

On-site Wastewater Treatment Solutions

October 2022



Basic wastewater terminology

To help you better understand each of our solutions, here are some definitions of terminology used when referring to wastewater:

- **Wastewater** - regarded as all wastewater generated by daily household activities (both blackwater and greywater). This includes wastewater generated from toilets, personal hygiene, and household cleaning.
- **Greywater** - refers specifically to water from washing machines, hand basins, baths, and showers, and requires that the greywater drainage be isolated. This water carries a lower organic load and can be reused for irrigation purposes with minimal processing.
- **Blackwater** - includes water from toilets, dishwashers and kitchen sinks with high concentrations of organic compounds and pathogenic bacteria that need to be reduced before it can be safely released into the environment, or re-used for non-potable applications.
- **Effluent** - generally refers to wastewater exiting a system or a process, such as sewage exiting a home or processed waste exiting a septic tank.

When choosing a solution, consider the following:

- The desired outcome
- The existing infrastructure
- The soil conditions on site
- The living conditions and volume of wastewater generated
- The height and variability of the groundwater table on site

Selection guide:

Product	Wastewater	Application	Installation	Ideal for	Detergents
Greywater tanks	Greywater	<ul style="list-style-type: none"> • Allows greywater to be reused for irrigation. • Reduces stress on septic tanks and soakaways in difficult soil. 	Below-ground	Homeowners who are looking for a simple, cost-effective way to reduce domestic water consumption.	Standard
Septic tanks with soakaways	Sewage	Collects and processes sewage before discharging it back into the soil through a soakaway system.	Below-ground	Areas with: <ul style="list-style-type: none"> • No connection to a sewer line. • Normal or sandy soil that will adequately absorb the effluent. • Low groundwater level (to prevent the contamination of groundwater sources). 	Bio-friendly
Conservancy tanks	Greywater and/or Blackwater	Temporarily stores wastewater and requires it to be pumped out.	Below-ground	Areas where connection to a sewer line is not possible, and septic tanks or wastewater treatment plants are not feasible/allowed.	Standard
On-site wastewater treatment plants	Greywater and/or Blackwater	Processes wastewater to a specified quality suited for irrigation purposes or other non-potable applications.	Above-or Below-ground	Applications where: <ul style="list-style-type: none"> • Waterborne, on-site sanitation is required. • Wastewater is to be reused to limit waste and/or reduce water usage. • The desired outcome is to go off-grid with all domestic wastewater. 	Bio-friendly

Need help making the most of your wastewater?

Our range of wastewater and sanitation solutions provides you the opportunity to better manage, dispose of, or recycle your wastewater in a safe, reliable and sustainable way.

Calcamite has the turnkey solution for you, whether you require a private sewage system because you don't have access to sewer mains, or you need an independent off-grid solution that is environmentally friendly.

Greywater tanks

The purpose of a greywater tank

A greywater system's purpose is to collect and treat greywater to allow you to safely reuse it for irrigation purposes.

