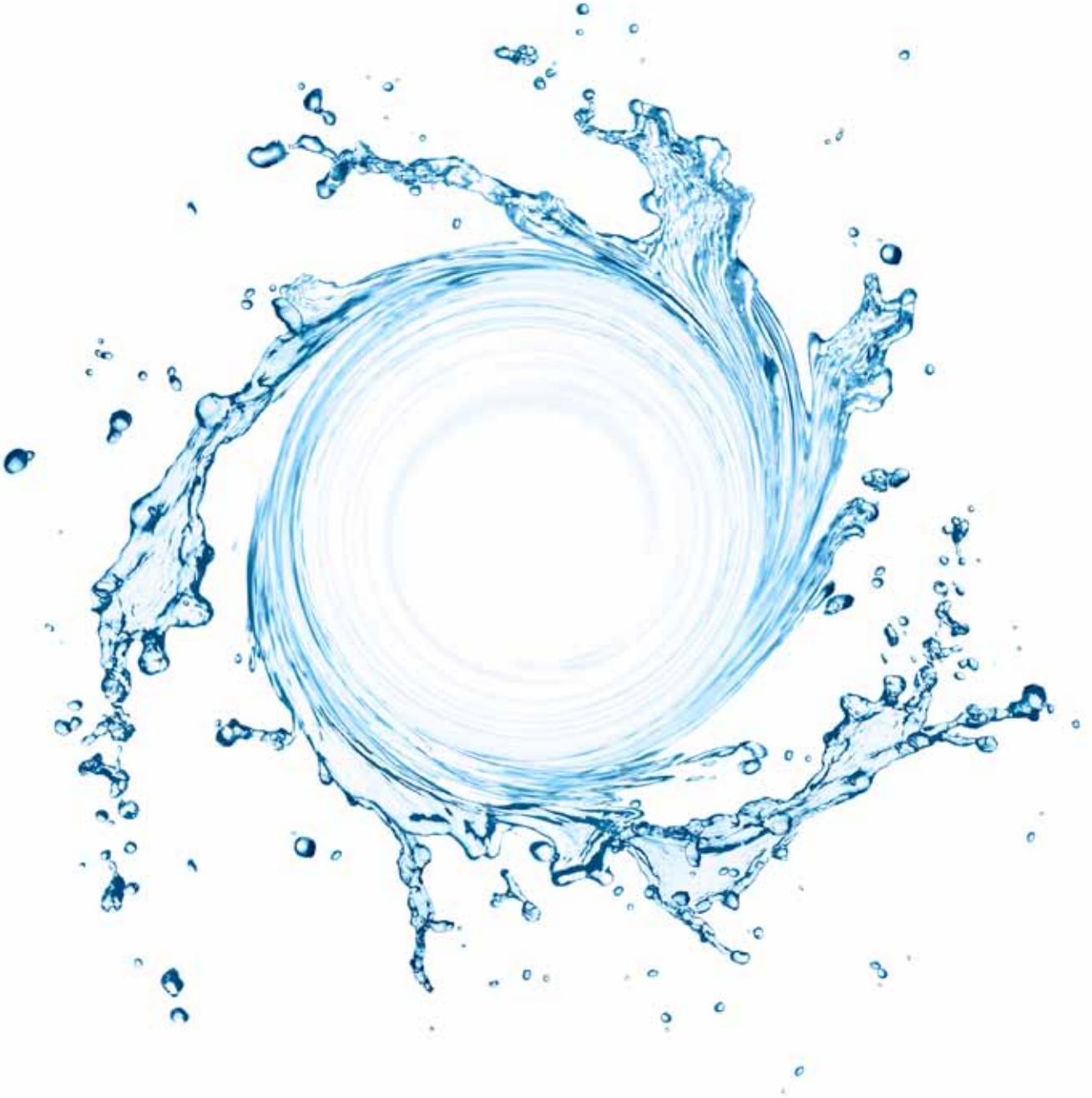




iWater – You Water !
Using greywater



iWater Wassertechnik GmbH & Co. KG specialises in decentralised water management. We are a premium partner for specialist retailers, trade professionals and industry supplying high-quality services and products for decentralised water supply and waste water disposal.

