Green Star SA – Retail Centre v1

POTABLE WATER & SEWAGE CALCULATORS GUIDE – VERSION 1.1

Last Update: 23 June 2010

1 Executive Summary

The Potable Water Calculator (the Calculator) estimates the potable water consumption based on efficiency of fittings (such as WCs, urinals, taps, and showers) and the reduction in potable water consumption achieved through rainwater, greywater or blackwater harvesting.

The Potable Water Calculator is used in the Green Star SA - Retail Centre v1 tool to estimate the consumption of potable water by retail centre developments, and forms the basis for points awarded in the Water category. The Calculator allows development projects to be compared on an equal basis, which is essential for equitable Green Star SA – Retail Centre v1 assessment. The Calculator is built for Green Star SA – Retail Centre v1 assessment purposes and should not be used for sizing sanitary fittings and water reticulation systems.

The estimated potable water consumption of each retail centre development is compared to benchmarks to determine the efficient use of water and hence the points achieved. The benchmarks used in this credit are based on fittings that are, for the most part, currently available in South Africa.

If all WCs, manually operated wash hand basin (WHB) taps, urinals and showerheads achieve the Category 3 flow rates listed in Table 2 of this guide, and no rainwater or recycled water systems are installed, then the Calculator awards one point. To achieve a greater number of points, further reduction in water consumption through the use of more efficient fittings and rainwater collection and/or water recycling systems is necessary.

The Calculator is divided into three sections. The first section establishes the predicted water consumption based on specified fittings and fixtures. The second section calculates the predicted water savings in the building due to water recycling. The third section reports results of the above calculations and identifies the number of points achieved in the credit Wat-1 'Occupant Amenity Water'. These points are automatically inserted in the Water tab on the Green Star SA – Retail Centre v1 spreadsheet tool.

2 Acknowledgements

The Green Star SA – Retail Centre v1 Potable Water and Sewage Calculators and this guidance document are based on those of the Australian Green Star – Retail Centre v1 rating tool. The Green Building Council of South Africa acknowledges the work of technical consultant WSP in adapting these items to the South African Green Star SA – Retail Centre v1 tool.

3 Predicted Water Consumption

The calculated potable water consumption is based on the average water consumption of fixtures specified in the project. The average usage data is based on studies undertaken in the U.K. by the Water Centre at the Building Research Establishment (BRE) for typical commercial buildings.

The usage per person per day is based on equal numbers of male and female occupants, outlined in Table 1. Male and female WCs are treated separately where urinals are installed. If there are no urinals then an average WC use of 2.3 times per person per day is assumed for all occupants. The Calculator assumes the frequency of use of kitchen sinks to be the same as WHBs for the Indoor Tap calculation. All base building WCs, WHB and sink taps, urinals and showers must be included in the calculations.

Type	No. of uses per day per person		Duration per use
	Male	Female	
WC	0.3	2.3	1 flush
Urinal	2	0	1 flush
Shower	Varies	Varies	5 minutes
Manual WHB/Sink tap	2.5	2.5	9 seconds
Timed WHB/Sink tap	2.5	2.5	7 seconds
PIR* WHB/Sink tap	2.5	2.5	6 seconds

*PIR- Passive Infra Red

Table 1: Data for average usage of water consuming facilities in retail centres used in the Potable Water Calculator.

3.1 Occupancy

The assumed number of staff used in the Calculator is based on one person per 60m^2 of Usable Area. The assumed number of visitors is based on the Usable Area divided by 0.3, which is based on statistical research from Australia. The Calculator is designed to produce a benchmark for equitable comparison of retail centre buildings. The Green Star SA - Retail Centre v1 tool assesses base building features, so hours of operation within the occupancy are not considered and no adjustment is made where the hours of occupancy may exceed normal hours of operation.

3.2 Fittings and Fixtures

The actual flow rate of the fixture or fitting should be entered manually into the calculator.

