



# **POTABLE WATER CALCULATOR GUIDE**

## **GREEN STAR – MULTI UNIT RESIDENTIAL V1**

**JUNE 2009**

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## 1.0 – INTRODUCTION

The Green Building Council of Australia (GBCA) has developed a Potable Water Calculator ('the Calculator') that is used in the Green Star – Multi Unit Residential v1 rating tool to estimate potable water consumption in buildings. The Calculator returns the number of awarded points (out of five available) for the Green Star credit Wat-1 'Occupant Amenity Water'. This guide explains how the calculator works and how it should be used. This guide should be used in conjunction with the Potable Water Calculator in the Green Star – Multi Unit Residential v1 rating tool.

The Calculator determines the number of points awarded based on the efficiency of fittings and fixtures (toilets, bathroom taps, kitchen taps and showers) as well as the collection of non-potable water (rainwater, greywater and blackwater) for use in toilets and clothes washers. The Calculator is embedded in the Green Star rating tool; it can be found on the tab in the spreadsheet next to the Water Category.

Please note that the GBCA assumes that the project teams have undertaken thorough calculations and dimensioning of all components in the water recycling system. The GBCA will not accept any responsibility for the dimensioning and functionality of the water recycling and water re-use systems that are being assessed under Green Star – Multi Unit Residential v1. The Calculator is intended to be used for benchmarking purposes only.

## 2.0 – HOW POINTS ARE AWARDED IN WAT-1 'OCCUPANT AMENITY WATER'

Up to five points are awarded in the Wat-1 'Occupant Amenity Water' credit. Up to two points are awarded for efficient fixtures and fittings and up to three points are awarded for the collection and re-use of non-potable water.

To award points for efficient fixtures and fittings, the Calculator imports data from the Water Efficiency Labelling and Standards (WELS) scheme, where the water efficiency of all fixtures and fittings sold in Australia is registered. The WELS scheme awards each fixture or fitting with a star rating from one to six stars (with six representing the highest water efficiency). Two points are awarded where the fixtures and fittings with the best available rating are installed; one point is awarded where all fixtures and fittings are within one WELS star of the best available rating. The WELS ratings of all fittings and fixtures sold in Australia are publicly available from an online database administered by the federal government. For further information about the WELS rating scheme and the water efficiency thresholds for each star band, please refer to AS/NZS 6400:2005 Water Efficient Products – Rating and Labelling and [www.waterrating.gov.au](http://www.waterrating.gov.au). The maximum WELS rating for showerheads is 3 stars rather than 6 stars. A showerhead is registered with a 3 star rating if the performance is between 9L/min and 7.5L/min. The target for one point is 9L/min and 8L/min is the target for two points. Projects that use flow restrictors to limit the flow through showers should note that this is not an acceptable alternative to a more efficient WELS rating. Projects must use the actual WELS rating for the shower and not the WELS flow rate from flow restrictors used with showers. This is because the WELS rating system includes requirements for spray pattern (e.g., spray spread angle) which cannot be achieved by a flow controller alone.

Where potable water is collected and re-used on-site, the number of points awarded is based on the proportion of water available for use in toilets and clothes washers. Three points are awarded where 100% of the water demand for toilets and clothes washers is met by on-site collected non-potable water, two points for 75% and one point for 50%.

These two benchmarks represent best water efficiency practice possible within current Australian health legislation in most jurisdictions. Potable water use in residential buildings could be further minimised through the use of non-potable water in showers and taps; however, the current health legislation in most Australian jurisdictions does not allow non-potable water to be used for these purposes. The efficiency of other water usages in residential buildings is awarded through the following credits:

- Wat-3 'Landscape Irrigation'
- Wat-4 'Heat Rejection Water'
- Wat-5 'Fire System Water'
- Wat-7 'Water Efficient Appliances'<sup>1</sup>
- Wat-8 'Swimming Pool/Spa Water Efficiency'

## 3.0 – ASSUMPTIONS

The total water demand is estimated based on assumptions about usage rates and occupancy; these are outlined in Table 1 and Table 2.