The main components

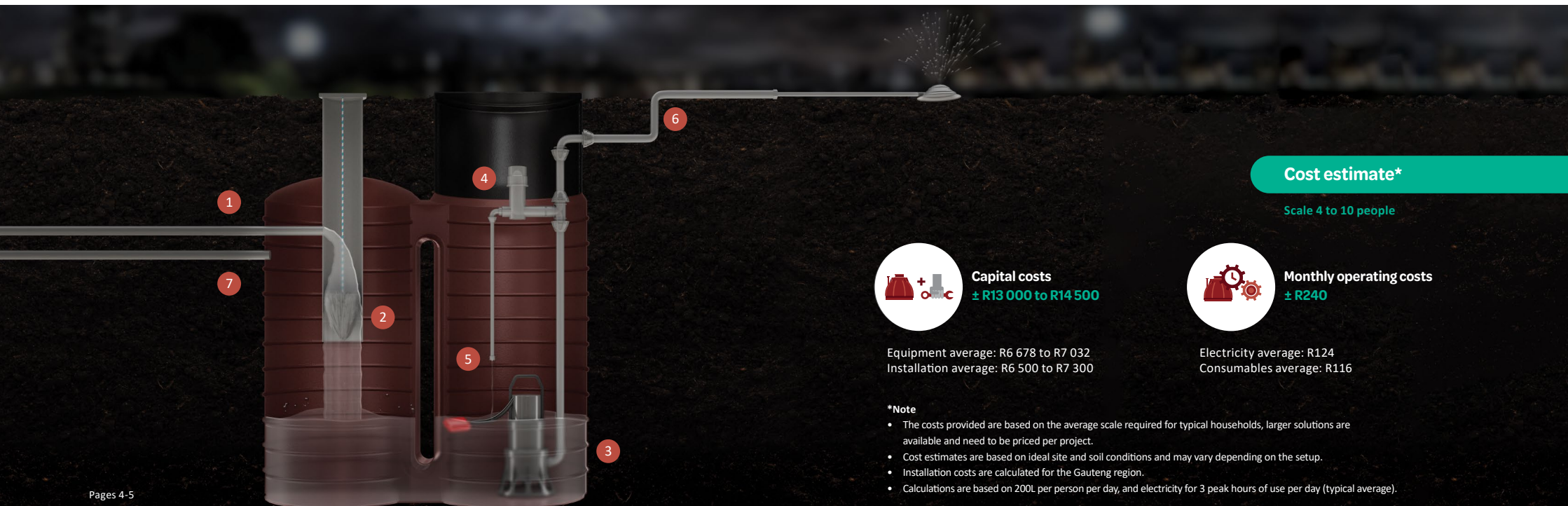
1. **Tank** - installed underground for greywater collection. **Note:** it is important that the tank is sized correctly to ensure it has enough capacity for all greywater to be collected and reused within a 24-hour period. **Greywater should never be stored for more than 24 hours before being used.**
2. **Disinfectant** - a disinfectant is a vital part of a greywater system as it makes the water safe for reuse and improves the quality of water inside the tank.
3. **Submersible pump** - a submersible pump suitable for dirty water uses is required to pump the greywater out of the tank and to your irrigation system.

How it works

- 1 Greywater from baths, showers, bathroom basins and laundry is redirected to the greywater system via the tank inlet.
- 2 Before entering the tank, the greywater passes through a filter brush designed to remove hair, lint and other solid particles that may be present in the waste stream. It is important to clean the filter brush on a regular basis to prevent flow blockage. **Note:** this is only applicable to the Greywater Basic System, not the Greywater Mini System.

- 3 After the greywater has passed through the filter brush, it enters the tank. Once the tank is filled to a required pre-set level, the pump's float switch is activated and it starts pumping the water through the disinfectant.
- 4 Here, the water is disinfected with calcium hypochlorite (a plant-friendly chlorine derivative) to kill pathogenic (potential disease forming) organisms.
- 5 A small percentage of the disinfected water is released back into the system to improve the quality of water stored in the tank and to help limit the development of foul odours.
- 6 The treated greywater is then pumped to the garden for irrigation purposes via the tank outlet. **Note:** to ensure effective distribution of the final treated effluent, a 20mm hose and a pyramid sprayer are recommended for this connection. As the water is pumped to the garden, the water level inside the tank drops. Once the water reaches the pre-set minimum level, the float switch switches the pump off to protect it from running dry and burning out.
- 7 The tank overflow is connected to the property sewer line, which is utilised when the tank gets too full, or when system maintenance is required.

- i Important:**
- This system has been designed to treat greywater (water from washing machines, bathroom basins, baths and showers).
 - Blackwater (water from kitchen drains, toilets or any water containing human waste) should be disposed of via your existing municipal sewer line, septic/conservancy tank or wastewater treatment plant.



Cost estimate*

Scale 4 to 10 people



Capital costs
± R13 000 to R14 500

Equipment average: R6 678 to R7 032
Installation average: R6 500 to R7 300



Monthly operating costs
± R240

Electricity average: R124
Consumables average: R116

*Note

- The costs provided are based on the average scale required for typical households, larger solutions are available and need to be priced per project.
- Cost estimates are based on ideal site and soil conditions and may vary depending on the setup.
- Installation costs are calculated for the Gauteng region.
- Calculations are based on 200L per person per day, and electricity for 3 peak hours of use per day (typical average).

Septic tanks

The purpose of a septic tank

A septic tank's purpose is to collect wastewater, and then separate and partially decompose as much heavy organic material as possible. The settled sewage can then either be discharged into the sub-soil via a soakaway system or treated further biologically for non-potable applications.

The main components

1. **Tank** - installed underground, in which sewage is collected and decomposed through bacterial activity.
Note: a septic tank can typically be expected to remove approximately 40% of the wastewater organic load.
2. **Soakaway drainage system** - after solids settle in the septic tank, the effluent is discharged to a soakaway drainage system for further treatment of discharged wastewater from the septic tank.
3. **Soil** - the soil surrounding the soakaway provides the final treatment and disposal of the effluent.