PREDICTED POTABLE WATER CONSUMPTION

WCs		
Type	Avg L/flush	% of WCs
dual flush standard	3.6	100%
<enter description here>		0%
<enter description here>		0%
<enter description here>		0%
		100%
Predicted Normalised WC Water Consumption Sub-Total (L/day/m^2)		0.43

Flow controlling devices can only be considered for this credit if they are an intrinsic attribute of the fitting or fixture, and cannot be removed or adjusted by maintenance staff without specialist equipment.

Up to four different types of fittings can be inserted and described in the Calculator for WCs, WHB/sink taps, urinals and showers. For each fitting type, the water consumption must be

entered, together with the percentage of each type of fitting in the building, as a percentage of the total number of fixtures of that type.

The average litres used for flushing a dual flush WC should be calculated as per the methodology provided in AS/NZS6400 (i.e. averaging 1 full flush and 4 half flushes). For example a 6/3 litre WC should be entered as (6x1+3x4)/5 = 3.6 litres. For WCs with flush valves, the valve flow rate (in litres/sec) must be multiplied by the flush duration (in seconds) to find the litres/flush. A minimum flush duration of 7 seconds should be assumed.

If a number of urinals feature a timed automatic flush (as may be found in refurbishment projects) rather than a manual or sensor flush, then the actual details of cisterns are to be inserted, together with number of cisterns and the percentage of timed automatic flush urinals as a percentage of all urinals, measured by urinal 'stalls' (each 600mm of trough or the number of individual urinal stalls) throughout the project. Insert the flush capacity for timed flush cisterns or the average flush capacity where multiple timed automatic flush cisterns are installed. The number of flushes entered must be for a 24 hour period.

For refurbishment projects only, urinals can be converted and deemed to be 'waterless' without completely removing existing plumbing if the water supply to them has been permanently disabled (i.e. physically dismantled in such a way that reconnecting the water supply for flushing is NOT possible without additional construction work). For new buildings, in order to qualify as "waterless," urinals must be specified as being designed to function without the use of water. The specification of standard water-based urinals with cartridges to negate the need for water does not qualify as 'waterless'.

A system for labelling efficiency of water fittings is still under development in South Africa and inclusion of relative performance of fittings in Table 2 below is for guidance only.

Water Fittings Consumption - for Guidance:

Type	**Usage unit**	**Flow Rate Category**						
		0 Worst	**1**	**2**	**3**	**4**	**5**	**6 Best**
WC	L(Average flush volume)/flush	6	5.5	4.5	4.0	3.5	3.0	2.5
Flush valves	L/min	65	-	-	-	-	-	-
Urinal flushing	L/flush per stall or 600mm width of trough	2.5	2.5	2.5	2.0	1.5	1.0	1.0
Indoor taps & flow controls	L/min	20.0	15.0	12.0	9.0	8.0	6.0	4.5
Showers	L/min	16.0	16.0	12.0	10.0	9.0	9.0	9.0

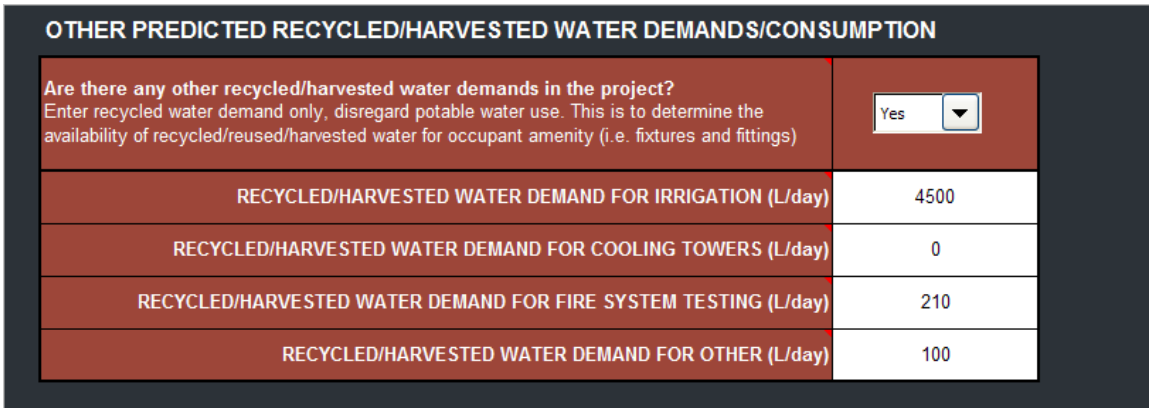
Table 2: Water Consumption for Fittings (FOR GUIDANCE ONLY)