**Table 1:** Assumed usage rates of fixtures and fittings in the Calculator

Fixture/fitting	Assumed usage
Toilets	4 uses per person per day
Wash basins	7 x 0.15 minute uses per person per day
Kitchen taps	4 x 0.5 minute uses per person per day
Showers	1 x 8 minute use per person per day
Clothes washers	2 washes per person per week

**Table 2:** Assumed dwelling occupancy used in the Calculator

Dwelling type	Assumed occupancy (persons)
Studio/1 bedroom	2
2 bedroom	3
3 bedroom	4
4 bedroom	5
5+ bedroom	6

It is also assumed that all residential developments include toilets, bathroom taps, kitchen taps and showers and points will not be displayed until data about all these uses has been entered into the Calculator.

<sup>1</sup> N.B. While the supply of non-potable water to the clothes washer is awarded in Wat-1 'Occupant Amenity Water', the water efficiency of clothes washers is awarded in Wat-7 'Water Efficient Appliances'.

The points for efficient fittings and fixtures are awarded when the efficiency equivalent to the total consumption in Table 3 is achieved in the building; hence it is not necessary to meet each individual target for points to be awarded. These benchmarks have been developed in collaboration with the Australian Government’s Department of Environment, Water, Heritage and the Arts and are based on sales figures representing best practice for the respective plumbing product. The benchmark for one point represents best practice for the product, while the benchmark for two points represents the most efficient product available on the market.

Points for efficient fixtures and fittings are awarded independently of non-potable water collection and usage.

**Table 3:** Water efficiency required to achieve 1 or 2 points for efficient fittings and fixtures

Dwelling type	1 point	2 points
Toilets	5 star (3L/flush)	6 star (2.5L/flush)
Bathroom taps	5 star (6L/min)	6 star (4.5L/min)
Kitchen taps	5 star (6L/min)	6 star (4.5L/min)
Showerheads	3 star (9L/min)	3 star (7.5L/min)

The points awarded for non-potable water usage are calculated by comparing the non-potable water demand from clothes washers and toilets to the available supply.

The supply of rainwater is estimated based on the following parameters: rainfall on location; roof area connected to collection systems; number of rain days; rainwater tank size; and roof run-off coefficient. This data is entered by the user by following directions in the section 4.4. The volume of collected rainwater is calculated on a monthly basis, with the unused water at the end of each month being carried forward to the following month. It is assumed that the rainwater tank is initially half full.

The greywater and blackwater supplies are estimated by calculating the water consumption of the applications that are connected for water collection. These include<sup>2</sup> taps, showers, clothes washers and other sources (e.g. dishwashers) for greywater and toilets, taps, showers, clothes washers and other sources (e.g. sewer mining) for blackwater.

Where several sources of non-potable water are available, it is assumed that rainwater is used first, then greywater and finally blackwater. It is also assumed that the available non-potable water is used to meet the credit criteria in other credits<sup>3</sup> before the demand from toilets and clothes washers.

<sup>2</sup> The regulations governing rainwater and wastewater water recycling vary throughout Australia. Project teams are advised to check with their local plumbing authority for the particular requirements that apply to their project.

<sup>3</sup> Wat-3 'Landscape Irrigation', Wat-4 'Heat Rejection Water' or Wat-8 'Swimming Pool/Spa Water Efficiency'.

## 4.0 – HOW TO USE THE POTABLE WATER CALCULATOR

The user is required to enter data into the white cells only. The information in the grey cells is generated by the Calculator.

### 4.1 – BUILDING INFORMATION

The number of each type of dwelling should be entered into the section 'Building Information' as in Figure 1. The assumed number of occupants is generated by the Calculator.