Our company offers a portfolio of products and services geared to decentralised water management which is unique on the market. We provide our customers and partners with support for this core subject through all the main stages of the process, from planning through to implementation.


Our employees have many years of experience in a wide range of applications and provide the basis for iWater's success. We will work with you to solve even the most ambitious challenges and find new solutions together.

iWater, your competent partner for the utilisation of

greywater
rain water
black water
well water
water treatment
pump technology

in residential, commercial and industrial buildings.

The  ewuaqua brand stands for the water supply, water treatment and water recycling divisions within the  EWUGruppe.

As part of  EWUGruppe, iWater Wassertechnik GmbH & Co. KG is in a position to provide customers and interested parties in the fields of energy, water and environment with advice that goes beyond its own products and services and to work together to find common solutions.

Feel free to contact us with any questions you may have. We look forward to hearing from you.

Your iWater Wassertechnik team

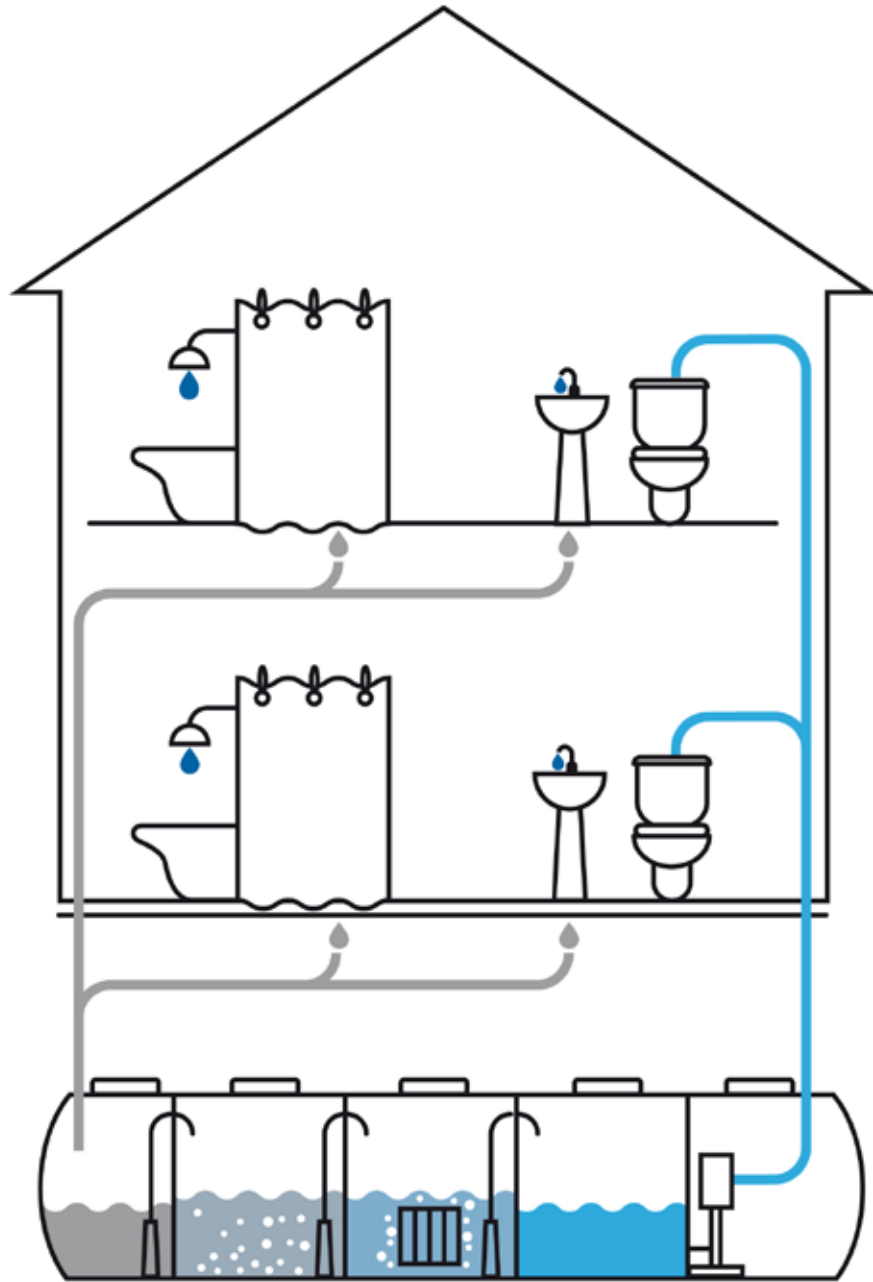





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Using greywater



-  Potable water
-  Operational water
-  Greywater

Information for planning, implementing and maintaining greywater systems from iWater.