How it works

- 1 **First Chamber**
 - Domestic sewage enters the primary settlement chamber, where the heavier organic materials separate from the liquids. The heavier organic material settles to the bottom as sludge which is then partially decomposed under anaerobic conditions over time.
 - Lighter material (fats, oils and grease) accumulate on the water surface, forming a scum layer. This natural separation process allows a relatively solid-free, supernatant effluent to form in the mid-section of the water column.
 - **Note:** it is essential to size a septic tank correctly to allow for a minimum retention period of 24 hours.
- 2 **Second Chamber**
 - This chamber or inner baffle is designed to extract water from the clearest, most solid free zone of the primary settlement tank.

- 3 **Soakaway drainage system**
 - A soakaway (also called a French drain or leach field) is an essential component of an on-site wastewater management system that allows treated wastewater to percolate into the soil.
 - The soil then further purifies the wastewater before it reaches the groundwater or adjacent surface waters such as rivers, lakes and estuaries.

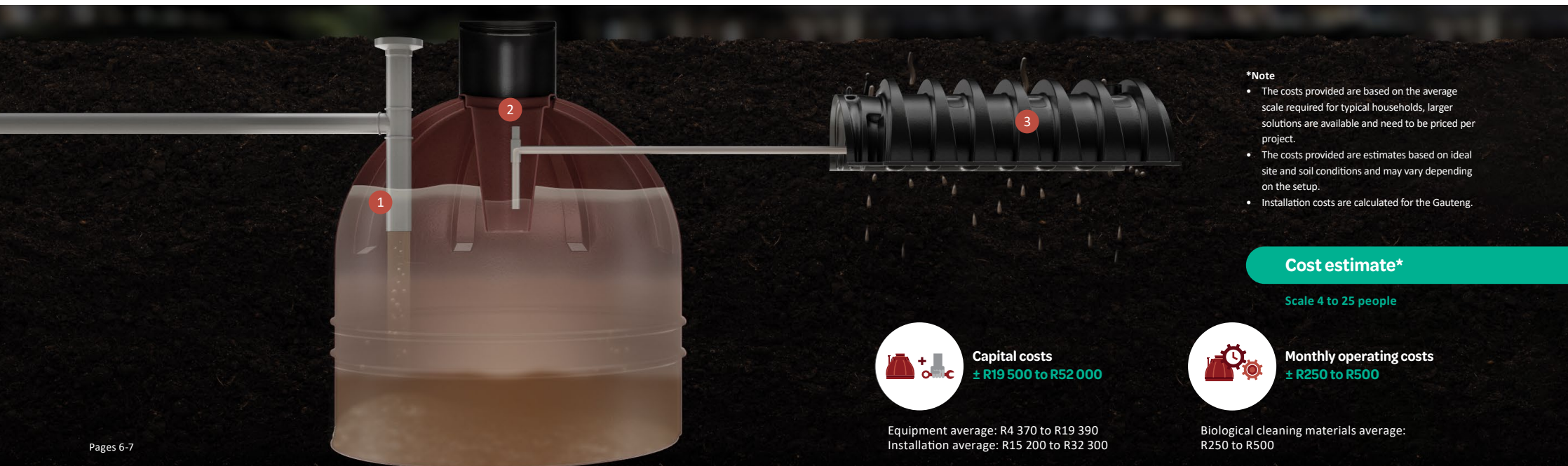
- i Important:**
- A soakaway drainage system should be adequately sized to allow for complete sub-soil disposal of the daily generated waste flow. The size is determined by an on-site percolation test (as per SANS 10400-P).
 - A loamy or sandy soil profile is required for suitable percolation.
 - A high groundwater table, waterlogged or clay soil, as well as rocky sub-terrain is usually unsuitable for the construction of a soakaway.
 - Soakaways should never be installed in dolomitic areas due to the risk of sinkhole formation.

Types of soakaways:

- Conventional soakaways consist of one or more trenches excavated into the subsoil that is filled with rocks and gravel and a series of pipes punctured with holes. This allows seepage to take place, and the effluent to gradually soak away into the ground. **Note:** we advise against the use of car tyres to fill a soakaway, as the waterproof rubber prevents percolation where it makes contact with the soil.
- **Infiltration Chambers are more cost-effective and less invasive alternatives, that greatly increase the efficiency of the post septic tank treatment.** They allow for the formation of a biological carpet or mat (bio-mat) of bacteria, which further digest any organic material still in the waste stream. As the bio-mat continues to grow, microbes in the soil consume it, developing a mini ecosystem within the subsoil. The result is a highly treated secondary effluent.