Building Information		
Dwelling type	Number of dwellings	Assumed occupancy (persons)
Studio/1 bedroom	5	10
2 bedroom	14	42
3 bedroom	3	12
4 bedroom	0	0
5+ bedroom	0	0
<b>Total</b>	<b>22</b>	<b>64</b>

Figure 1: Sample of building information entered into the Potable Water Calculator.

## 4.2 – EFFICIENT FIXTURES AND FITTINGS

Data about the fixture and fittings included in the building design should be entered into the section 'Part 1: Efficient Fixtures and Fittings'. The information can be entered by entering the water consumption in the 'Manual entry from manufacturer's data sheet' cell or by using the drop down menus in the column 'WELS star rating selection'. The corresponding water consumption is automatically generated in the adjacent grey cell titles 'Resulting water efficiency used in calculator'.

The WELS star ratings represent maximum and minimum water consumption for a particular product. For purposes of this calculator, the highest water consumption allowed for that particular WELS star rating is used in all calculations. The actual water consumption, as displayed on the WELS label on registered products, can be manually entered into the Calculator if known (For example, see the entry for showerheads in Figure 2). The percentage of each type of fitting should also be entered.

The total water consumption ('Calculated Water Consumption') for each category is generated by the Calculator. It is then added up ('Total Project Water Consumption' and compared to a benchmark figure ('Benchmark for total water consumption to achieve 1 point' and 'Benchmark for total water consumption to achieve 2 points').

	Water Efficiency (Enter manually OR nominate WELS star rating)		Resulting water efficiency used in calculator (l/min, except for toilets, l/flush)	Percentage of Each Type	Calculated Water Consumption (L/day)
	Manual entry from Manufacturer's data sheet (l/min, except for toilets, l/flush)	WELS Star rating selection			
<b>Toilets</b>					
Acme Dual flush		5 Star	3	100%	
<enter description>		Select star rating			
<enter description>		Select star rating			
<enter description>		Select star rating			
	<b>Total</b>			100%	0.0
<b>Bathroom Taps</b>					
Efficient taps		6 Star	4.5	100%	
<enter description>		Select star rating			
<enter description>		Select star rating			
<enter description>		Select star rating			
	<b>Total</b>			100%	0.0
<b>Kitchen Taps</b>					
Acme Kitchen Taps		6 Star	4.5	100%	
<enter description>		Select star rating			
<enter description>		Select star rating			
<enter description>		Select star rating			
	<b>Total</b>			100%	0.0
<b>Showerheads</b>					
Acme Showerhead	7.5		7.5	100%	
<enter description>		Select star rating			
<enter description>		Select star rating			
<enter description>		Select star rating			
	<b>Total</b>			100%	0.0

Figure 2: Sample of data entry for efficient fixtures and fittings.

## 4.3 – NON-POTABLE WATER DEMAND

Data about the non-potable water demand from clothes washers should be entered into the section 'Non-potable water demand'. The information can be entered by writing the water consumption in the 'Manual entry from manufacturer's data sheet' cell or by using the drop down menus in the column 'WELS star rating selection'. The corresponding water consumption is automatically generated in the adjacent grey cell. Data about toilets is automatically generated based on data entered in the previous section ('Resulting water efficiency used in calculator'). See figure 3 for an example.

The WELS star ratings represent maximum and minimum water consumption for a particular product. For purposes of this Calculator, the highest water consumption allowed for each WELS star rating is used in all calculations. The actual water consumption, as displayed on the WELS label on registered products, can be manually entered into the Calculator if known. Please note that an average practice water efficiency must be entered if no clothes washers are installed as part of the base building.

The drop down boxes for 'Non-potable water source (in addition to mains water)' on the far right should be used to indicate whether or not rainwater, greywater or blackwater is supplied to each particular application. A total non-potable water demand ('TOTAL non-potable water demand from toilets and laundries') is then estimated by adding together the demand from clothes washers and toilets.