3.3 Shower Use

Enter the fixture description and the applicable flow rate, followed by the percentage of fixtures as a percentage of all shower fixtures. Once shower usage is entered in the calculator, the benchmark is automatically adjusted so that shower usage is not unduly penalised. Shower usage is assumed for 3% of the building staff.

3.4 Other Predicted Consumption

Other water demands within the project can be entered into the 'Other Predicted Water Consumption' section of the Calculator. These values are used to calculate the quantity of recycled water which will be available to reduce demand for potable water. Annual demands should be calculated and converted to values in litres per day and entered into these fields.



Please note that all 'other' daily demands must be calculated based on work days (i.e. 260 days per year), with the exception of irrigation recycled water demands which must be calculated on total days (i.e. 365 days per year).

4 Predicted Reduction in Potable Water Consumption

The results from the Potable Water Calculator are based on default values for occupancy and usage, and these results may not be accurate representations of the actual potable water consumption. The results for reduction of water use from the Potable Water Calculator are only intended for benchmarking purposes in Green Star SA – Retail Centre v1 and **should not be used to size and specify rainwater and greywater recycling systems**.

4.1 Rainwater Recycling

The Calculator produces an estimate of the amount of rainwater that could be collected and used to replace part or all of the potable water demands entered elsewhere in the calculator, based on:

- monthly rainfall;
- collection area;
- run-off coefficient;
- annual number of rainy days;
- storage capacity; and
- volume of rainwater collected used for irrigation or other purposes.

Table 3 displays the run-off coefficients for rainwater collection systems used in the Calculator:

Roof Type	Run-off Coefficient
Steel roof (>30° angle)	0.9
Non-absorbent roof (>30° angle)	0.9
Flat non-absorbent roof (<30° angle)	0.8
Flat gravel or turf roof (<30° angle)=0.8-0.15 evaporation/transpiration	0.65