System maintenance:

- **The removal of settled organic material is typically applied on a minimum annual basis** to ensure that the hydraulic retention in the septic tank is not being compromised by accumulating volumes of sludge and/or scum. The services of a mobile tanker to remove this material from the site and to a municipal wastewater treatment plant is usually applied.



Conservancy tanks

The purpose of a conservancy tank

A conservancy tank's purpose is to temporarily collect and hold domestic wastewater on-site while preventing the contamination of groundwater.

The main components

1. **Tank** - installed underground, in which domestic wastewater is temporarily stored. **Note:** it is very important that a conservancy tank is sized correctly, as higher volumes of wastewater will require more frequent disposal.
2. **Waste removal** - once the tank is full, the wastewater needs to be pumped out and transferred to a suitable treatment plant. As an alternative to being disposed of, wastewater can also be treated in an on-site wastewater treatment plant for reuse in non-potable applications.

How it works

- 1 Domestic wastewater is directed into the tank via the inlet. **Note:** the watertight tank prevents possible contamination of the soil and groundwater.
- 2 Once full, the waste is pumped out via the lid/manhole and disposed of according to legislation.

Things to consider

- The tank size should be carefully considered as higher volumes of wastewater requires more frequent disposal.
- Ensure that there is a waste disposal company in your area that can assist with disposal of the waste as and when required. Bear in mind that the waste needs to be collected and then transferred to a suitable treatment plant.



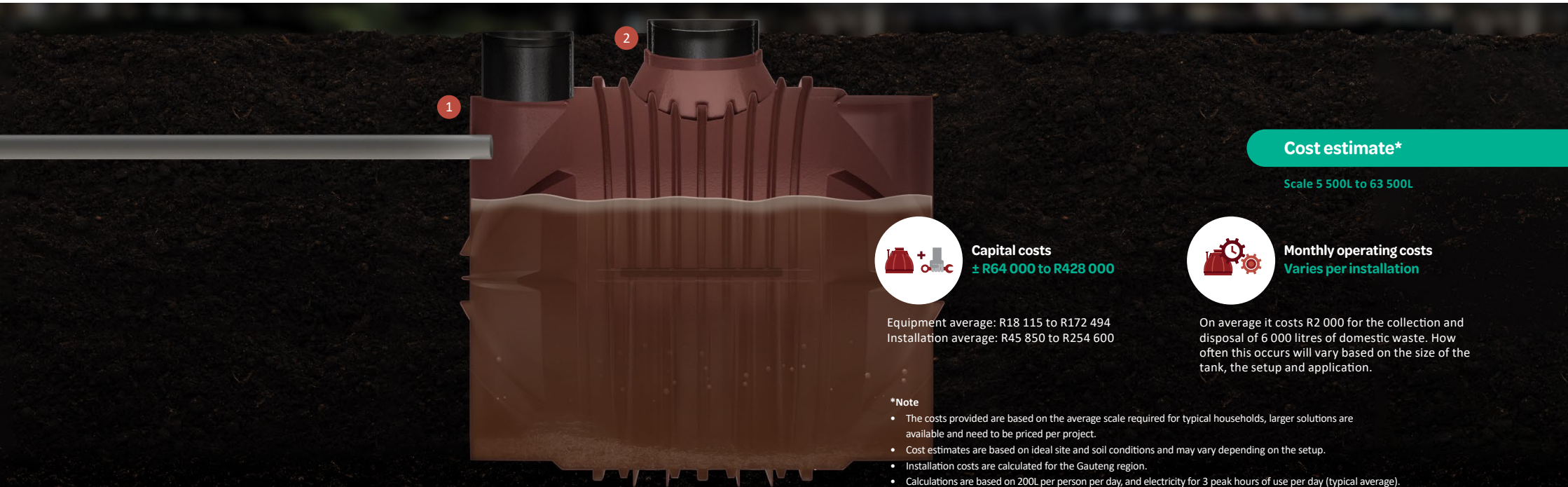
Important:

The illustration below demonstrates how a conservancy tank is used for wastewater storage.

