.

Externalities

This includes any positive externalities associated with the supply of water (defined as positive benefits associated with using water that are not already captured in the scarcity value term).

The ability to estimate the value of externalities will necessarily depend on the availability of robust source data. Depending on the specific data source, different methods and assumptions may be needed to derive estimates of social costs in the required units (ie, $ per kilolitre). The specific methods and assumptions used will be explained in our annual Water Conservation Report, and do not form part of the ELWC Methodology.

3.3.2 The long-run value of water

The long-run value of water will be the prevailing residential retail usage price of water.

3.3.3 The intermediate value of water

The intermediate value of water will be calculated as a linear interpolation between the short-run and long-run value of water. The value of water in any given year (year 't') is therefore given by the following:

$$VW_t = VW_{SR} + (Y_t - Y_{SR})\frac{VW_{LR} - VW_{SR}}{Y_{LR} - Y_{SR}} \qquad (8)$$

Where:

Parameter	Definition	Units
VW_t	The value of water in year 't'	$ / kL
VW_{SR}	The short-run value of water	$ / kL
VW_{LR}	The long-run value of water	$ / kL
Y_{SR}	The number of years that defines the end of the short-run, starting at year 0 (ie, 5)	#
Y_{LR}	The number of years that defines the start of the long-run (ie, 20)	#
Y_t	A sequential number that defines, as at the start of year 't', the number of years that have elapsed since the start of year 0, where $Y_{SR} < Y_t < Y_{LR}$	#

The relevant value of water depends on the length of estimated water savings. For example, if the water savings from a project are anticipated to accrue for 10 years, the parameter Y_t in equation (7) would be set to a value of 10 in order to estimate the benchmark value of water.

3.4 Applying the ELWC Methodology

Sydney Water's internal planning processes will produce a list of potential water conservation projects, which we refer to in the ELWC Methodology as candidate projects.

In order to apply the ELWC Methodology, the planner responsible for a candidate project will run step-by-step through the process outlined in Figure 2, applying the various concepts, methods and assumptions set out in chapter 3 of this report.

At the conclusion of step 4 of the process, all economically viable projects are collated into a draft Water Conservation Program. This will consist of three sub-programs relating to leak management, water efficiency, and water recycling. As per the definition in section 3.1, the ELWC is the sum total of water that could be saved from all economically viable candidate projects.

Figure 2: Process for applying the ELWC Methodology

Step 1
- Quantify the volume of water that would be saved over the life of the water conservation project

Step 2
- Quantify and value costs over the life of the candidate project, including:
  - Design and implementation costs
  - Avoided and/or avoidable costs
  - Any positive external (social and environmental) benefits

Step 3
- Calculate the levelised cost of the candidate project.

Step 4
- Compare the levelised cost against the value of water, and only carry forward a project if the levelised cost is less than the value of water.

Step 5
- Finalise the list of candidate projects and develop a draft Water Conservation Program.
- Calculate the ELWC volume for the relevant time period(s).

For clarity, because it is based on estimated costs and water savings from projects that have not been implemented yet, the ELWC is a forward looking measure. As such, the ELWC represents an estimate of the potential efficient level of water savings for the coming period. In practice, however, funding constraints and changing circumstances may mean that not all viable candidate water conservation projects can or will receive funding.

The complete list of projects assessed under the ELWC Methodology will be reported each year in our Water Conservation Report, including the levelised cost of each project and the relevant value of water used to assess economic viability. The Water Conservation Report will also provide details of projects that were actually implemented and, where available and practical, estimates of the volume of water savings achieved.

Appendix A – Input Parameters

ELWC Input Parameter	ELWC Methodology	Eg of current value[1]
Analysis period: a) Short-run projects b) Intermediate-term projects c) Long-run projects	a) 5 years b) 20 years c) 30 years	
Discount rate:	Regulated real, pre-tax WACC as determined by IPART.	4.2% (real, pre-tax)
Short-run water supply costs a) Drinking water b) Drinking water supplied from the Sydney Desalination Plant	a) Variable costs of: • Bulk water purchases from WaterNSW (non-drought, SDP on), plus • Water treatment costs, plus • Water distribution costs (chemicals and electricity), divided by the volume of water supplied. b) Regulated water usage charge for Sydney Desalination Plant.	a) $0.26 / kL across all water systems b) $0.82 / kL
Short-run scarcity value: Water use with restrictions a) Water Wise Rules b) Level 1 c) Level 2 d) Level 3	a) Current unrestricted water residential water use, in litres / person / day (LPD). b) Residential water use following the introduction of Level 1 water restrictions, in LPD. c) Residential water use following the introduction of Level 2 water restrictions, in LPD. d) Residential water use following the introduction of Level 3 water restrictions, in LPD.	a) 202 LPD b) 193 LPD c) 182 LPD d) 164 LPD
Short-run scarcity value: social cost of water use restrictions a) Water Wise Rules b) Level 1 c) Level 2 d) Level 3	Foregone consumer surplus (opportunity cost) due to restrictions on the type and/or volume of water consumed. Calculated as the incremental reduction in consumer surplus compared to the previous level of restrictions (e.g. the cost of level 2 restrictions would be the incremental change in consumer surplus for the reduction in water use over and above the savings already achieved at level 1).	a) $0.00 b) $2.92 / kL c) $7.30 / kL d) $11.83 / kL
Long-run value of water:	Regulated retail residential water usage price.	$2.67 / kL (non-drought) $3.70 / kL (drought)

[1] as at August 2025