Table 3: Run-off coefficients used in the Potable Water Calculator

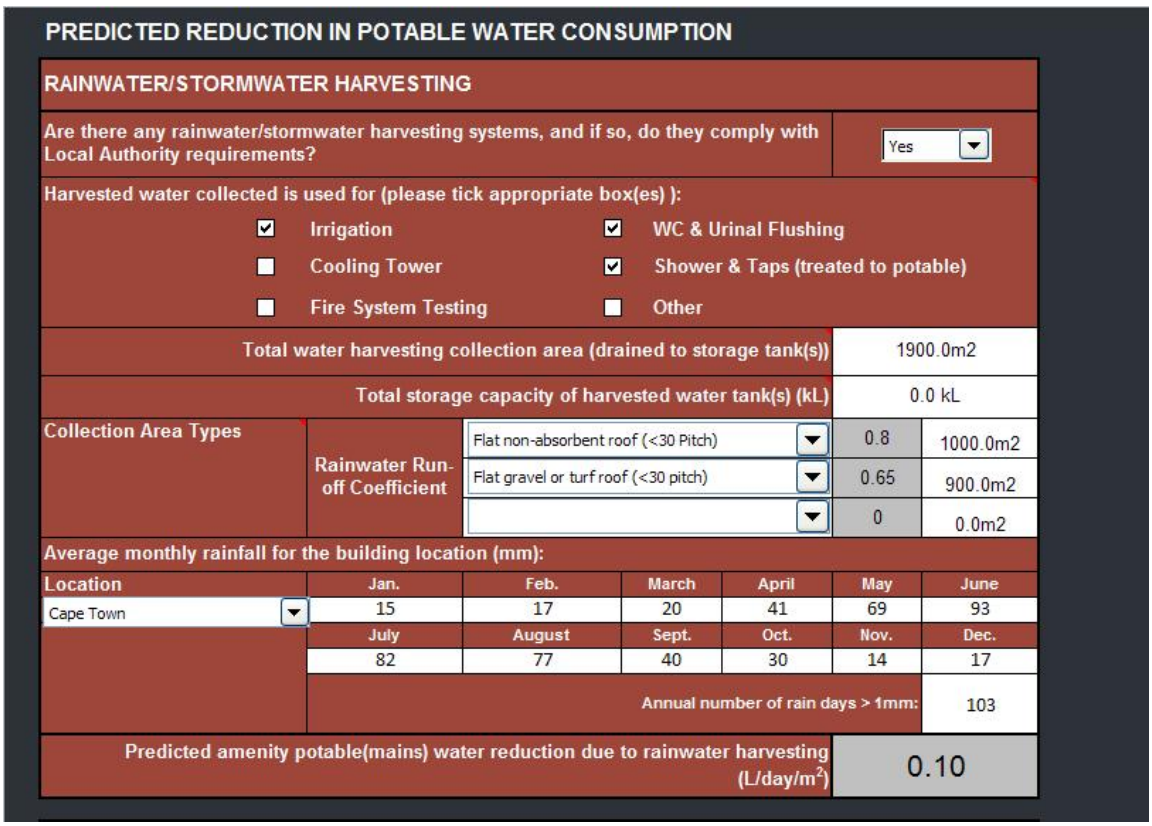
Projects may include rainwater harvested from surfaces other than those given in the run-off coefficient table above. However, the run-off coefficient of 0.65 for 'Flat gravel or turf roof (<30° angle)' must be used. Project teams wishing to use an alternative rainwater run-off coefficient for such surfaces may submit a Credit Interpretation Request (CIR) clearly justifying the alternative run-off coefficient.

To complete the rainwater component of the Calculator, systematically answer the question below:

- **Are there any rainwater systems proposed for the project?**

If **NO** then this section of the Calculator is now complete. Go to the greywater and blackwater sections of the Calculator.

If **YES** then select the type of demands that the rainwater supplies, by checking any or all of the check boxes in the fields "Rainwater collected is used for" area. Note that these fields can be selected in rain, grey or black water sections of the calculator. Where demand(s) are met via multiple sources, for the purposes of benchmarking, the potable water calculator prioritises the consumption of recycled/harvested water based on environmental preference (i.e. blackwater and greywater are prioritised before rainwater, with potable water used to supplement where recycled/harvested water is deficient). Recycled/harvested water from the prioritised sources is supplied to different demands (e.g. irrigation, WCs & urinals, showers & taps etc.) proportionally based on the demand breakdown.



Other daily demands such as Irrigation, Cooling Tower and Fire Test water have been entered previously and do not need to be re-entered.

Enter the collection area(s), total rainwater storage tank capacity and select the runoff co-efficient(s).

Monthly rainfall and number of rain days must now be selected by choosing the city/town or nearest city/town to which the project is located in the drop down menu. The calculator automatically enters the rainfall data from an internal database.

This section of the calculator is now complete and the quantity of potable water that is replaced by the rainwater system is shown in litres per day per m².