There is currently no single, explicit, globally recognised definition of greywater. The European Standard 12056-1 defines greywater as wastewater with a low pollution level and no faecal matter such as produced by shower, bath, wash basin and washing machine and which can be used to prepare service water. In contrast, wastewater from the kitchen is not included due to the high levels of fat and food waste it contains.

The use of greywater, like the use of rainwater or well water, is a suitable way of reducing potable water consumed in buildings, helps protect the environment and lower the costs of water consumption. Furthermore, less wastewater is produced as a result of recycling greywater since the water is used twice, which leads to additional ecological and economic potential. It can be safely said that greywater recycling in large groups of buildings and hotels can be a sensible means of saving water and wastewater with little effort and offers significant returns due to its relatively low level of contamination representing an extremely efficient way of cutting costs.

There are various technical approaches to recycle greywater. Technologies differ considerably in their complexity, size, recycling performance and recycling quality. There are direct-use systems, retention systems as well as physical, chemical, biological and bio-mechanical systems.

Comparative studies have shown that the membrane bio-reactor (MBR) currently represents the best technology to recycle greywater thanks to its outstanding cleaning performance. Greywater systems using MBR technology also have the advantage that they require little space and can guarantee the relevant quality parameters even if the inflow characteristics fluctuate, which means that the requirements of the European Directive concerning the quality of bathing water are always guaranteed.

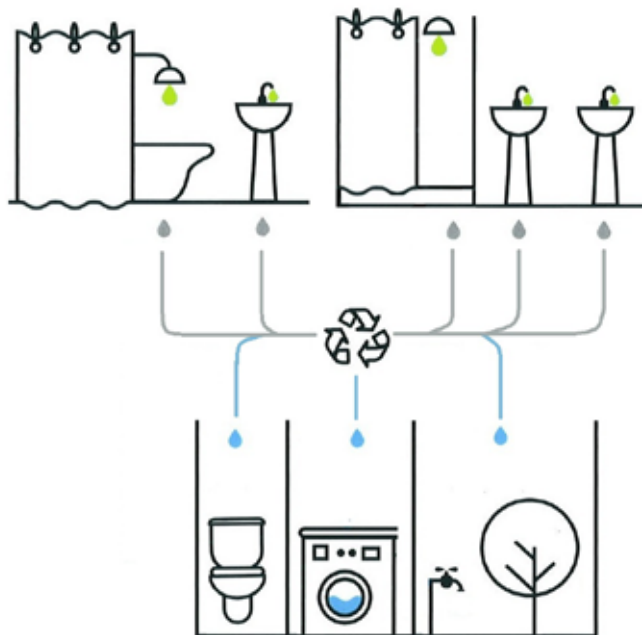
iWater greywater plants work in accordance with cutting-edge technology using MBR equipment. Our greywater plants are designed to treat greywater from showers, baths and wash basins. Wastewater from kitchens should only be connected with an additional pre-clarification system due to the fats contained in the wastewater. The barrier effects of the immersed cartridges with ultra-filtration membrane (with a pore size of 0.00005 mm) used in our technology mean that we can guarantee the safe and complete retention of all dirt particles and the complete retention of all bacteria; even the smallest viruses are removed with a retention rate of 99.999 %. This allows the recycled water to be used at all points of consumption where potable water is not required. We recommend using the water for toilet flushing, cleaning purposes, car washing and watering the garden.

Greywater quantity and quality

Greywater results from water which contains pollutants following use. The volume of greywater produced and the degree of pollution is largely determined by the habits of consumers. Greywater is permanently available independent of the weather due to daily personal hygiene needs.