NON-POTABLE WATER DEMAND										
	Water Efficiency (Enter manually OR nominate WELS star rating)		Resulting water efficiency used in calculator (L/wash)	Load Capacity (kg)	Percentage of Each Type	Demand (L/day)	Non-potable water source (in addition to mains water)			
	Manual entry from Manufacturer's data sheet (L/wash)	WELS Star rating selection					Rainwater	Greywater	Blackwater	
<b>Clothes Washers</b>	A default water efficiency of 2.5 Stars and 6 kg capacity must be used if no clothes washers are installed as part of the base building. Please note that the efficiency of the Clothes Washers is awarded in Ene-11 Energy Efficient Appliances									
Acme Washer		3 Star	73.5	5	100%					
<enter description>		Select Star rating		Select Load Capacity						
<enter description>		Select Star rating		Select Load Capacity						
<enter description>		Select Star rating		Select Load Capacity						
<b>Total</b>					100%	1344.0	Yes	No	No	
<b>Toilets (data from calculations above)</b>						768.0	Yes	Yes	No	
<b>TOTAL non-potable water demand from toilets and laundries (L/day)</b>						2112.0				

Figure 3: Sample of data entry for non-potable water demand.

The non-potable water used to meet the credit criteria in other credits<sup>4</sup> must be entered into the Calculator, see Figure 4. The drop down boxes on the far right should be used to indicate whether or not rainwater, greywater or blackwater is used in a particular application. The total non-potable water demand ('Total non-potable water demand') for uses rewarded in other credits and the total for all non-potable water uses in the project is then calculated.

<sup>4</sup> Wat-3 'Landscape Irrigation' Wat-4 'Heat Rejection Water' or Wat-8 'Swimming Pool/Spa Water Efficiency'.

	Demand (L/day)	Rainwater	Greywater	Blackwater
If non-potable water is used to achieve Wat-3 'Landscape Irrigation', enter the volume of non-potable water used	500	Yes	No	No
If non-potable water is used to achieve Wat-4 'Heat Rejection Water', enter the volume of non-potable water used	3000	No	Yes	No
If non-potable water is used to achieve Wat-8 'Swimming Pool/Spa Water Efficiency', enter the volume of non-potable water used	4500	Yes	No	No
<b>TOTAL non-potable water demand from uses rewarded in other credits (L/day)</b>	<b>8000.0</b>			
<b>Total non-potable water demand (L/day)</b>	<b>10112.0</b>			

Figure 4: An example of how the daily non-potable water demand used to meet the credit criteria in other credits<sup>3</sup> should be entered.

## 4.4 – RAINWATER CALCULATOR

The Rainwater Calculator makes a simplified assessment of the amount of rainwater that could be collected. It is based on the design of the rainwater system and rainfall for the specified location. The Rainwater Calculator within this spreadsheet is intended to be used for benchmarking the amount of available rainwater. This Calculator is not intended to be used by designers to size and specify rainwater systems.

To use the Green Star Rainwater Calculator, the user must answer 'Yes' from the drop-down that states 'Will the Green Star Rainwater Calculator be used?'. The user must then input the rainfall collection area; select the run-off coefficient for the roof from the drop down menu; and indicate the size of the rainwater storage capacity. The average monthly rainfall for the building location must also be entered; this data is accessible from the Bureau of Meteorology at: <http://www.bom.gov.au/climate/averages/>.

The data entered for the rainfall collection area, run-off coefficient and storage capacity must be justified in the documentation submitted for compliance with Wat-1 'Occupant Amenity Water'. An example of data entered into the rainwater calculator is provided in Figure 5.

RAINWATER CALCULATOR						
Rainfall collection area (m2)		650				
Run-off co-efficient	Steel roof (> 30 pitch)	0.9				
Storage capacity (kL)		10000				
Average monthly rainfall for the building location (mm) Data for the fields below can be found at the Bureau of Meteorology <a href="http://www.bom.gov.au/climate/averages/">http://www.bom.gov.au/climate/averages/</a>						
January	February	March	April	May	June	
102	117.9	129.9	126.2	120.7	130.6	
July	August	September	October	November	December	
97.6	81.7	69.4	76.8	83.5	77.8	
Annual number of rain days/year >1mm:						100

Figure 5: Sample of entries into the rainwater calculator.

