Green Star SA – Public & Education Building v1

POTABLE WATER CALCULATOR GUIDE

VERSION 2.0

Last update: 15 March 2013

Table of Contents

1 Introduction

The Green Star SA water credits encourage and recognise reduction in potable water consumption through various water saving initiatives. The Potable Water Calculator has been developed in an effort to equitably relate potable water savings across all building water uses to Green Star SA points awarded.

The potable water demand reduction is assessed by comparing the total estimated consumption of the project, as designed or built (the *Actual Building*) to a standard practice reference building (the *Notional Building*). Green Star SA points are awarded based on the percentage demand reduction shown.

The calculator is divided into four sections – Building information inputs, Water demand, Sustainable Water and Water Usage Summary, as detailed in this document.

Under **Building Information Inputs**, the user enters details on how many people will occupy each major space type in the building, and how often, which directly impacts on the usage patterns of occupants in the building. The user also records where the building is located, so that rainfall and irrigation schedules can be determined.

Under **Water Demand**, all the major water demands are estimated for the *Actual Building* and the *Notional building*. At this stage, it is still assumed that the total water demand for the Actual and the Notional buildings will be met by potable water. Water savings compared to the reference case up to this point is due to water efficiency alone.

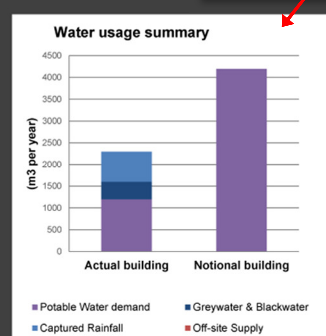
In the next section of the calculator, **Sustainable Water**, the reduction of potable water consumption through the use of non-potable water is considered. Only the Actual Building is assumed to use non-potable water.

Finally, the estimated potable water demand reduction is compared to the Notional building, and the amount of Green Star SA points claimed, is shown under **Water Usage Summary**.

Scale of how points are awarded

Water usage summary

	Actual building	Notional building
Total Water Demand	2 300	4 200
Water reductions from non-potable sources	1 100	0
Greywater & Blackwater	400	0
Captured Rainfall	700	0
Off-site Supply	0	0
Potable Water demand	1 200	4 200
Reduction vs. Notional Building	71.43%	
Points Claimed	7	



Reduction	Points claimed
0%	0
5%	1
15%	2
25%	3
35%	4
45%	5
55%	6
65%	7
75%	8
80%	9
85%	10
90%	11
95%	12

Figure 1 - Extracts from Potable Water Calculator showing summary of Water Usage

2 Building Information Input

In this section, information relating to building occupancy and location is entered into the calculator. This information will be used for the Actual Building and the Notional Building calculations.

Occupant information is used to establish the total number of hours people will spend in the building, which forms the basis of calculating Actual and Notional Building occupant amenity water consumption.

Building location information is used in landscape irrigation to determine seasonal irrigation schedules, and to determine monthly rainfall in rainwater balancing calculations.

2.1 Inputs

Users are required to enter the following information:

1.	2.	3.	4.	5.
Occupant type	Design number of occupants	Occupancy profile	Peak days per week	Percentage of occupants with access to showers
Office workers	25	Office	5 day week	100%
Lecturers	30	A3 Tertiary Education	5 day week	100%
Students	400	A3 Tertiary Education	5 day week	0%
		<Please select>		
		<Please select>		
		<Please select>		
		<Please select>		
		<Please select>		
		<Please select>		
		<Please select>		
		<Please select>		
		<Please select>		
		<Please select>		
		<Please select>		
		<Please select>		
	455			

Figure 2 – Occupant information input into the calculator

1. Occupant type

Descriptive name for each type of occupant, with distinct occupancy patterns

2. Design number of occupants

The number of each type of occupant the building is designed for. The sum of these must be consistent with the occupancy given for Tra-3, if pursued.

If the design number of occupants for an area is unknown, it can be calculated using the area of the occupied space, divided by a default design occupant density, as per Table 1.

Table 1 – Default design occupant densities

Occupant Densities	
	m2 per person
Office	15
A1 Community / day centre	5
A1 Restaurant / Public House	5
A2 Sports Centre / Leisure centre	5
A2 Theatres / Cinemas / Music Halls	5
A3 Tertiary Education	5
A3 Primary and Secondary Schools	5
A4 Places of Worship	5
Airport / Public Transport terminal buildings	10
C1 Convention Centre / Exhibition hall	10
C2 Libraries / Museums / Galleries	20
Courts	15
Gym	5

3. Occupancy profile

The occupancy schedule occupants will follow in the space. This determines how many of the occupants are present in the space at different times in the day. The schedule selected should define the main function of the space, for example 'Office' includes all areas which serve an office area – office space, toilets, tea kitchens, etc. The occupancy profile can either be selected from the list of defaults provided in the dropdown, or be manually entered in the space provided (cells ES&ET:15-38). If manually entered, 'User Defined' should be selected from the 'Occupancy Profile' dropdown list. Manually entered occupancy profiles must be based on the profiles contained in the Energy Modelling Activity Schedules available for download from the GBCSA website.

For gym areas, one of the 'GYM' occupancy profiles has to be selected, as shower usage patterns in gyms are different to those in other areas.

Details on these profiles and information on manually entering an alternative occupancy profile are given in Appendix A.

4. Peak days per week

Number of days per week occupants will occupy the space according to the 'Peak' profile (as in Appendix A). Remaining week days are considered to be 'Off-peak'.

5. Percentage of occupants who have access to shower

This input is used to differentiate occupant shower patterns between staff, visitors and gym members.

To make provision for public spaces (such as libraries) where staff showers are provided, but the majority of the occupants will not be staff, users are asked to specify what percentage of the occupants in the space will have access to shower facilities.

Example: In a museum designed for 100 people, of whom 10 are staff members, 10% of the occupants will have access to shower facilities. In office areas where cyclist facilities are provided, 100% of the occupants have access to showers, as in gyms. In education buildings, where only staff have access to showers, only the staff component of the occupants should be input as having access to showers.

6. Building location

Select the city or town that your site is located in or closest to, to determine rainfall data for the site and the SANS 204 climatic region the building is in. This is used in calculations for irrigation, swimming pool water consumption and rainwater harvesting calculations.

2.2 Calculation methodology

The occupant information provided under 'Building Information' is used to determine the total number of occupants in the building, how much time they will spend there and how many times they will use amenities like toilets and urinals.

2.3 Summary of inputs

Building Information input	ACTUAL BUILDING	NOTIONAL BUILDING
	VERIFICATION DOCUMENTS	
Occupant type	**Statement of Confirmation (1)** from the Building Owner or Project Architect confirming: • Occupant inputs (occupant type, design number of occupants, occupancy profile, peak days per week, percentage of occupants who have access to shower); • The number of staff that will work in the building simultaneously during standard operation; and • The maximum number of visitors/students to the building simultaneously during standard operation.	As Actual Building
Design number of occupants		As Actual Building
Occupancy profile		As Actual Building
Peak days per week		As Actual Building
Percentage of occupants who have access to shower		As Actual Building

3 Water demand

All major potable water demands within the project including external uses such as irrigation are taken into account in this section. The actual building design consumption is compared against a Notional building of the same size with default consumption figures to determine potable water savings. The water consumption is calculated in the following sections:

3.1 Occupant Amenity water - internal plumbing fixtures

3.2 Heat Rejection water demand – water consumed by cooling towers and other evaporative cooling systems

3.3 Irrigation water demand

3.4 Swimming pools

3.5 Laundry Facilities

3.6 Commercial kitchens

3.7 Other water uses

3.1 Occupant Amenity Water

Installing water efficient fixtures and fittings is the first step in reducing potable water demand. This section focuses on the major domestic fixtures and fittings. Projects will be credited for installing water fixtures with flow rates lower than those assumed for the Notional Building (assumed Notional Building consumption is shown under 'Summary of Inputs and Notional Building assumptions' at the end of this section).

Further occupant amenity water demand reduction is possible by using non-potable water for some of these demands. This is calculated under the 'Sustainable water' section of the tool.

3.1.1 Inputs

Users are required to enter information regarding all the toilets, urinals, indoor taps and showers installed in the building. Users enter fitting description, flow rate and the percentage of the installed fittings that accounts for each different type of fitting.

Toilets

Enter the toilet type, the flow rate (litres/flush) for each type and the percentage of each type based on total toilets installed.

- For single flush toilets, input the rate per flush (L/flush)
- For dual flush toilets – enter toilet consumption calculated as per AS/NZS6400 – the average of one full flush and four half flushes: (Full flush x 1) + (Half flush x 4) / 5. Eg if the toilet is a 3 litre/6litre dual flush system, the flush rate entered would be: ((6 litres X 1) + (3 litres X 4)) /5 = 3.6 litres

Urinals

Users specify whether urinals are installed in the building or not. With urinals, installed occupants are assumed to use the toilet less often which is reflected in the calculations.

Types of urinals are divided into manually flushed or Passive Infra Red (PIR) controlled urinals (urinals flushed after each use) and urinals on auto-timer. Input the urinal type, the flow rate (litres/flush) for each type and the percentage of each type based on total urinals installed.

For manually flushed or PIR controlled urinals, input the rate per flush (L/flush)

For urinals on auto-timers, consumption is calculated based on the number of flushes per day and litres per flush provided by the user, for 365 days of the year.

Where urinal troughs on an auto-timer are installed, each 600mm of trough (or part thereof) should be counted as one urinal in order to enter the percentage of urinal troughs compared to the total number of urinals in the project

The notional building's consumption is calculated assuming manually flushed urinals are installed.

Indoor Taps

Input types of taps, the flow rate (litres/min) and percentage of each type installed. Options for different types of controls are provided; this affects the duration taps are used. The control options are:

- Manual WHB/Sink Tap – 9 seconds per use
- Timed WHB/Sink Tap – 7 seconds per use
- PIR WHB/Sink Tap – 6 seconds per use

Indoor taps accounted for in this section include those in tea kitchen facilities. Taps used in kitchens for large-scale meal preparation are included under Section 2.6 Large Kitchens. Any kitchen taps not accounted for in Section 2.6 must be accounted for here under Indoor Taps.

Showers

The user is asked to specify anticipated shower usage, based on facilities provided and the number of staff expected to use showers. Please ensure consistency with the number of points claimed for Tra-3 Cyclist Facilities.

As stated under 'Building Information Inputs', users must select the gym occupancy profiles for gym areas. It is assumed that more occupants in gym areas will use the showers.

The table overleaf shows the number of staff expected to use the shower based on user input provided.

Table 2 - Occupant shower usage

Percentage of occupants who use shower	
No showers installed	0%
No significant gym or cyclist facilities	3%
1 pt for Tra-3	3%
2 or 3 pts for Tra-3	6%
Gym area	80%

Shower head types, percentages and flow rates (litres/min) are entered.