The degree of greywater pollution depends on the preceding application and results from body care products, washing agents and levels of soiling (body, clothing). These types of contamination are considered easily biodegradable.

When re-using greywater, the water is collected from showers, baths and wash basins and recycled in such a way that it is particularly suitable for use for flushing toilets, washing clothes and watering the garden.



The quality of service water (usable water obtained from greywater) usually has little to do with the quality of dirty bath water, as scientific studies about greywater have shown. On the contrary, with a properly constructed system in accordance with these planning guidelines, the water complies with the European threshold values for bathing water. In this case the water is permanently clear, colourless, does not smell and is free of any solid particles. We can recommend operating a washing machine using service water without any reservations.

EU threshold values for bathing water are defined in such a way that illness cannot be caused by prolonged bodily contact or by mistakenly swallowing it. Moreover, studies by various hygiene institutes have shown that no bacteriological differences can be found between dry washing washed with potable water and dry washing washed with service water.

Potable water regulations explicitly state that the decision to use service water for washing clothes is entirely up to the consumer. Leading dermatologists also have no concern about people suffering from allergies using service water in this way. Recycled greywater itself does not trigger allergies.

Allergies are triggered either by certain materials in textiles or by chemical residues from washing detergents. Since service water is usually softer than potable water, its use in washing machines usually requires less detergent, which lowers the risk of detergent residues in washed clothes. This is something that our grandmothers were already aware of.

Observing certain minimum technical standards is the prerequisite for constantly high water quality. On the other hand, any mistakes made during planning, component selection or implementation may result in a drastic reduction in quality that is soon noticeable through unpleasant smells.



iWater Waterdetect

An independent, battery-operated water alarm that warns the user with a buzzing signal when a leak is encountered or when water escapes. It protects your house and property against water damage and mould.

Treatment

The treatment of greywater first involves cleaning by micro-organisms before other substances are separated out by means of membrane filtration.

The iWater Greywater recycling plant treats greywater in two stages:

1. Biological treatment

The first stage involves biological treatment through oxygen enrichment. The micro-biological environment with cleaning bacteria breaks down bio-degradable contents.

2. Membrane filtration

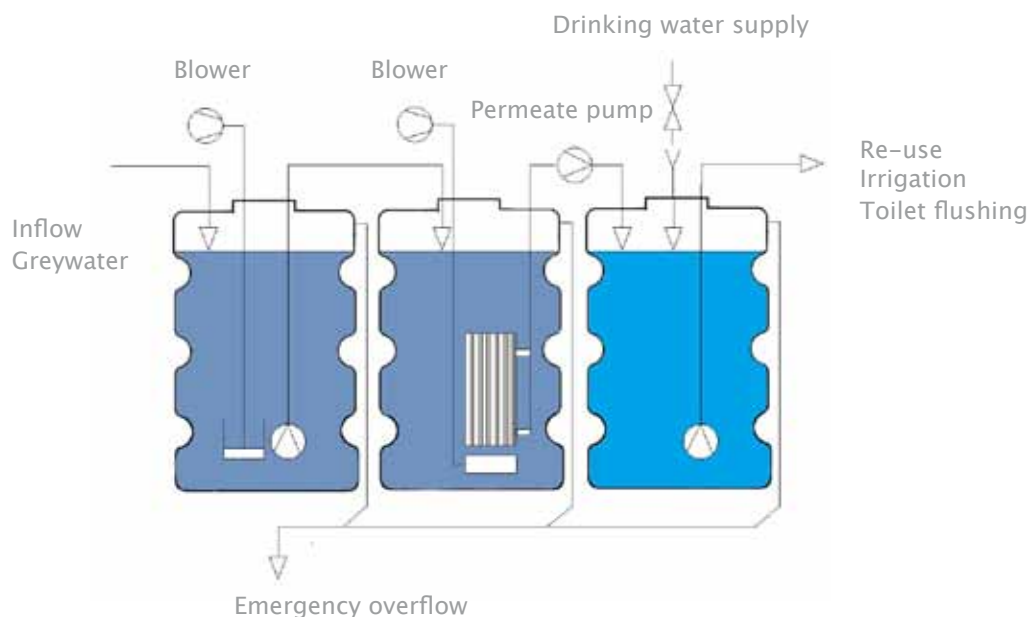
In the second stage, following micro-biological treatment, the water is transformed into hygienic service water through membrane filtration, which safely holds back any substances in the water.