The calculator computes the potable water reduction on a per month basis, sums and divides by the total number of work days (i.e. non-weekend days) to attain the daily volume. The calculator also assumes a 20 litre/100m2 "first flush" volume of water is lost for each rain event/day. The first flush volume is the volume of water diverted from the storage tank at the beginning of a rain event, due to the large quantity of initial debris and pollutants.

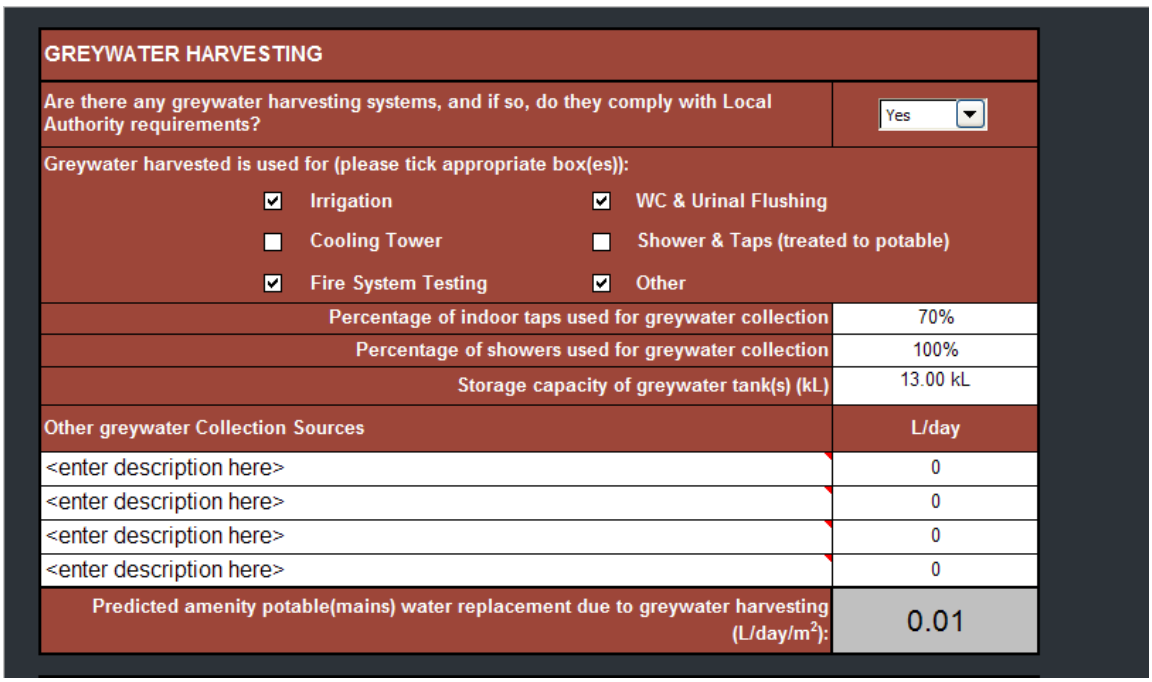
4.2 Greywater Recycling

To complete the greywater component of the Calculator, answer the question below:

- **Are there any greywater systems proposed for the project?**

If **NO** then this section of the Calculator is now complete. Go to the blackwater section of the Calculator.

If **YES** then select the type of demands that the rainwater supplies, by checking any or all of the check boxes in the fields "Greywater harvested is used for" area. Where demand(s) are met via multiple sources, for the purposes of benchmarking, the potable water calculator prioritises the consumption of recycled/harvested water based on environmental preference (i.e. blackwater and greywater are prioritised before rainwater, with potable water used to supplement where recycled/harvested water is deficient). Recycled/harvested water from the prioritised sources is supplied to different demands (e.g. irrigation, WCs & urinals, showers & taps etc.) proportionally based on the demand breakdown.