3.1.2 Calculation methodology

Occupant information entered under 'Building Information' is used to determine the total number of hours occupants will spend in the building, and therefore how many times they are likely to use toilets, urinals, indoor taps and showers, based on occupant usage patterns shown in Table 4.

The total actual building water consumption is then calculated using fitting information entered by the user. For the comparative notional building, fitting flow rates are assumed to be of average water efficiency, as under 'Summary of Inputs & Notional Building Assumptions' below.

Table 3 - Assumed uses per day

Uses per day (based on 9.5hr workday)		REFERENCE
Toilet - no urinal (l/flush)	2.3 uses per day	Water Centre at the Building Research Establishment, UK
Toilet with urinal (l/flush)	1.3 uses per day	
Urinal (l/flush)	1 use per day	
Taps (l/min)	2.5 uses per day	
Manual WHB/Sink tap	9 sec per use	
Timed WHB/Sink tap	7 seconds per use	
PIR WHB / Sink tap	6 seconds per use	
Shower (l/min)	1 use per day, 5 min per use	

3.1.3 Summary of inputs & Notional Building Assumptions

Occupant Amenity Water	ACTUAL BUILDING		NOTIONAL BUILDING	
		VERIFICATION DOCUMENTS		REFERENCE
Toilets flush rates	As per design	Extracts from the specifications/Manufacturers Data Sheets, showing flow rates and controls entered into the calculator.	4 litres per flush	WELS 3 Star
Urinal flush rates	As per design		2 litres per flush	WELS 3 Star
Taps flow rates	As per design		9 litres per minute, no controls	WELS 3 Star
Shower flow rates	As per design		12 litres per minute	WELS 2 Star

3.2 Heat rejection water demand

Heat rejection water consumption can be one of the major water consuming aspects of a building, but is largely undetected since it is out of sight from most building occupants.

The aim of this section is to encourage and recognise the reduction of potable water used for heat rejection in large buildings.

Cooling towers (water based heat rejection) are assumed for the Notional building reference case for buildings with a Nominated Area (HVAC)* of greater than 2000m^2. Reduction in potable water usage for heat rejection can then be achieved through

- Using air based heat rejection

Or, if water-based heat rejection is used, through

- Passive and low energy building design, to reduce the heat rejection load
- Using non-potable water for heat rejection
- Efficient cooling tower design

Notional building heat rejection loads for buildings with Nominated Area (HVAC) < 2000m^2

Air based heat rejection is assumed for the Notional Building reference case for buildings with a Nominated Area (HVAC)* of less than 2000m^2. For projects smaller than this size, using water based heat rejection will therefore in effect be penalised if they use any potable water for heat rejection.

*For the purpose of this credit *Nominated Area (HVAC)* must be entered, consistent with the inputs provided in ENE-1. A definition of Nominated Area (HVAC) can be found in the Energy Calculator and Modelling Protocol guide.

Notional building heat rejection loads for buildings with Nominated Area (HVAC) > 2000m^2

The reference case against which these improvements are measured is based on the Notional Building modelling results from the ENE-1 Credit. However as ENE-1 assumes the base case to be air cooled a COP conversion factor is used within the tool. For the conversion factor, it is assumed that the notional air-cooled chiller has an average COP of approximately 3, and the notional water-cooled chiller a COP of 5. Therefore, a conversion factor of -10% is applied.

Please note: This conversion factor is applied automatically and users need not perform any additional calculations on the Notional Building energy modelling results. The statement above is for information only.

3.2.1 Inputs

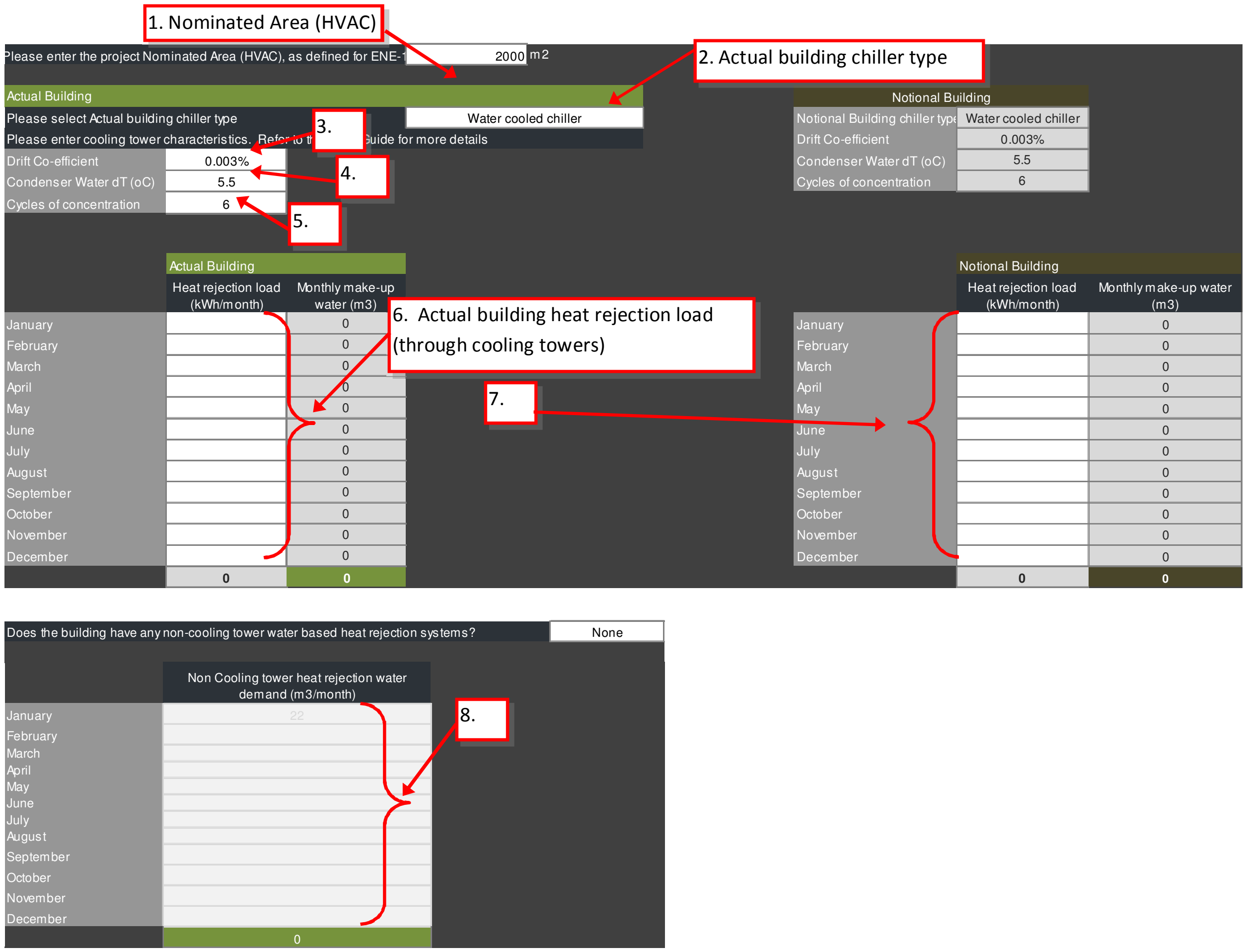


Figure 3 – Heat Rejection water demand inputs required

1. Nominated Area (HVAC)

For the purpose of this credit *Nominated Area (HVAC)* must be entered, consistent with the inputs provided in ENE-1. A definition of Nominated Area (HVAC) can be found in the Energy Calculator and Modelling Protocol guide.

2. Actual building chiller type

The user must select whether the actual building has an air-cooled or water-cooled chiller.

3. Drift co-efficient

This is only applicable if the actual building has water cooled chillers, and does not need to be filled in for buildings with air-cooled chillers.

This quantifies the percentage of condenser water lost due to droplets of water escaping the cooling tower, through wind or other environmental factors. For the actual building, a default value of 0.003% can be used; alternatively users can input their own value, with justification. Notional building drift co-efficient is assumed to be 0.003%, if the notional building chiller is assumed to be water-cooled.

4. Condenser Water dT

This is only applicable if the actual building has water cooled chillers, and does not need to be filled in for buildings with air-cooled chillers.

This is the temperature difference between condenser water flowing into and out of the cooling tower. For the actual building, a default value of 5.5°C can be used; alternatively users can input their own value, with justification. Notional building condenser water dT is assumed to be 5.5°C, if the notional building chiller is assumed to be water-cooled.

5. Cycles of concentration

This is only applicable if the actual building has water cooled chillers, and does not need to be filled in for buildings with air-cooled chillers.

This quantifies how much water is lost to bleed-off for each condenser water cycle. For a cycle of concentration of 'X', each unit of water can circulate 'X' times through the cooling tower, before too much water has been evaporated from it and it the concentration of impurities in the water becomes too high. To keep water quality at an acceptable level, 1/Xth of the condenser water is bled off after each cycle, and replaced with 'new' water.

For the actual building, a default of 6 cycles of concentrations can be used assuming that municipal potable quality water is used (). Using recycled water will typically result in a reduced number of cycles of concentration (due to recycled water containing a higher concentration of impurities), leading to more water (but less potable water) being used. If non municipal water is used please justify the cycle of concentration assumed.

For the Notional building, 6 cycles of concentration is assumed, if the notional building chiller is assumed to be water-cooled.

6. Actual Building heat rejection load

This is only applicable if the actual building has water cooled chillers, and does not need to be filled in for buildings with air-cooled chillers.

This is the heat load rejected through the cooling towers, including the refrigeration effect and the work done by the chiller. The user is required to enter the monthly heat rejection load into the calculator, consistent with the Actual Building results obtained from the detailed energy modelling done for ENE-1.

For buildings where there is both water-based and air-based based heat rejection, only the heat load that is rejected via the cooling towers is to be entered into the water calculator for the actual building. This must be justified and be consistent with ENE-1 inputs and calculations.

If the method of compliance for ENE-1 is not through energy modelling and no model was constructed, the monthly cooling loads can be calculated by the mechanical engineer.

7. Notional Building heat rejection load

This is only applicable if the notional building is assumed to have water cooled chillers, and does not need to be filled in for notional buildings with air-cooled chillers.

This is the heat load rejected through the cooling towers, including the chiller load. The user is required to enter the monthly heat rejection load into the calculator, consistent with the Notional Building results obtained from the detailed energy modelling done for ENE-1.

As described previously, a conversion factor will be applied to the Notional Building heat rejection loads, to account for the Notional Building being modelled with an air-cooled chiller.