The conservancy tank's application will determine the connection and installation setup. It is important to specify what you intend to store inside our conservancy tanks in order for us to provide you with the correct setup and guidelines as per your requirements.

Tanks in our range that can be used as conservancy tanks:

- Septic tanks
- Underground Modular tanks



Cost estimate*

Scale 5 500L to 63 500L



Capital costs

± R64 000 to R428 000

Equipment average: R18 115 to R172 494
Installation average: R45 850 to R254 600



Monthly operating costs

Varies per installation

On average it costs R2 000 for the collection and disposal of 6 000 litres of domestic waste. How often this occurs will vary based on the size of the tank, the setup and application.

*Note

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- Installation costs are calculated for the Gauteng region.
- Calculations are based on 200L per person per day, and electricity for 3 peak hours of use per day (typical average).

Wastewater Treatment Plants

The purpose of an on-site wastewater treatment plant

To receive all domestic wastewater and treat it to a specified quality, typically so that it can be safely re-used for non-potable applications, or returned to the environment without any negative impact.

The associated treatment phases

- 1. Primary phase** - utilises septic tanks for the removal of organic material.
- 2. Secondary phase** - deploys the Calcamite configured Bio-reactor to achieve aerobic oxidation of organic compounds through the growth of bacteria.
- 3. Disinfection** - eliminates pathogenic bacteria in the treated wastewater, rendering it safe for re-use/discharge.
- 4. Soakaway drainage system** - can be deployed to discharge surplus wastewater safely into the sub-soil.

How it works

- 1. Septic tank first chamber**
 - Domestic sewage enters the primary settlement chamber, where the heavier organic materials separate from the liquids. The heavier organic particles settle to the bottom of the tank where they will be subjected to anaerobic digestion.
 - Lighter material (fats, oils and grease) accumulate on the water surface, forming a scum layer. This natural separation process allows a relatively solid-free, supernatant effluent to form in the mid-section of the water column.
- 2. Septic tank second chamber**
 - This chamber or inner baffle is designed to extract water from the clearest, most solid free zone of the primary settlement tank.

- 4. Final settlement chamber**
 - Any residual organic material that dislodges from the biomass growing on the plastic filter media in the Bio-reactor, is allowed to settle in this chamber.
 - This ensures discharge of a high quality effluent that is low in suspended particles.
 - The settled material (referred to as humus) is pumped back into the septic tank for settlement and ultimate removal with the settled septic sludge.
- 5. Disinfection**
 - In the final stage of the treatment process, the settled effluent is disinfected to eliminate pathogenic bacteria. This ensures that potential disease outbreaks are mitigated.
 - Chlorine is a preferred option as a disinfectant, and is offered as a standard in our solutions. Alternative disinfection methods can be considered if needed.
- 6. Reuse of processed water**
 - The treated wastewater is then pumped to the garden for irrigation or other non-potable applications.
 - It is important to note that the wastewater can be processed to a specific target effluent quality, and utilised for a variety of applications. For the purpose of the illustration presented below, the re-use of the treated effluent for irrigation is indicated.
- 7. Soakaway drainage system**
 - The overflow is connected to a soakaway (a drain field that allows the treated wastewater to percolate into the ground) should the tank get too full or when system maintenance is required.
- i Important**
 - Please refer to the Septic Tank section on page 7 for detailed information on soakaways and basic system maintenance.

- 3. Bio-reactor**
 - Here, aerobic conditions are established by transferring predetermined quantities of air from the atmosphere via a small mechanical blower.
 - As a result, aerobic bacteria (present in the wastewater) manifest on the surface area of a unique plastic filter media inside the Bio-reactor, and feed on the organic compounds in the wastewater.



Cost estimate*

Scale 4 to 25 people live in full time

Capital costs
± R78 500 to R190 000

Equipment average: R34 782 to R114 350
Installation average: R43 500 to R75 600

Monthly operating costs
± R600 to R6700

Electricity average: R259 to R297
Consumables average: R116 to R860
Biological cleaning materials average: R250 to R1 500
Maintenance average (for larger systems): R4 000

***Note**

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- Calculations are based on 200L per person per day, and electricity for 3 peak hours of use per day (typical average).

Do you know about our turnkey solutions?

We offer a wide range of standard products, as well as turnkey solutions that include design, manufacturing, transportation, installation, maintenance, and supervision services for all wastewater and sanitation requirements.

Need some assistance? We would love to help.

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FOR WATER FOR LIFE