Filtration grade

The membrane permanently and safely retains all relevant particles that are larger than the pore size of 0.00005 mm.

3. Saving service water

The water for re-using is saved in the third tank and will be ready for use flushing toilets, washing clothes and watering the garden.



PowerClear greywater systems collect greywater that accumulates and stores treated service water. ewuaqua systems ensure that legal and technical regulations are safely complied with at all times and guarantee a constant supply of water for flushing toilets, washing clothes, household cleaning and watering the garden. According to DIN EN 1717 there must be no possibility of a connection between the service water and potable water networks. For this reason our ewuaqua PowerClear plants integrate a fully automatic system for potable water backfeed which meets all the provisions contained in DIN 1988 and DIN EN 1717. Separate pipes for water supply and disposal must be installed in the house to connect to the domestic system. Supply pipes must be clearly and permanently labelled. The greywater system is generally ventilated via the inlet pipe connections, or separate ventilation can be installed if required. The overflow device of the greywater system should be equipped with a siphon trap before being connected, and backwater and retention devices should be installed where necessary. The PowerClear plant greywater tanks are designed to hold a reserve of service water sufficient to cover an entire day's needs. It is not necessary to install large tanks since the service water requirements and greywater yields are approximately equal. The entire greywater plant is managed from a single control panel where all settings can be made. If desired, the control system can also be monitored via remote access enabling all the values relating to treatment to be monitored by our specialists at regular intervals.



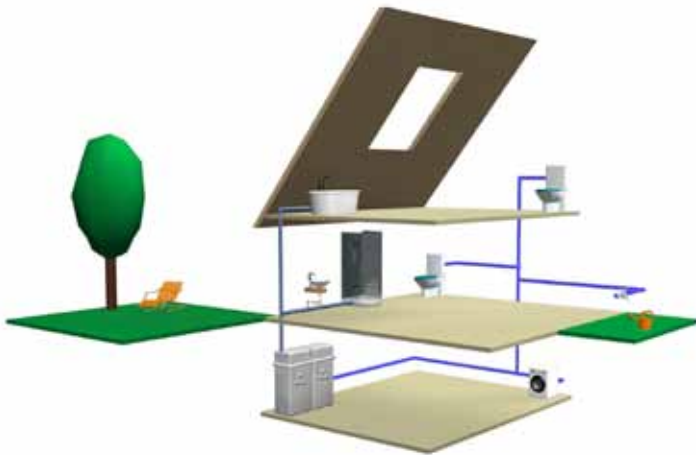
iClear 200 indoor

A greywater recycling plant to treat greywater over several stages and feed the filtered water back into a downstream clear water tank. A system for basement installation integrated in two PE tanks.

Installation options

An ewuaqua PowerClear plant can generally be installed indoors or outdoors. When installed indoors, usually in the basement, underground garage or technical room, polyethylene tanks are delivered fully equipped and can be set up on site. Depending on the treatment capacity, a system will comprise two or three tanks. As a general rule, ewuaqua systems with a treatment capacity of 1000l per day or more are supplied with 3 tanks.

Outdoor installation is also possible for systems of all sizes. In these cases the plant is also supplied with two or three tanks made from polyethylene or concrete, which are then fitted out on site. The control system for the plant is then installed in the basement or in a separate utility shaft. The entire plant can be monitored and configured via the control system. It is not necessary to constantly open the buried tanks, which ensures the same level of convenience as a basement system.