8. Non Cooling tower heat rejection water demand

If the building has a non-cooling tower water-based heat rejection system such as direct evaporative cooling, the user is required to enter the system's monthly water demand, calculated manually, in m3 per month. Should a building have both cooling tower and non-cooling tower water-based heat rejection, the heat load rejected through cooling towers and water consumed through non-cooling tower heat rejection should be apportioned accordingly.

The Notional building is assumed to have no non-cooling tower water based heat rejection systems.

3.2.2 Calculation Methodology

The total heat rejection make-up water demand is calculated taking into account:

- Evaporation – the water evaporating into the atmosphere because it's absorbing heat from the building. The amount lost is directly related to the building heat load, and calculated using water characteristics as shown in the table in figure 6.
- Drift – the percentage of the condenser water lost as it flows through the cooling tower, due to environmental factors like wind. This is influenced by the cooling tower design (how sheltered it is) and by the amount of water flowing through the tower.
- Bleed – the amount of water that has to be removed from the system and replaced after each cycle, to keep the concentration of dissolved solids in the water at an acceptable level. This is influenced by the purity of the condenser water.

Table 4 - Assumed constants for calculating heat rejection water demands

List of constants	
Latent heat of vaporisation (kJ/kg)	2256
Density of water (kg/L)	1
Specific heat of water (kJ/LoC)	4.18

3.2.3 Summary of inputs & assumptions

Heat Rejection Water	ACTUAL BUILDING		NOTIONAL BUILDING	
		VERIFICATION DOCUMENTS		REFERENCE
Heat rejection method	As per design	Extracts from Tender Documentation/As Built Drawings verifying the heat rejection method	Nominated Area (HVAC) < 2000m2 - Air-cooled; Nominated Area (HVAC) > 2000m2 - Water-cooled	Consistent with ENE-1 Compliance route 2
If actual and or notional building is water-cooled				
Drift co-efficient	As per design	Extracts from Tender Documentation/Manufacturers Data Sheets verifying the values used in the calculator	0.003%	ASHRAE 2008 HVAC Systems and Equipment S39 SI - Cooling Towers (TC 8.6)
Condenser water dT	As per design		5.5	Standard industry practice
Cycles of concentration	As per design		6	Eurovent, 9/5, 2nd Edition: 2002, Recommended Code of Practice to Keep Your Cooling System Efficient & Safe
Heat rejection load	Same as Energy Model actual building results	Actual Building total heat rejection load as determined by Energy Modelling, or calculated by Mechanical engineer if no modelling was done for ENE-1	Same as Energy Model SANS 204 notional building results	SANS 204 Notional Building total heat rejection load as determined by Energy Modelling, or calculated by Mechanical engineer if no modelling was done for ENE-1

3.3 Irrigation water demand

Landscape irrigation can often form the largest portion of the water demand. This water does not need to be treated to levels suitable for drinking, however in most cases, potable mains water is used for irrigation purposes.

This section rewards landscape irrigation design efficiency - the use of appropriate plant choices with low water demands and irrigation systems which are effective at providing water without environmental losses due to wind drift etc. It also aims to encourage projects to have irrigation controls which scheduled irrigation supply according to seasonal demand or rainfall.

While some irrigation designs still assume a set weekly irrigation rate throughout the year, best practice is to define different rates for different rainfall seasons; Green Star SA therefore assumes that this water saving practice is used in the Notional Building.

For the purposes of the Potable Water Calculator, default seasonal irrigation schedules are determined based on rainfall in that region. The Notional building makes use of this default schedule whereas the Actual building must specify if any, and which irrigation controls, are installed. The irrigation schedule ranges from 100% (none of the irrigation demand is met by rain) to 50% (50% of the irrigation requirement is met by rain).

Further landscape irrigation demand reduction by using non-potable water is calculated under 'Sustainable Water'.

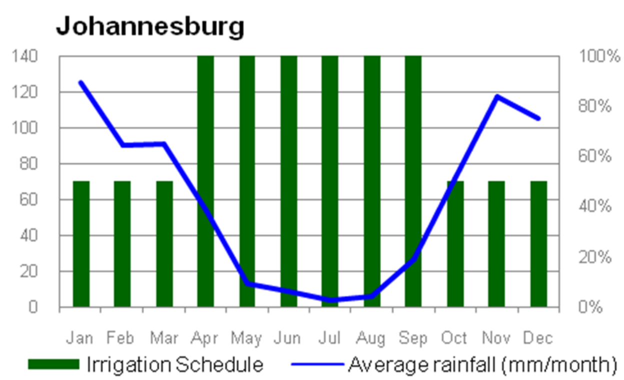


Figure 4 – Example seasonal irrigation schedule: Johannesburg. All schedules included in Appendix C

3.3.1 Inputs

1. Landscape Area description	2. Area (m2)	3. Irrigation requirements	Consumption per week	4. Irrigation system	5. Microclimate	6. Irrigation System Controls
Landscape 1	1200	Medium low	12.5mm/m2/week	Drip - Under mulch	Normal	Seasonal Programmable Timer
Landscape 2						
Landscape 3						
Landscape 4						
Landscape 5						
TOTAL (m2)	1 200					

Figure 5 – Landscape irrigation input table

1. Landscape area description

A descriptive name for each landscape area

2. Area

Enter the area in m2 for each landscaped area.

3. Irrigation requirements

Choose high, medium, low or xeriscape irrigation requirement based on the planting types and the irrigation requirements as prescribed by the landscape designer. These default peak established demands (in mm/m2/week) can be compared against the plant listing table in Appendix B that itemizes a number of commonly used landscape plants and their respective irrigation demands.

Table 5 - Assumed water consumption for different irrigation requirements

Irrigation requirement	Peak established demand
Xeriscaping	0mm/m2/week
Low	7.5mm/m2/week
Medium low	12.5mm/m2/week
Medium	20mm/m2/week
Medium high	30mm/m2/week
High	40mm/m2/week

4. Irrigation system

Select the irrigation system installed for each landscaped area. Different irrigation systems have varying degrees of efficiency when it comes to delivering the required amount of water to landscaped areas, and factors such as wind, runoff and uniformity impact on how much water reaches, and can be absorbed, by plants. This is taken into account by the user selecting an irrigation method, with associated application efficiency. In this way, projects are rewarded for installing irrigation systems which are efficient. Select the irrigation efficiency according to the type of irrigation and when the irrigation is applied. The Notional building assumes 75% efficiency (Sprinklers applied at night). Due to surface run-off, rainfall is assumed to be 60% effective.

Table 6 - Assumed irrigation application efficiency for different irrigation methods

Average irrigation application efficiency	
Rainfall	60%
Sprinklers - Day	65%
Sprinklers - Night	75%
Sprays - Day	65%
Sprays - Night	70%
Microsprays - Day	60%
Microsprays - Night	65%
Drip - Bare soil	80%
Drip - Under mulch	85%
Subsurface drip (SDI)	90%
Hand watering (by hose)	50%

5. Microclimate

The level of exposure is selected based on the location of the landscaped area in relation to other features that may protect it, to account for landscaped areas which would require more or less irrigation due to being sheltered or exposed. The 'Normal' micro-climate is used for the Notional building.

Table 7 - Assumed microclimate factors

Microclimate factor	
Exposed - no shade during the day, high temperatures, full wind exposure on all sides	1.3
Normal	1
Protected - full shade, no direct sun during the day. High wind protection, shelter on 3 or 4 sides	0.7

6. Irrigation System Controls

For the Actual Building, select which of the following controls are installed:

1. **No controls** - landscape is irrigated at the same peak requirement throughout the year
2. **Seasonal Programmable Timer** - irrigation schedule as per Notional building – irrigation is set to 100% during dry seasons and 50% during rainy seasons.
3. **Precipitation sensing** – Takes rainfall into account to reduce irrigation requirements.

The Notional building is assumed to have the default seasonal schedule.

SANS 204 region and rainfall data (entered under Building Information)

This input has already been entered under 'Building information'. The SANS 204 climatic region corresponding to the building location is determined when the building location is selected under 'Building Inputs'. This is used to determine the default seasonal schedule which is used by the Notional building and is an option for the Actual building. It assumes that irrigation is reduced during the rainy season. Graphs for each of the climatic zones are provided in Appendix C.

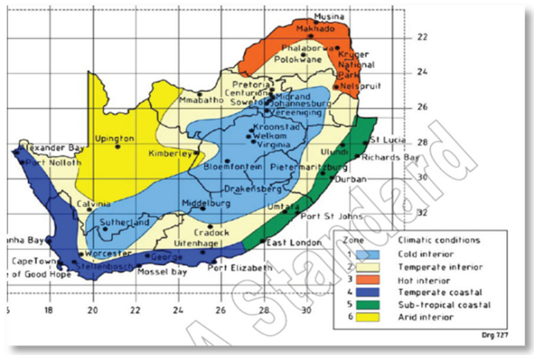


Figure 6 – SANS 204 Climatic regions

3.3.2 Calculation Methodology

The volume of water required for irrigation is calculated using the irrigated areas at the rates provided. The irrigation efficiency and microclimate are factors applied to the required irrigation rate to determine the volume of water that must be provided.

Depending on the irrigation controls specified, the following irrigation schedules are used

- If there are no irrigation controls, no schedule is applied to plant water demand and irrigation requirement is simply the monthly plant water demand
- With a seasonal programmable timer, it is assumed that the irrigation schedule will be a default seasonal schedule based on the SANS 204 climatic region
- If there is precipitation sensing, the rainfall data is correlated with the irrigation requirement to determine how much of the requirement is met by rainfall.

3.3.3 Summary of Inputs & Assumptions

Irrigation	ACTUAL BUILDING		NOTIONAL BUILDING	
Landscape irrigation		VERIFICATION DOCUMENTS		REFERENCE
Landscape areas and description	As per design	Tender/As Built Drawings marked up to show the different landscaped areas, plant types, irrigation demands, landscape area sizes, and microclimate	As Actual Building	-
Irrigation requirements	As per design	Extract from Tender Documentation/As Built Drawings indicating projected established water demand, and species plant list	30mm/m2/week	Industry standard practice
Irrigation system	As per design	Extract from Tender Documentation/As Built Drawings/Manufacturers Datasheets indicating irrigation systems to be installed	75% (night time sprinklers)	-
Microclimate	As per design	Tender/As Built Drawings	normal	-
Irrigation system controls	As per design	Tender/As Built Drawings detailing irrigation system controls	Seasonal programmable timer	-

3.4 Swimming pools

Reduction in potable water usage for swimming pools can be achieved through any combination of the following:

- Efficient pool filtration systems
- The use of a pool cover
- Using non-heated pools
- Sheltering the pool from environmental conditions (indoor pool)
- Reuse of backwash water, which is included under the 'Sustainable Water' section of the calculator

Two water demands from swimming pools are taken into account in the calculator – backwash for cleaning the filters, and evaporation. Several factors influence the water consumption of swimming pools. Backwash is influenced by the type of filtration system and the type of filtration system controls. Evaporation is influenced by whether it is an indoor or outdoor swimming pool, whether it is heated and if a pool cover is installed.