Where the Green Star Rainwater Calculator is not used (by selecting 'No' in the 'Will the Green Star Rainwater Calculator be used?'), the 'Enter the percentage of total rainwater demand that is met by on-site collection' field must be filled out. Calculations will need to be provided to demonstrate available rainwater. These calculations must at a minimum include information on how:

- The demand of rainwater claimed in other credits has been met before it is allocated to the demand of the clothes washers and toilets;
- Rainwater availability was calculated on a monthly basis or during a shorter time period;
- The tank has been sized to accommodate all these uses;
- The run-off coefficient for the roof must be justified; and
- Monthly rainfall data must be justified for the building location. Data from the Bureau of Meteorology can be accessed at <http://www.bom.gov.au/climate/averages>.

## 4.5 – GREYWATER AND BLACKWATER CALCULATORS

The white cells in the greywater collection section of the Calculator should be filled in by the user (as per the example in Figure 6). The Calculator generates the estimated volume of available greywater collected on-site. The total volume of greywater (measured in L/day) is then calculated. The blackwater section of the Calculator requires the same inputs (see Figure 7 for an example of inputs).

	% discharge water collected for re-use	L/day greywater collected for re-use
<b>GREYWATER COLLECTION</b>		
Bathroom taps	75%	226.8
Kitchen taps	50%	288
Showerheads	100%	3840
Clothes washers	0%	0
Enter the litres/day amount of greywater collected from other sources (e.g. Dishwasher)		0
<b>TOTAL L/day greywater collected for re-use</b>		<b>4354.8</b>

**Figure 6:** Sample of entries into the greywater collection section of the Calculator.

<b>BLACKWATER COLLECTION</b>	<b>% discharge water collected for re-use</b>	<b>L/day blackwater collected for re-use</b>
Toilets	100%	768
Bathroom taps	0%	0
Kitchen taps	0%	0
Showerheads	0%	0
Clothes washers	0%	0
Enter the litres/day amount of blackwater collected from other sources (e.g. Sewer mining)		0
<b>TOTAL L/day blackwater collected for re-use</b>		<b>768</b>

Figure 7: Sample of entries to the blackwater collection section of the Calculator.

## 4.6 – POINTS CALCULATION FOR NON-POTABLE WATER

The points awarded for the non-potable water supply in the Wat-1 'Occupant Amenity Water' are then calculated. See Section 2.0 Benchmarks and Assumptions of this guide for further details as to how points are awarded in the Calculator.

Points Achieved (efficient fixtures and fittings)	2
Points Achieved (non-potable water use)	3
<b>TOTAL Points Achieved</b>	<b>5</b>

Figure 8: Sample points summary.

A table summarising the points awarded in the Calculator is provided at the top of the Calculator sheet (see Figure 8 for an example). The points awarded are then automatically exported to the Wat-1 'Occupant Amenity Water' credit in the Water category summary sheet.

## 5.0 – THE GREEN STAR – MULTI UNIT RESIDENTIAL V1 SEWERAGE CALCULATOR

The Green Star – Multi Unit Residential v1 Sewerage Calculator does not require any data input from the user. All required data is entered to the Potable Water Calculator and then exported to the Sewerage Calculator. The Sewerage Calculator returns the number of awarded points (out of four available<sup>5</sup>) for the Green Star credit Emi-6 'Discharge to Sewer'. The Sewerage Calculator is embedded in the Green Star rating tool; it can be found on a tab in the spreadsheet next to the Emissions Category.

Points are awarded based on the percentage reduction compared to a standard practice building. Reduced flow to sewer can be achieved through water-efficient fixtures and fittings as well as the collection of greywater and blackwater. The standard practice building is assumed to not include any grey- or blackwater collection and the fixtures and fittings outlined in Table 3.