GREYWATER HARVESTING	
Are there any greywater harvesting systems, and if so, do they comply with Local Authority requirements?	Yes
Greywater harvested is used for (please tick appropriate box(es)):	
☑ Irrigation ☑ WC & Urinal Flushing	
☐ Cooling Tower ☐ Shower & Taps (treated to potable)	
☑ Fire System Testing ☑ Other	
Percentage of indoor taps used for greywater collection	70%
Percentage of showers used for greywater collection	100%
Storage capacity of greywater tank(s) (kL)	13.00 kL
Other greywater Collection Sources	L/day
<enter description here>	0
<enter description here>	0
<enter description here>	0
<enter description here>	0
Predicted amenity potable(mains) water replacement due to greywater harvesting (L/day/m^2):	0.01

Enter the percentage of each type of fixture used for collection and the storage volume of the greywater tank. Enter any other sources of collection of water for greywater processing such as fire test water.

The potable water calculator completes a check on the capacity of the greywater storage tank(s) and the predicted greywater inflow. For the purposes of benchmarking, if the daily greywater inflow exceeds the total capacity of the nominated storage tank, then the excess is assumed not available for reuse (i.e. diverted to sewer).

This section of the calculator is now complete and the quantity of potable water that is recycled by the greywater process is shown in litres per work day (i.e. non-weekend days) per m^2.

4.3 Blackwater Recycling

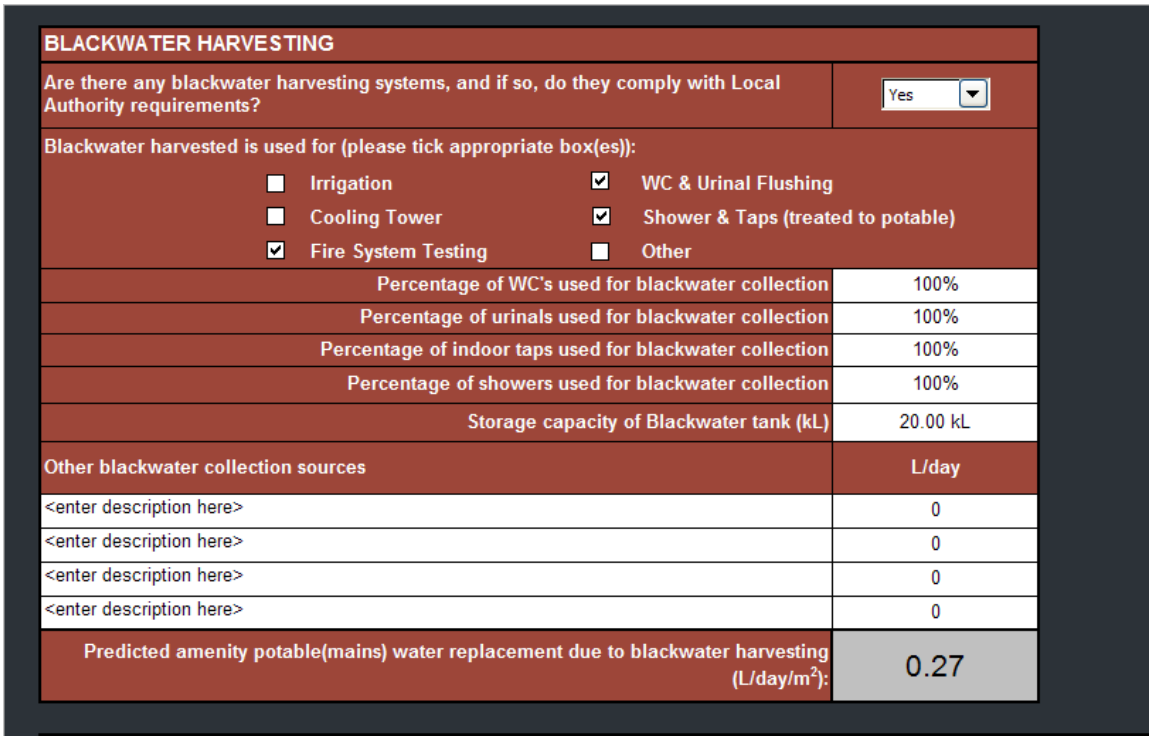
In locations where on-site black water treatment is generally not permitted, projects are encouraged to contact local authorities to discuss the benefits of on site water treatment for the project and local infrastructure.