3.4.1 Inputs

SANS 204 climatic region & Rainfall region

Selections from the Irrigation section carry over for use in this section. If no regions are selected an error is indicated.

Pool volume [m3]

The volume of the pool is input into the calculator to determine the notional building pump size. The same pool volume is assumed for the Notional and Actual buildings. For the notional building, it is assumed that the pump is sized to have the capacity to cycle the whole volume of the pool within 5 hours. The pump size is used to calculate backwash water consumption. For the Actual building the actual pump size is used.

Pool surface area [m2]

The surface area of the pool is input into the calculator for calculating the evaporation off the pool water surface. The same surface area is assumed for the Notional and Actual buildings.

Pool filtration system

For the Actual building, users can select between a sand / sorptive media filter, a cartridge filter or natural filtration, depending on the system installed in the actual building.

- Sand/Sorptive Media filters require backwashing, which consumes water. If Sand/sorptive Media filter is selected, the user is required to enter the pool pump flow rate (in litres per minute), which is used to determine backwash water requirements. It is assumed that filters are backwashed once for every 70 hours of pump operation (based on one cycle every two weeks at 5 hours per day – recommended spring/autumn schedule). Water used for backwashing is eligible for recycling, and can be indicated as such under the 'Sustainable Water' section of the calculator.

- Cartridge filters require manual cleaning (hosing down the filters). If cartridge filtration is selected, the user has to enter the number of cartridges installed in the pool which is used to determine filter cleaning water requirements. As with backwashing, cartridges are assumed to be cleaned once every 70 hours of pump operation, and to use 100 litres per cartridge per cleaning cycle. This is more water efficient than backwashing, but more difficult to recapture the cleaning water for reuse. If the user claims that cleaning water is recycled, it must be demonstrated that the system is designed for this.
- Natural filtration requires no backwash/cleaning water

The Notional building assumes a standard sand filter.

Pool filtration controls

If Sand / Sorptive media or cartridge filters are selected, the user selects whether filtration systems have basic or advanced controls. Basic controls have standard hours of pumping per day for all seasons of the year. Advanced controls include automated control systems that allow for seasonal pool routine (i.e. multiple timer settings), automatic pressure sensors with automatic backwashing (reducing backwash cycles per year) and controlled backwash periods. Advanced controls have a backwash period of 1.5mins instead of 2.5mins for Basic controls.

Pool filtration controls influence the frequency of backwashing and cartridge filter cleaning, and the duration of backwashing, as shown in the tables below.

Table 8 - Backwash / Cartridge filter cleaning schedules for different controls

Backwash schedule	(Assuming one backwash for every 70hrs of pool operation)			
Basic controls				
	Pump hrs/day	Days/year	Pump operation Hrs/year	Backwash/Cartridge cycles per year
Summer	7	90	630	9.0
Spring/Autumn	7	183	1281	18.3
Winter	7	92	644	9.2
TOTALS		365	2555	36.5
Advanced Controls				
	Pump hrs/day	Days/year	Hrs/year	Backwash/Cartridge cycles per year
Summer	7	90	630	9.0
Spring/Autumn	5	183	915	13.1
Winter	2.5	92	230	3.3
TOTALS		365	1775	25.4

Indoor or outdoor

It is assumed that an indoor pool will have only 40% of the evaporation of an equivalent outdoor pool. This assumes that the pool hall is kept at a balanced temperature and humidity to reduce the temperature and humidity differences between the pool water and surrounding air. The Notional building will be the same as the actual building.

Heated or non-heated

Heated pools lose significantly more water than non-heated pools. It is assumed heated pools will lose 40% more water than non-heated pools. The Notional building pool is assumed to be non-heated.

Pool cover

Input whether the Actual building has a pool cover or not. The Notional building assumes no cover. Please note that the pool cover must be an evaporation barrier – safety nets are not considered pool covers. It is assumed that the pool is covered at night during the swimming season. Furthermore it is assumed that most rainwater falling on the pool is able to enter the swimming pool even when the cover is in place. A pool cover is assumed to reduce evaporation loss by 90%. (Daisy Pool Covers, *Fact sheet 1 Evaporation*, 2005).

The table below shows the various different assumed pool evaporation co-efficients.

Table 9 - Pool evaporation co-efficients

Evaporation co-efficients	
Indoor	40%
Outdoor	100%
Non-heated	100%
Heated	140%
Pool Cover	10%

Filtration pool area

If a user selects 'Natural Filtration' under filtration systems, the filtration pool area, and whether the filtration pool is indoor or outdoor, is requested. This is only required if a dedicated and physically distinct filtration pool area, which will not be used for swimming, is installed. If the filtration pool area forms part of the main pool, its area can be included under 'Pool surface area' and 'Filtration pool area' can be set to 0.

3.4.2 Calculation methodology

Water consumption by swimming pools is calculated for the entire year – It is assumed that the pool will be operational throughout the year.

The water consumption is calculated as the sum of the evaporation off the swimming pool surface and the water loss due to backwashing.

Evaporation

Evaporation is calculated by multiplying the pool surface area with an average monthly evaporation rate for the climatic region. ETO evaporation data from Agromet Weather Stations for each of the six SANS 204 climatic zones were used to determine the monthly average evaporation rate.

The evaporation rates are adjusted with the evaporation co-efficient, based on whether the pool is indoor/outdoor, heated/non-heated or has a pool cover, as described earlier.

Monthly evaporation is offset by monthly rainfall data to calculate the net evaporation loss (Evaporation loss – rainfall gain). This method does not account for pool overflow, which is conservative and will slightly benefit the design team. Indoor pools do not receive any rainfall top-up.

Backwash / filter cleaning water loss

Dependant on the filtration system selected, the water loss for filter maintenance is determined as follows

- Sand/Sorptive media filters – The pump flow rate (in litres per minute) is multiplied by either 1.5min or 2.5min (according to which filtration controls were selected) and by the number of times per month the filters are backwashed (according to which filtration controls were selected). This gives monthly backwashing water requirements. This water can be claimed for reuse under the 'Sustainable water' section of the calculator.
- Cartridge filters – the number of filters installed, as specified by the user, is multiplied by the number of times the filters are cleaned per year (according to which filtration controls were selected). As stated, each filter cleaning is assumed to consume 100 litres of water. This cleaning water can be reused under the 'Sustainable water' section of the calculator but must be justified through design demonstration as it is not intrinsic to the filtration system.

3.4.3 Summary of inputs

Swimming Pools	ACTUAL BUILDING		NOTIONAL BUILDING	
		VERIFICATION DOCUMENTS		REFERENCE
Pool volume (m3)	As per design	Tender drawings / as built drawings verifying inputs into the calculator	As Actual Building	-
Pool surface area (m2)	As per design		As Actual Building	-
Indoor / Outdoor	As per design		Outdoor	-
Pool filtration system	As per design	Extracts from tender documentation/Manufacturers Data Sheets detailing pool filtration system design, and verifying inputs entered into the calculator	Sand filter	Industry standard practice
Pool pump flow rate (litres/min)	As per design		Sized to cycle pool volume in 5 min	Industry standard practice
Pool filtration controls	As per design		Basic controls	Industry standard practice
Number of cartridge filters (if applicable)	As per design		not applicable	-
Pool cover used	As per design		No	-
Heated / Non-heated	As per design		None heated	-
Filtration pool area (m2) and location, if applicable	As per design	Tender/as built drawings showing filtration pool	not applicable	-

3.5 Laundry Facilities

Where laundry facilities are provided as part of the base building (i.e. laundry supports or is ancillary to the primary function of the base building), projects need to enter the estimated laundry load per month (in kg). Note that this does not apply for commercial laundries acting as retail tenants within a building as these are susceptible to churn. If the Notional Building consumption for laundry accounts for more than 3% of the total typical building water consumption (occupant amenities, heat rejection and irrigation), the project needs to account for laundry facilities in the calculator. At less than 3% of total (a very small laundry facility), projects can choose whether to include laundry facilities in the calculator or not. The Notional Building reference case assumes 26 litres of water per kilogram of laundry.

Reduction in potable water usage can be achieved through more efficient wash extractors or through the use of non-potable water for laundry. In this section, only the efficiency of the equipment is considered to establish the total Actual Building consumption. Where projects make use of rainwater harvesting and/or treated grey/blackwater water to reduce the potable water usage, it is entered under the 'Sustainable Water' section of the calculator.

3.5.1 Inputs

Estimated laundry load per month

The user is required to enter the estimated laundry load per month. This can be based on the estimated load per day, multiplied by the number of days per month. Due to the varying nature of laundry loads projects are asked to input their own estimates, with justification (a conference centre might only do laundry 5 days a week, opposed to a hotel where laundry is done daily). Monthly input is required to facilitate later non-potable water demand reduction calculations.

The same laundry loads are assumed for the Actual and Notional buildings.

In the example shown below, the laundry load for a conference centre with 500kg (500 sets of linen) is shown. If they wash every third day, the laundry load for January is calculated as 500kg x 10 days =5000kg, and so forth for the other months.

	Estimated Laundry Load (kg)
January	5 000
February	5 000
March	5 000
April	5 000
May	5 000
June	5 000
July	5 000
August	5 000
September	5 000
October	5 000
November	5 000
December	5 000
	60 000

Figure 6 – Example input of estimated laundry loads per month

Efficiency of equipment

This input is optional if Notional Building Laundry consumption accounts for less than 3% of total Notional Building water consumption.

The user is required to enter the water efficiency of the laundry equipment in litre per kilogram. Water efficiency of the equipment needs to be justified with a manufacturer's data sheet confirming the litres of water used per kilogram of linen.

3.5.2 Calculation Methodology

The equipment efficiency entered by the user is multiplied by the monthly load to determine the monthly water consumption by the laundry facility.

Potable water savings due to the use of recycled or rainwater is taken into account under the 'Sustainable Water' section of the calculator.