It should be noted that the standard practice for showerheads is set at the highest available rating, 3 star WELS rating. The data for standard practise has been established in collaboration with the Australian Government's Department of Environment, Water, Heritage and the Arts. A showerhead is registered under a 3 star rating if the performance is between 9 and 7.5L/min. The most inefficient (9L/min) is used in the benchmark; hence improvements in water efficiency can be achieved by entering the actual l/min performance of the showerhead. Projects that use flow restrictors to limit the flow through showers should note that this is not an acceptable alternative to a more efficient WELS rating. Projects must use the actual WELS rating for the shower and not the WELS flow rate from flow restrictors used with showers. This is because the WELS rating system includes requirements for spray pattern (e.g., spray spread angle) which cannot be achieved by a flow controller alone.

Please refer to the Technical Manual for further details on how points are awarded and the documentation requirements for Emi-6 'Discharge to Sewer'.

**Table 3:** WELS star ratings assumed to be standard practice in the Sewerage Calculator.

Fixture/fitting	WELS star Rating
Toilet	3 stars (4L/flush)
Bathroom taps	4 stars (7.5L/min)
Kitchen taps	4 stars (7.5L/min)
Showerheads	3 stars (9L/min)
Clothes washers	2.5 stars, 6 kg load capacity

<sup>5</sup> The Sewerage Calculator awards up to four points, there are however five points available in the Emi-6 'Discharge to Sewer' credit, for further details please refer to the Technical Manual.

## 6.0 – THE GREEN STAR – MULTI UNIT RESIDENTIAL V1 ENERGY CALCULATOR

The Green Star – Multi Unit Residential v1 Energy Calculator is designed to assess reductions in greenhouse gas emissions compared to a standard practice building. The Energy Calculator is embedded in the Green Star rating tool; it can be found on a tab in the spreadsheet next to the Energy Category. More information about the Green Star – Multi Unit Residential v1 Energy Calculator is available in the Green Star – Multi Unit Residential v1 Energy Calculator Guide, available at [www.gbca.org.au](http://www.gbca.org.au).

Reduction in the volume of domestic hot water usage is one efficient way to reduce greenhouse gas emissions associated with buildings. Standard practice hot water consumption in a building is based on the data in Table 4. The data for standard practise has been established in collaboration with the Australian Government’s Department of Environment, Water, Heritage and the Arts. It is assumed that 50% of the water used in these applications is hot water. Reductions in greenhouse gas emissions can be achieved by installing more efficient fittings and fixtures or installing an efficient hot water system such as solar hot water.

**Table 4:** WELS star ratings assumed to be standard practice in the Energy Calculator for assessment of energy consumption for domestic hot water.

Fixture/fitting	WELS star Rating
Bathroom taps	4 star (7.5L/min)
Kitchen taps	4 star (7.5L/min)
Showerheads	3 star (9L/min)

It should be noted that the standard practice for showerheads is set at the highest available rating, 3 star WELS rating. A showerhead is registered under a 3 star rating if the performance is between 9 and 7.5L/min. The most inefficient (9L/min) is used in the benchmark; hence improvements in water efficiency can be achieved by entering the actual l/min performance of the showerhead. Projects that use flow restrictors to limit the flow through showers should note that this is not an acceptable alternative to a more efficient WELS rating. Projects must use the actual WELS rating for the shower and not the WELS flow rate from flow restrictors used with showers. This is because the WELS rating system includes requirements for spray pattern (e.g., spray spread angle) which cannot be achieved by a flow controller alone.

It is important for projects to fill this section accurately. It not only assists projects in calculating the overall water efficiency of their project, it also affects the points awarded under Ene-1 ‘Greenhouse Gas Emissions’. The ‘Greenhouse Gas Emissions Calculator’ imports information on the water efficiency of the showers to calculate the amount of hot water consumption in the development.