To complete the Blackwater component of the Calculator, answer the question below:

- **Are there any blackwater systems proposed for the project?**

If **NO** then this section of the Calculator is now complete.

If **YES** then select the type of demands that the blackwater supplies, by checking any or all of the check boxes in the fields "Blackwater harvested is used for" area. Where demand(s) are met via multiple sources, for the purposes of benchmarking, the potable water calculator prioritises the consumption of recycled/harvested water based on environmental preference (i.e. blackwater and greywater are prioritised before rainwater, with potable water used to supplement where recycled/harvested water is deficient). Recycled/harvested water from the prioritised sources is supplied to different demands (e.g. irrigation, WCs & urinals, showers & taps etc.) proportionally based on the demand breakdown.



BLACKWATER HARVESTING	
Are there any blackwater harvesting systems, and if so, do they comply with Local Authority requirements?	Yes
Blackwater harvested is used for (please tick appropriate box(es)): ☐ Irrigation ☑ WC & Urinal Flushing ☐ Cooling Tower ☑ Shower & Taps (treated to potable) ☑ Fire System Testing ☐ Other	
Percentage of WC's used for blackwater collection	100%
Percentage of urinals used for blackwater collection	100%
Percentage of indoor taps used for blackwater collection	100%
Percentage of showers used for blackwater collection	100%
Storage capacity of Blackwater tank (kL)	20.00 kL
Other blackwater collection sources	L/day
<enter description here>	0
<enter description here>	0
<enter description here>	0
<enter description here>	0
Predicted amenity potable(mains) water replacement due to blackwater harvesting (L/day/m^2):	0.27

Enter the percentage of each type of fixture used for collection and the storage volume of the blackwater tank. Enter any other sources of collection of water for blackwater processing such as fire test water.

The potable water calculator completes a check on the capacity of the blackwater storage tank(s) and the predicted blackwater inflow. For the purposes of benchmarking, if the daily blackwater inflow exceeds the total capacity of the nominated storage tank, then the excess is assumed not available for reuse (i.e. diverted to sewer).

This section of the calculator is now complete and the quantity of potable water that is recycled by the blackwater process is shown in litres per work day (i.e. non-weekend days) per m2.

5 Net Potable Water Consumption

The resulting predicted potable water consumption is calculated by subtracting the predicted reduction in potable water consumption from the predicted consumption of fixtures. The result is then compared to consumption benchmarks, and a Green Star SA – Retail Centre v1 Wat-1 score is generated.

TOTAL REDUCED POTABLE WATER USE		
Predicted Water Consumption from Fixtures	0.46	L/day/m^2
Predicted Recycled/Harvested Water available to Fixtures	0.28	L/day/m^2
NET POTABLE (MAINS) WATER CONSUMPTION	0.18	L/day/m^2
POINTS ACHIEVED:	4	

6 Sewage Calculator

The Sewage Calculator is a reporting tool. Data entered to the Potable Water Calculator is used to report on expected flow to the sewerage system. The flow is then compared to flow reduction benchmarks that are set against a standard case. If shower usage is entered, the benchmark is adjusted so that showers are not unduly penalised. Efficient fittings, as well as grey water and blackwater recycling systems, reduce flow to sewerage.

REDUCED SEWER DISCHARGE	
The following estimated discharge to sewer is based on the data entered above and does not represent actual discharge to the sewer in the building.	
	L/day/m^2
Predicted Water Consumption by Fixtures	0.46
Less predicted Greywater and Blackwater treated	0.27
Estimated discharge to sewer (L/day/m^2)	0.19
Points Achieved	3