3.5.3 Summary of Inputs & Assumptions

Laundry Facilities	ACTUAL BUILDING		NOTIONAL BUILDING	
		VERIFICATION DOCUMENTS		REFERENCE
Monthly laundry load (kg)	As per project estimates	Short report including calculations showing laundry load estimates	As Actual building	-
Efficiency of laundry equipment (litre per kg)	As per equipment installed	Extracts from Tender Documentation/Manufacturer's data sheet showing equipment consumption in litre per kg	26 litres per kg	Sydney Water EDC documents

3.6 Large Kitchens

Large kitchens are defined as kitchens where meals are served to building users, and do not include tea kitchens or kitchens for personal food preparation. Note that this does not include restaurant tenancies within the building as these would be susceptible to churn, but does include kitchens in restaurant buildings and base-building kitchens for cafeteria's, conference centres, etc. Where large kitchens are provided as part of the base building, projects need to enter the estimated number of meals served per month, and indicate which of the following kitchen items are installed in the project, for use in preparing meals:

- Dishwashers
- Pre rinse valves
- Basin / Sink Taps
- Steam cookers

The Notional Building consumption is calculated based on which of the above is installed, using the reference values in Table 10. If the Notional Building consumption accounts for more than 3% of the total typical building water consumption (occupant amenities, heat rejection and irrigation), the project needs to account for Large Kitchens in the calculator. At less than 3% of total, projects can choose whether to include Large Kitchens in the calculator or not.

Reduction in potable water usage can be achieved through more efficient kitchen appliances or through the use of non-potable water for dishwashers. Where projects make use of rainwater harvesting and/or treated grey/blackwater water to reduce the potable water usage, it is entered under the 'Sustainable Water' section of the calculator.

Table 10 – Notional building Large Kitchen usage assumptions

Kitchen Item	Reference case usage	Usage
Dishwasher* - under counter	13 ltr/rack	1 rack per 10 meals
Pre rinse valves	20 ltr/min	1 minute per 5 meals
Basin / Sink Taps	12 ltr/min	1 minute per 5 meals
Steam Cookers	57 ltr/hour	1 hour per 25 meals

* Based on Energy Star Specifications

3.6.1 Inputs

Estimated meals served per month

The user is required to enter the estimated number of meals served per month. This can be based on the estimated meals per day, multiplied by the number of days per month. Due to the varying nature of meals served projects are asked to input their own estimates, with justification (an office might serve meals only 5 days a week, opposed to a hotel where meals are served 7 days a week). Monthly input is required to facilitate later non-potable water demand reduction calculations.

In the example shown below, the number of meals served in a conference facility where lunch is provided for 500 visitors, 10 times a month, is shown. The number of meals served in January is calculated as 500 x 10 =5000, and so forth for the other months.

	Estimated number of meals served
January	5 000
February	5 000
March	5 000
April	5 000
May	5 000
June	5 000
July	5 000
August	5 000
September	5 000
October	5 000
November	5 000
December	5 000
	60 000

Figure 7 – Example input of estimated meals served per month

Kitchen items installed

For each kitchen item, the user is asked to indicate whether or not the item is to be used in during meal preparation in the project.

Actual Building kitchen water demand per meal

This input is optional if Notional Building Kitchen consumption accounts for less than 3% of total Notional Building water consumption.

The user is required to enter the calculated kitchen water demand per meal. For details on how these calculations are done, please refer to Appendix D.

3.6.2 Calculation Methodology

The water demand per meal is multiplied by the monthly number of meals served to determine the monthly water consumption of the kitchen facility.

Potable water savings due to the use of recycled or rainwater is taken into account under the 'Sustainable Water' section of the calculator.

3.6.3 Summary of Inputs & Assumptions

Large Kitchens	ACTUAL BUILDING		NOTIONAL BUILDING	
		VERIFICATION DOCUMENTS		
Monthly number of meals served	As per project estimates	Short Report including calculations showing meals served estimates	As Actual Building	-
Calculated water demand per meal	As per project estimates	Please refer to Addendum D	As per Table 10	-

3.7 Other major water demands

Where a project team feels that there is another base-building major water demand in which they have reduced potable water consumption, which is not covered in the tool, they can enter the monthly water demand in the space provided under 'Other major water demands', for both the Actual and the Notional Buildings. Space is provided for up to three other demands, and each demand will only be eligible if the reference case (Notional Building) demand exceeds 3% of the total Notional Building demand for occupant amenities, heat rejection and irrigation. This 'Other major water demand' will become available as a source of recycled water under 'Sustainable water'. The project must clearly demonstrate the claimed water consumption through calculations and verification documentation, approved by the GBCSA through a CIR process.

Water demand description		Car Wash
	Actual Building (m3/month)	Notional Building (m3/month)
January	150	220
February	150	220
March	150	220
April	150	220
May	150	220
June	150	220
July	150	220
August	150	220
September	150	220
October	150	220
November	150	220
December	150	220

When the descriptive name for the other water use is entered, it becomes available as a recycled water source, and can use recycled or rainwater, just as any other building water demand

Recycled water - Greywater, blackwater, swimming pool backwash water				Yes
Recycled water SUPPLY				
	Recycled/Not?	Total consumption (m3/year)	% recaptured for reuse	Recycled water available
Toilets		0		0
Urinals		0		0
Indoor Taps		0		0
Showers		0		0
Bleed		0		0
Swimming Pool backwash		0		0
Car Wash	Recycled	1 800	60%	
Total recycled water supply (m3 per year)				**0**

Recycled water **DEMAND**		
	connected to recycled	reduction by greywater
Toilets		0
Urinals		0
Indoor Taps		0
Showers		0
Heat Rejection		0
Irrigation		0
Swimming pool make up		0
Car Wash	100%	1 080
Demand reduction due to water recycling (m3/year)		**1 080**

In the example shown, 60% of the Car Wash water is recycled for re-use by the same car wash facility

Figure 8 – Example input showing how 'Other major water demands' is reflected under the 'Sustainable Water' section of the calculator

4 Sustainable water

Once the water consumption is calculated, alternative water supplies are considered to determine how much of the water demand can be offset using non-potable water sources.

Sustainable Water is defined as water that is collected on site or recycled/recovered from a previous use such as black water or grey water. Previously unused water from high-value fresh water sources (e.g. lake, river or groundwater) cannot contribute to the amount of sustainable water used. In addition, extracting ground water from any neighbouring fresh-water sources impacts on the water table level and merely localises a problem what otherwise would take place on the municipal or provincial level

The following sources of sustainable water are taken into account:

- **Recycled water** – greywater from indoor taps and showers; blackwater from toilets and urinals; recaptured heat rejection bleed and swimming pool backwash
- **Rainwater** harvested from flat building surfaces
- **Other non-potable water supplies**, specified by the user

It is possible that one water demand can be met by multiple sustainable water sources – for example landscape irrigation which is fed by both recycled greywater and rainwater. For such cases, the calculation is done in a way to prioritise greywater and blackwater recycling (which benefits the projects in EMI-6 Discharge to Sewer) and accurately model demands that are met by more than one non-potable source.

The table below summarises the inputs and verification documents required for 'Sustainable Water'.

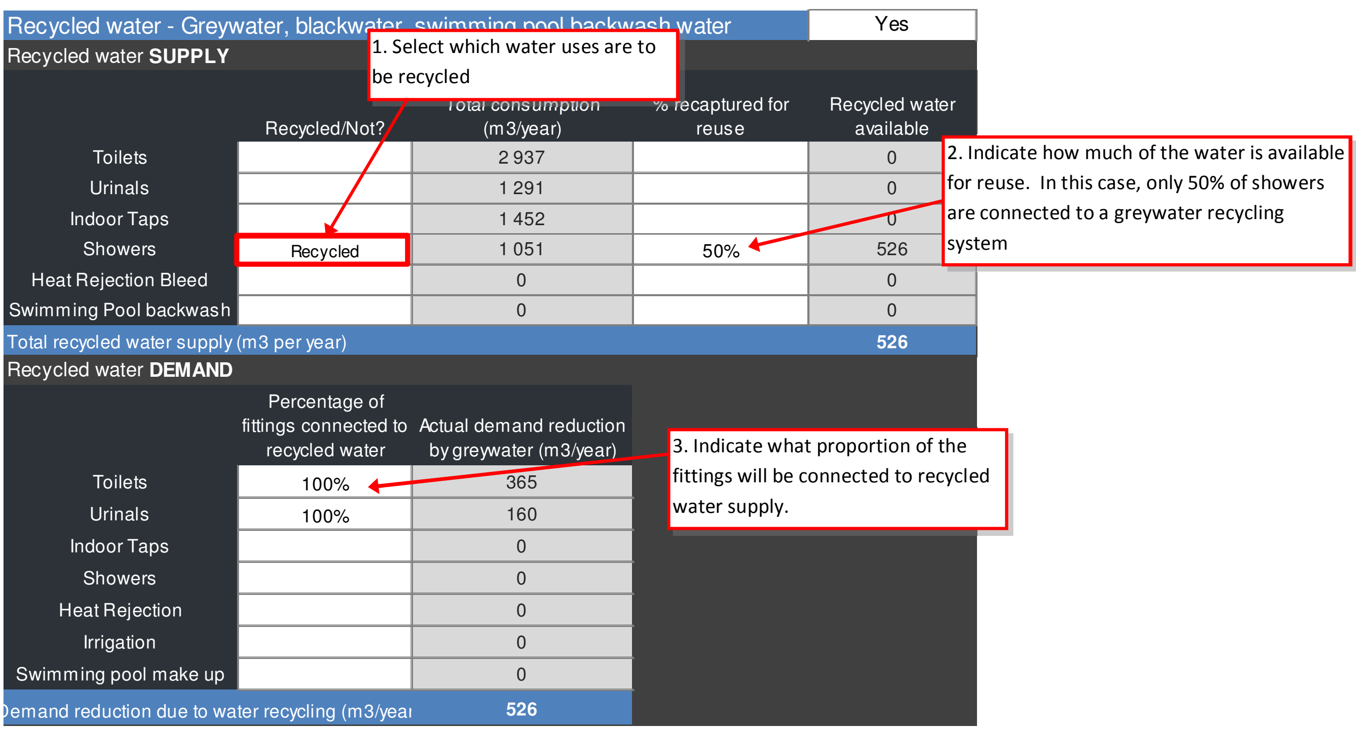
4.1 Summary of input for Sustainable Water supplies

Sustainable Water	ACTUAL BUILDING	NOTIONAL BUILDING
Greywater and Blackwater recycling	VERIFICATION DOCUMENTS	
Water reuse system installed	Tender/As Built Documentation showing the contractual requirement to install the proposed sustainable water system, description of the overall system operation, storage capacity, connections to the non-potable water supply/demand and all operational parameters necessary for completion of the Potable Water Calculator.	No water recycling assumed for Notional Building
Daily system capacity		
Percentage recaptured		
Rainwater harvesting		
Storage size (m3)	Tender/As Built Documentation showing the contractual requirement to install the proposed sustainable water system, description of the overall system operation, storage capacity, connections to the non-potable water supply/demand and all operational parameters necessary for completion of the Potable Water Calculator.	No rainwater harvesting assumed for Notional Building
Rainwater harvesting area description and areas		
Run-off co-efficient		

Other sustainable water supply		
Monthly supply available	Tender Documentation/As Built Drawings Showing the connection to off-site reclaimed water supply, and connection to water demands. Evidence of agreement with water supplier if supplied off-site, and capacity to supply the detailed volumes of water	No 'Other sustainable water supply' assumed for Notional Building

4.2 Recycled water

For calculation purposes, greywater, blackwater and swimming pool backwash are treated as a single source. The treatment required is the responsibility of the design team and does not affect the Potable Water Calculator. The total water recycled from these sources is summed and it is assumed the system capacities are sized to handle the load. Where a building includes a recycling system which is too small to deal with the full water supply, the percentage input as recaptured should be adjusted to account for this.



Recycled water - Greywater, blackwater, swimming pool backwash water				Yes
Recycled water SUPPLY				
	Recycled/Not?	Total consumption (m3/year)	% recaptured for reuse	Recycled water available
Toilets		2 937		0
Urinals		1 291		0
Indoor Taps		1 452		0
Showers	Recycled	1 051	50%	526
Heat Rejection Bleed		0		0
Swimming Pool backwash		0		0
Total recycled water supply (m3 per year)				526

Recycled water DEMAND		
	Percentage of fittings connected to recycled water	Actual demand reduction by greywater (m3/year)
Toilets	100%	365
Urinals	100%	160
Indoor Taps		0
Showers		0
Heat Rejection		0
Irrigation		0
Swimming pool make up		0
Demand reduction due to water recycling (m3/year)		526

Figure 9 – SANS 204 Climatic regions

4.2.1 Inputs

Recycled water supply

The user specifies which building water uses will be recycled, and how much of the water will be recaptured for reuse. From this is calculated the total recycled water supply available.

Recycled water demand

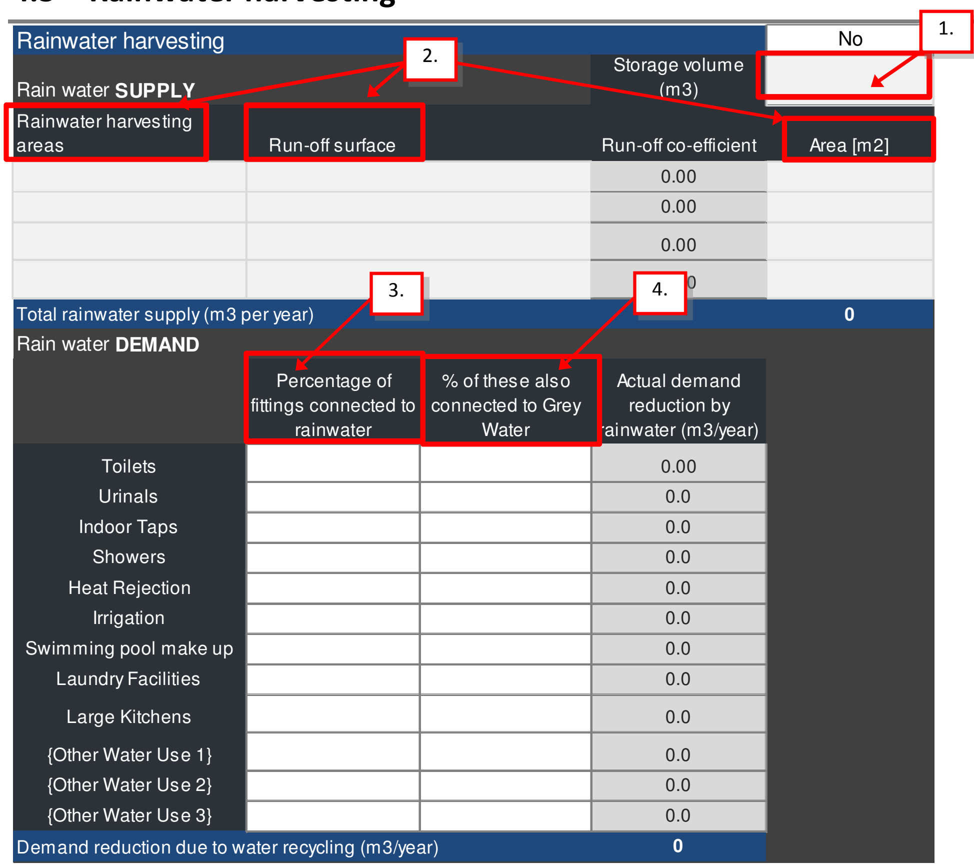
For each building water demand, the user specifies which percentage of the demand is connected to recycled water (for example 100% if all toilets are connected to non-potable supply, 33% if only one of three toilet blocks are connected).

4.2.2 Calculation Methodology

Monthly recycled water supply is calculated based on the fittings that feed the recycled supply. No storage is taken into account for recycled water, as it assumed that the systems designed include sufficient storage and treatment capacity to process the amount specified as recaptured, and most recycled water is used as it becomes available.

All the recycled water supply is lumped together, as is the demand, and monthly balancing calculations determine the amount of potable water saved.

4.3 Rainwater harvesting



Rainwater harvesting			No
Rain water **SUPPLY**		Storage volume (m3)	
Rainwater harvesting areas	Run-off surface	Run-off co-efficient	Area [m2]
		0.00	
		0.00	
		0.00	
		0	
Total rainwater supply (m3 per year)			0
Rain water **DEMAND**	Percentage of fittings connected to rainwater	% of these also connected to Grey Water	Actual demand reduction by rainwater (m3/year)
Toilets			0.00
Urinals			0.0
Indoor Taps			0.0
Showers			0.0
Heat Rejection			0.0
Irrigation			0.0
Swimming pool make up			0.0
Laundry Facilities			0.0
Large Kitchens			0.0
{Other Water Use 1}			0.0
{Other Water Use 2}			0.0
{Other Water Use 3}			0.0
Demand reduction due to water recycling (m3/year)			0

Figure 10 –Rainwater harvesting inputs

4.3.1 Inputs

1. Storage volume

The size, in m3, of the rainwater storage provided.

2. Rainwater harvesting areas

The user selects a descriptive name for each rainwater catchment area, its area (in m2) and the catchment surface which determines the run-off co-efficient for that area.

3. Rainwater demand

For each building water demand, the user specifies which percentage of the demand is connected to rainwater supply.

4. Percentage of fittings also connected to grey water

The user must also enter what percentage of fittings connected to rainwater, are *also* connected to greywater. This will determine how much of the demand, if any, is partly met by greywater.

For example – consider a building with two toilet cores:

Scenario 1 - Both toilet cores are connected to grey water and rainwater. Thus 100% of the toilets are connected to rainwater, and *of that 100%, 100% is connected to greywater as well.*

	Percentage of fittings connected to rainwater	% of these also connected to Grey Water
Toilets	100%	100%

Scenario 2: One toilet core is connected to both rain and greywater. Thus 50% of the toilets are connected to rainwater, and *of that 50% 100% is connected to greywater as well.*

	Percentage of fittings connected to rainwater	% of these also connected to Grey Water
Toilets	50%	100%

Scenario 3: One toilet core is connected to rainwater only, the other is connected to greywater only. Thus, 50% of the toilets are connected to rainwater, and *of that 50%, none are connected to greywater as well.*

	Percentage of fittings connected to rainwater	% of these also connected to Grey Water
Toilets	50%	0%

This is in order to not incorrectly attribute rainwater and greywater where single demands are met by multiple sustainable water sources.

4.3.2 Calculation Methodology

Daily inflow / outflow calculations are used to determine potable water reduction due to rainwater harvesting. A design rainfall year is calculated using monthly weather data from the building location. For each rainy day

- The gross run-off generated from flat surfaces (in m3) is calculated from surface areas and descriptions entered into the calculator by users
- A volume of water must be diverted from the water storage to prevent storage from being contaminated with pollutants. This volume is referred to as the first flush, and assumed to be 0.5L/m2. The first flush volume lost (calculated at 0.5L/m2) in each rainfall event is subtracted from the gross run-off available, to determine the harvested rainwater available

Calculating rainwater demand per day

- The water demand, as determined from user input, is used to determine the demand for rainwater per day. Reduction in daily demand due to recycled water usage is taken into account.

Daily water balancing calculations

- Daily rainwater supply and demand is used to determine reduction in potable water consumption, with excess supply stored for use the next day

The table below shows the assumptions used in rainwater harvesting calculations.

Table 11 - Assumed constants for rainwater harvesting calculations

Rainwater collection	
First flush volume	0.5L/m2
Rain day minimimum	1mm
Run-off co-efficients	
Steel roof >30o Pitch	0.9
Non-absorbent roof>30o Pitch	0.9
lat non-absorbent roof < 30o Pitch	0.8
Flat gravel or turf roof < 30o pitch	0.65

4.4 Other non-potable water supply

"Other sustainable water supply" is any non-potable water that is being used in the building that is not already addressed in the calculator, such as treated effluent from a waste water treatment plant or condensate from the chillers.

Previously un-used water from high-value fresh water sources (e.g. lake, river or ground water) cannot contribute to the amount of non-potable water used. In addition to the surface water table dropping, there is a global deficit of groundwater, and extracting water from any neighbourhood fresh water sources merely localises what otherwise would take place on the municipal or state level.

4.4.1 Inputs

Other sustainable water supply

The calculator allows for up to three supplies to be considered. A description of each supply and the monthly water available is input by the user. The design team must justify the assumptions and calculations in supporting documentation.

Other sustainable water demand

For each building water demand, the user specifies which percentage of the demand is connected to other sustainable water supply.

4.4.2 Calculation Methodology

Monthly supply of each other sustainable water supply is entered by the user, however in the calculations all entered supply sources are treated as a single supply. No storage is taken into account. Potable water reduction is calculated by subtracting monthly demands from the monthly supply that serves the demands.

5 Water usage summary

The water usage summary shows the water demand for the Actual and Notional buildings, and the reduction in water demand for the Actual building because of non-potable water sources. The percentage reduction in potable water consumption of the actual building compared to the notional building, and the associated number of points claimed, is determined from this.

6 Reduction in discharge to sewer – connection to EMI-6

Buildings get rewarded for reducing the amount of water they discharge to the sewerage system.

Project teams do not need to input any information into the Sewerage Calculator. All information required for the calculations are taken for the Potable Water calculator.

Discharge to sewer can be reduced through water efficient fixtures and fittings, and diverting greywater and blackwater from the sewers, for treatment and re-use.

7 Summary of Inputs

Building Information input	**ACTUAL BUILDING**		**NOTIONAL BUILDING**	
	VERIFICATION DOCUMENTS			
Occupant type	**Statement of Confirmation (1)** from the Building Owner or Project Architect confirming: • Occupant inputs (occupant type, design number of occupants, occupancy profile, peak days per week, percentage of occupants who have access to shower); • The number of staff that will work in the building simultaneously during standard operation; and • The maximum number of visitors/students to the building simultaneously during standard operation.		As Actual Building	
Design number of occupants			As Actual Building	
Occupancy profile			As Actual Building	
Peak days per week			As Actual Building	
Percentage of occupants who have access to shower			As Actual Building	
Occupant Amenity Water	**ACTUAL BUILDING**		**NOTIONAL BUILDING**	
		VERIFICATION DOCUMENTS		REFERENCE
Toilets flush rates	As per design	Extracts from the specifications/Manufacturers Data Sheets, showing flow rates and controls entered into the calculator.	4 litres per flush	WELS 3 Star
Urinal flush rates	As per design		2 litres per flush	WELS 3 Star
Taps flow rates	As per design		9 litres per minute, no controls	WELS 3 Star
Shower flow rates	As per design		12 litres per minute	WELS 2 Star
Heat Rejection Water	**ACTUAL BUILDING**		**NOTIONAL BUILDING**	
		VERIFICATION DOCUMENTS		REFERENCE
Heat rejection method	As per design	Extracts from Tender Documentation/As Built Drawings verifying the heat rejection method	Nominated Area (HVAC) < 2000m2 - Air-cooled; Nominated Area (HVAC) > 2000m2 - Water-cooled	Consistent with ENE-1 Compliance route 2
If actual and or notional building is water-cooled				
Drift co-efficient	As per design	Extracts from Tender Documentation/Manufacturers Data Sheets verifying the values used in the calculator	0.003%	ASHRAE 2008 HVAC Systems and Equipment S39 SI - Cooling Towers (TC 8.6)
Condenser water dT	As per design		5.5	Standard industry practice
Cycles of concentration	As per design		6	Eurovent, 9/5, 2nd Edition: 2002, Recommended Code of Practice to Keep Your Cooling System Efficient & Safe
Heat rejection load	Same as Energy Model actual building results	Actual Building total heat rejection load as determined by Energy Modelling, or calculated by Mechanical engineer if no modelling was done for ENE-1	Same as Energy Model SANS 204 notional building results	SANS 204 Notional Building total heat rejection load as determined by Energy Modelling, or calculated by Mechanical engineer if no modelling was done for ENE-1
Irrigation	**ACTUAL BUILDING**		**NOTIONAL BUILDING**	
Landscape irrigation		VERIFICATION DOCUMENTS		REFERENCE
Landscape areas and description	As per design	Tender/As Built Drawings marked up to show the different landscaped areas, plant types, irrigation demands, landscape area sizes, and microclimate	As Actual Building	-
Irrigation requirements	As per design	Extract from Tender Documentation/As Built Drawings indicating projected established water demand, and species plant list	30mm/m2/week	Industry standard practice

Irrigation system	As per design	Extract from Tender Documentation/As Built Drawings/Manufacturers Datasheets indicating irrigation systems to be installed	75% (night time sprinklers)	-
Microclimate	As per design	Tender/As Built Drawings	normal	-
Irrigation system controls	As per design	Tender/As Built Drawings detailing irrigation system controls	Seasonal programmable timer	-
Swimming Pools	**ACTUAL BUILDING**		**NOTIONAL BUILDING**	
		VERIFICATION DOCUMENTS		REFERENCE
Pool volume (m3)	As per design	Tender drawings / as built drawings verifying inputs into the calculator	As Actual Building	-
Pool surface area (m2)	As per design		As Actual Building	-
Indoor / Outdoor	As per design		Outdoor	-
Pool filtration system	As per design	Extracts from tender documentation/Manufacturers Data Sheets detailing pool filtration system design, and verifying inputs entered into the calculator	Sand filter	Industry standard practice
Pool pump flow rate (litres/min)	As per design		Sized to cycle pool volume in 5 min	Industry standard practice
Pool filtration controls	As per design		Basic controls	Industry standard practice
Number of cartridge filters (if applicable)	As per design		not applicable	-
Pool cover used	As per design		No	-
Heated / Non-heated	As per design		None heated	-
Filtration pool area (m2) and location, if applicable	As per design	Tender/as built drawings showing filtration pool	not applicable	-
Laundry Facilities	**ACTUAL BUILDING**		**NOTIONAL BUILDING**	
		VERIFICATION DOCUMENTS		REFERENCE
Monthly laundry load (kg)	As per project estimates	Short report including calculations showing laundry load estimates	As Actual building	-
Efficiency of laundry equipment (litre per kg)	As per equipment installed	Extracts from Tender Documentation/Manufacturer's data sheet showing equipment consumption in litre per kg	26 litres per kg	Sydney Water EDC documents
Large Kitchens	**ACTUAL BUILDING**		**NOTIONAL BUILDING**	
		VERIFICATION DOCUMENTS		
Monthly number of meals served	As per project estimates	Short Report including calculations showing meals served estimates	As Actual Building	-
Calculated water demand per meal	As per project estimates	Please refer to Addendum D	As per Table 10	-
Other major demands	**ACTUAL BUILDING**		**NOTIONAL BUILDING**	
		VERIFICATION DOCUMENTS		
Other major water uses monthly demands	As per project estimates	Calculations and verification documents supporting claimed water consumption for actual building through CIR process	As per project estimates	Calculations and verification documents supporting claimed water consumption for notional building

Sustainable Water	ACTUAL BUILDING	NOTIONAL BUILDING
Greywater and Blackwater recycling	VERIFICATION DOCUMENTS	
Water reuse system installed	Tender/As Built Documentation showing the contractual requirement to install the proposed sustainable water system, description of the overall system operation, storage capacity, connections to the non-potable water supply/demand and all operational parameters necessary for completion of the Potable Water Calculator.	No water recycling assumed for Notional Building
Daily system capacity		
Percentage recaptured		
Rainwater harvesting		
Storage size (m3)	Tender/As Built Documentation showing the contractual requirement to install the proposed sustainable water system, description of the overall system operation, storage capacity, connections to the non-potable water supply/demand and all operational parameters necessary for completion of the Potable Water Calculator.	No rainwater harvesting assumed for Notional Building
Rainwater harvesting area description and areas		
Run-off co-efficient		
Other sustainable water supply		
Monthly supply available	Tender Documentation/As Built Drawings Showing the connection to off-site reclaimed water supply, and connection to water demands. Evidence of agreement with water supplier if supplied off-site, and capacity to supply the detailed volumes of water	No 'Other sustainable water supply' assumed for Notional Building

Appendix A: Occupancy Profiles

Standard occupancy profiles are based on the UK Dept. of Communities and Local Government's National Methodology (NCM) Activity Databases. For instructions on completing a custom profile, please refer to next page.

	Office		A1 Community / day centre		A1 Restaurant / Public House		A2 Sports Centre / Leisure centre		A2 Theatres / Cinemas / Music Halls		A3 Tertiary Education	
Time	Office		Hall / Lecture Theatre		Eating / Drinking area		School semester		Hall / Lecture Theatre		Classroom (Tert)	
	Peak	Off-Peak	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak
12am - 1am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1am - 2am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2am - 3am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3am - 4am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4am - 5am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5am - 6am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6am - 7am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
7am - 8am	15%	0%	0%	0%	25%	25%	0%	0%	0%	0%	0%	0%
8am - 9am	60%	5%	10%	0%	25%	25%	0%	0%	0%	0%	25%	0%
9am - 10am	100%	5%	25%	0%	50%	50%	0%	0%	75%	0%	50%	0%
10am - 11am	100%	5%	75%	0%	50%	50%	0%	25%	100%	0%	100%	0%
11am - 12pm	100%	5%	100%	0%	50%	50%	0%	25%	100%	0%	100%	0%
12pm - 1pm	100%	5%	100%	0%	100%	100%	25%	25%	75%	0%	100%	0%
1pm - 2pm	100%	5%	50%	0%	100%	100%	100%	25%	75%	0%	75%	0%
2pm - 3pm	100%	5%	50%	0%	50%	50%	100%	25%	100%	0%	75%	0%
3pm - 4pm	100%	5%	100%	0%	25%	25%	75%	25%	100%	0%	100%	0%
4pm - 5pm	100%	5%	100%	0%	25%	25%	0%	25%	100%	0%	100%	0%
5pm - 6pm	50%	0%	50%	0%	25%	25%	0%	25%	75%	0%	100%	0%
6pm - 7pm	15%	0%	50%	0%	50%	50%	0%	0%	0%	0%	50%	0%
7pm - 8pm	5%	0%	0%	0%	100%	100%	0%	0%	0%	0%	25%	0%
8pm - 9pm	5%	0%	0%	0%	100%	100%	0%	0%	0%	0%	0%	0%
9pm - 10pm	0%	0%	0%	0%	100%	100%	0%	0%	0%	0%	0%	0%
10pm - 11pm	0%	0%	0%	0%	50%	50%	0%	0%	0%	0%	0%	0%
11pm - 12am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Daily occupancy (person hours per day)	9.50	0.45	7.10	0.00	9.25	9.25	3.00	2.00	8.00	0.00	9.00	0.00
Maximum occupancy	100%	5%	100%	0%	100%	100%	100%	25%	100%	0%	100%	0%

Occupancy Profiles available in calculator (page 1 of 2)

Standard occupancy profiles are based on the UK Dept. of Communities and Local Government's National Methodology (NCM) Activity Databases. For instructions on completing a custom profile, please refer to next page.

	A3 Primary and Secondary Schools		A4 Places of Worship		Airport / Public Transport terminal buildings		C1 Convention Centre / Exhibition hall		C2 Libraries / Museums / Galleries		Courts		Gym	
	Classroom (General)		Hall / Lecture Theatre		Circulation		Hall / Lecture Theatre		Circulation		Hall / Lecture Theatre		Fitness suite / Gym	
Time	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak
12am - 1am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1am - 2am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2am - 3am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3am - 4am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4am - 5am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5am - 6am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6am - 7am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
7am - 8am	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%
8am - 9am	10%	0%	25%	0%	25%	25%	0%	0%	0%	0%	0%	0%	100%	100%
9am - 10am	25%	0%	75%	0%	50%	50%	75%	0%	0%	0%	75%	0%	25%	100%
10am - 11am	75%	0%	100%	0%	100%	100%	100%	0%	100%	0%	100%	0%	0%	100%
11am - 12pm	100%	0%	100%	0%	100%	100%	100%	0%	100%	0%	100%	0%	0%	100%
12pm - 1pm	100%	0%	50%	0%	100%	100%	75%	0%	100%	0%	75%	0%	25%	100%
1pm - 2pm	50%	0%	50%	0%	75%	75%	75%	0%	100%	0%	75%	0%	100%	100%
2pm - 3pm	50%	0%	100%	0%	75%	75%	100%	0%	100%	0%	100%	0%	100%	100%
3pm - 4pm	100%	0%	100%	0%	100%	100%	100%	0%	100%	0%	100%	0%	50%	100%
4pm - 5pm	100%	0%	50%	0%	100%	100%	100%	0%	100%	0%	100%	0%	0%	100%
5pm - 6pm	50%	0%	50%	0%	100%	100%	75%	0%	100%	0%	75%	0%	0%	100%
6pm - 7pm	50%	0%	0%	0%	50%	50%	0%	0%	0%	0%	0%	0%	50%	100%
7pm - 8pm	0%	0%	0%	0%	25%	25%	0%	0%	0%	0%	0%	0%	100%	100%
8pm - 9pm	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
9pm - 10pm	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	100%
10pm - 11pm	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
11pm - 12am	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Daily occupancy (person hours per day)	7.10	0.00	7.10	0.00	9.00	9.00	8.00	0.00	8.00	0.00	8.00	0.00	7.25	14.00
Maximum occupancy	100%	0%	100%	0%	100%	100%	100%	0%	100%	0%	100%	0%	100%	100%

Occupancy profiles available in calculator (page 2 of 2))

Instructions on how to enter user defined occupancy profiles are shown on this page. User defined schedules must be based on one of the Occupancy Profiles contained in the Energy Modelling Activity Schedules available for download from the GBCSA's website.

	<User Defined>	
Time	Enter description	
	Peak	Off-peak
12am - 1am		
1am - 2am		
2am - 3am		
3am - 4am		
4am - 5am		
5am - 6am		
6am - 7am		
7am - 8am		
8am - 9am		
9am - 10am		
10am - 11am		
11am - 12pm		
12pm - 1pm		
1pm - 2pm		
2pm - 3pm		
3pm - 4pm		
4pm - 5pm		
5pm - 6pm		
6pm - 7pm		
7pm - 8pm		
8pm - 9pm		
9pm - 10pm		
10pm - 11pm		
11pm - 12am		
Daily occupancy (person hours per day)	0.00	0.00
Maximum occupancy	0%	0%

Enter a descriptive schedule name.

Enter a short description of the schedule

Enter the percentage of design occupants typically present at a certain hour for peak and off-peak days

Figure 4 - User defined schedules

Appendix B: Watering Requirements for Typical Plants

List of Plants commonly used in the South Africa and their water usage

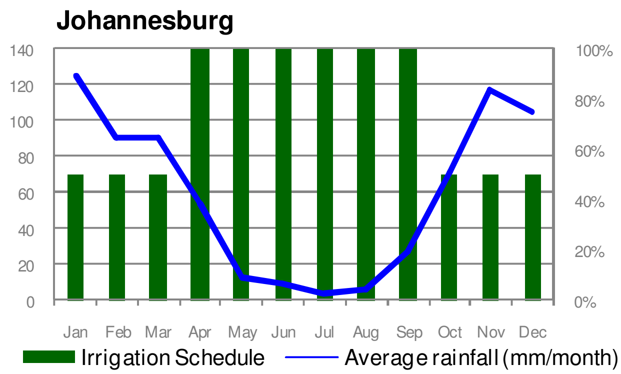
	mm/week
1. High Water demand plants	**40mm**
Cyperus textilis	
Kniphofia uvaria	
Wachendorfia spp.	
Zantedeschia aethiopica	
2. Medium high water demand plants	**30mm**
Elegia capensis	
Juncus krausii	
Melianthus major	
Plectranthus ciliatus	
Stenotaphrum secundatum (Buffalo Lawn)	
Sutera cordata	
Tulbaghia violacea	
3. Medium water demand plants	**20mm**
Asparagus densiflorus	
Barleria repens	
Buddleja salvifolia	
Carissa macrocarpa	
Cynodon dactylon (Kweek Lawn)	
Dietes grandiflora	
Dymondia margaretae	
Leonotis leonorus	
Pennisetum clandestinum (Kikuyu Lawn)	
Rhus crenata	
Scabiosa incisa	
4. Medium low water demand plants	**12.5mm**
Agapanthus praecox	
Agathosma spp.	
Arctotis acaulis	
Asystasia gangetica	
Bulbine frutescens	
Chrysanthemoides monilifera	
Crassula multicava	
Eriocephalus africanus	
Euryops pectinatus	
Felicia spp.	
Gazania spp.	
Hypoestes aristata	
Osteospermum jucundum	
Pelargonium capitatum	
Plectranthus neochilus	
Plumbago auriculata	
Salvia spp.	
Strelitzia reginae	
Tecoma capensis	
5. Low water demand plants	**7.5mm**
Aloe spp	
Aptenia codifolia	
Carpobrotus edulis	
Cotyledon orbiculata	
Euphorbia spp.	
Helichrysum petiolare	
Lampranthus spp.	
Portulacaria affra	
Ruschia macowanii	
Sanseveria spp.	

Please note: The above list is a selection of plant material that is typically used in the landscape industry. This is not intended to be a fully comprehensive list, but aims to guide the user as to types of plants and their water consumption. The amount of irrigation applied to these types of plants is intended to achieve a minimum acceptable level of landscape, ie: many of these plants can do with less water, but would not appear healthy and viable.

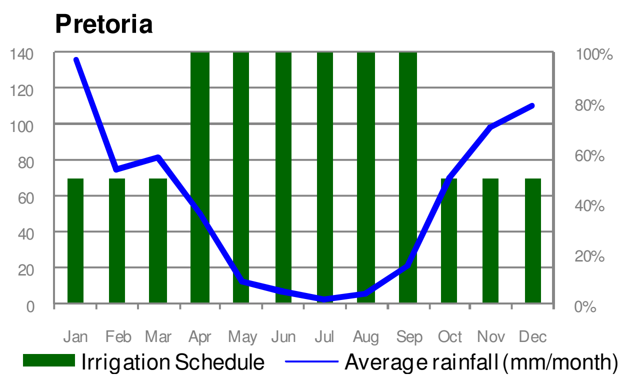
Appendix C: SANS 204 Climate Zones and Irrigation Schedules

Examples of irrigation schedules and annual average rainfall for SANS 204 climatic zones

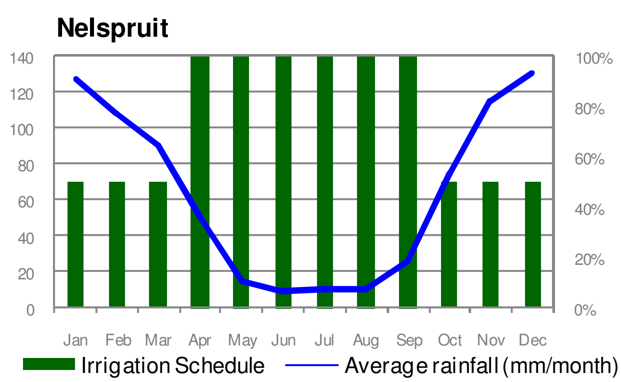
ZONE 1 – Cold Interior



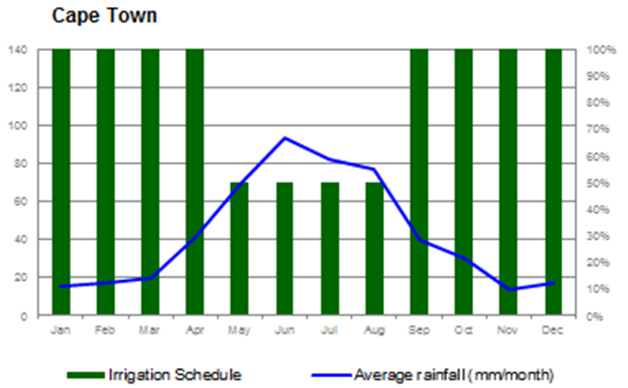
ZONE 2 – Temperate Interior



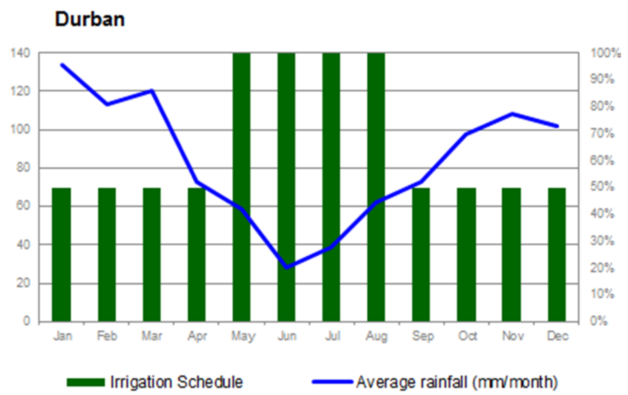
ZONE 3 – Hot Interior



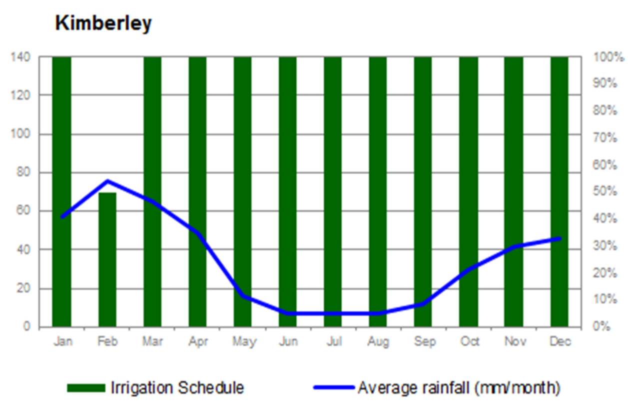
ZONE 4 – Temperate Coastal



ZONE 5 – Sub-tropical Coastal



ZONE 6 – Arid Interior



Appendix D: Establishing Large Kitchen Water Demand

The project must determine the water consumption per meal (in litres per meal) served in the kitchen, based on equipment installed. The reference case is established as per the table below. Follow the same procedure for the actual building. Water efficiency of equipment must be demonstrated and justified through manufacturer's datasheets.

Kitchen item	Reference case water usage	Usage	Reference Case (example based on a kitchen producing 600 meals per day)
Dishwasher[4]			
Under counter	13 ltr/rack	1 rack per 10 meals	1.3 litres per meal
Single Tank Door	8.4 ltr/rack	1 rack per 10 meals	0.84 litres per meal
Tank Conveyor	6 ltr/rack	1 rack per 10 meals	0.6 litres per meal
Multiple Tank Conveyor	4.1 ltr/rack	1 rack per 10 meals	0.41 litres per meal
Pre rinse valves	20ltr/min	1 minute per 5 meals	4 litres per meal
Basin / Sink taps	12ltr/min	1 minute per 5 meals	2.4 litres per meal
Steam Cookers	57 ltr/hour	1 hour per 25 meals	2.28 litres per meal

[4]Based on Energy Star Specifications

For a kitchen where Under Counter dishwashers are installed, along with pre rinse valves, basins and steam cookers, the consumption per meal would be 1.3 + 4 + 2.4 + 2.28 = 9.98 litres per meal.