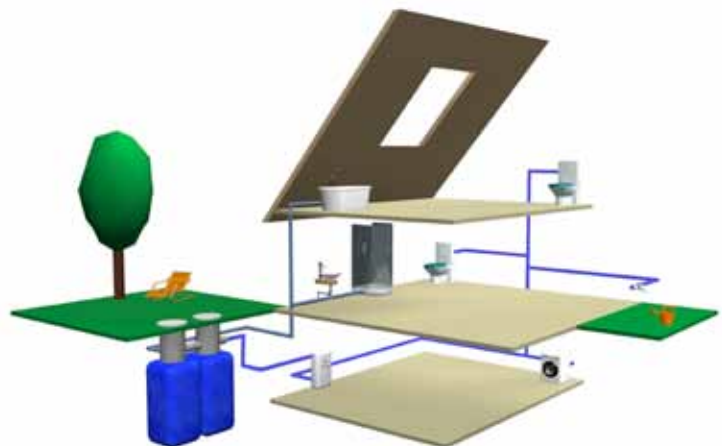


Indoor installation:

- compact installation of all components in the basement
- small footprint in basement
- simple maintenance
- no need to breach the wall to the outside
- no excavations required

Outdoor installation:

- space savings as tanks installed outdoors
- low heat loss through installation below ground
- large systems also possible



Large systems

Large residential, commercial and industrial complexes increasingly call for environmentally friendly and economic water circulation systems. Installing a local water management system makes it possible to use large quantities of service water in areas where potable water is not required, for example toilet flushing, production, irrigation and fire-extinguishing systems.

Large rain water and greywater plants are generally comparable with the standardised domestic system, but the plant components and size are individually designed for the relevant field of application. Each project, from planning through to implementation, demands years of experience and practical expertise that we can provide together with our competent partners.

The complex control systems in large plants can be accessed remotely, which makes it possible to monitor treatment performance on a permanent basis easily. When integrated with the building management system in large facilities, the plant will provide a signal when pressure increases or the system fails informing the people responsible immediately. This ensures that toilets, washing machines and outlet points for cleaning water and garden watering are constantly supplied. For large ewuaqua PowerClear systems, iWater Wassertechnik technicians and engineers will provide the customer with advice and practical assistance and will support the entire construction project from the initial idea for a greywater system through to construction, implementation and maintenance.

The LEED, BREEAM and DGNB certification systems are becoming increasingly important for the implementation of large construction projects. Lowering (drinking) water consumption is an important criterion for this, which makes the implementation of a local water management system to meet these requirements indispensable. The ecological and economical benefits of installing a large system are of interest for all types of developer, regardless of whether private or institutional investor.

| Certification system | Category | Criterion |
|----------------------|------------------------------------|---|
| BREEAM | water | Water consumption, water consumption volume, detection of Leaks in the system, disconnecting means of sanitary facilities, Irrigation systems, water treatment systems |
| LEED | Water efficiency, sustainable Site | Reduce water consumption by 20%, reduce potable water use by 50% No potable water use, innovative wastewater treatment, reduction of water consumption 30% / 35% / 40% , Rainwater quantity, Rainwater quality |
| DGNB | ecological quality | reduce potable water and waste water consumption |



Saving potable water

Saving potable water through the use of greywater

The following calculations relating to consumption are based on a period of one day.

Greywater yields

The average person in Germany uses approximately 111 l of potable water each day, of which 50 l are needed for the shower, wash basin and bath. This equates to 18.000 l per person each year.

Greywater requirements

| | | |
|-----------------------|--------------------|-----------------------|
| WC flushing | approx. 33 l | = 11.880 l/year |
| Washing machine | approx. 15 l | = 5.400 l/year |
| General cleaning | approx. 3 l | = 1.080 l/year |
| Garden, miscellaneous | <u>approx. 4 l</u> | <u>= 1.440 l/year</u> |
| | approx. 55 l | = 19.800 l/year |

For a household of 4 people this means that

$4 \times 18.000 \text{ l/year} = 72.000 \text{ l/year}$, corresponding to 72.00 m^3 per year

of potable water is transformed into greywater in the shower, bath and wash basin, which is then available for treatment in the greywater recycling system.

Once recycled, this water can then be used for flushing toilets, washing clothes, general cleaning, garden irrigation and other purposes. For a household of 4 people this means:

$4 \times 19.800 \text{ l/year} = 79.200 \text{ l/year}$, corresponding to $79,20 \text{ m}^3$ per year

There will therefore always be sufficient greywater available.

A household of 4 people will thus save around $72,00 \text{ m}^3$ of potable water and wastewater each year, since this volume does not flow off into the sewer. It is instead used for flushing the toilet or washing clothes.

Amortisation

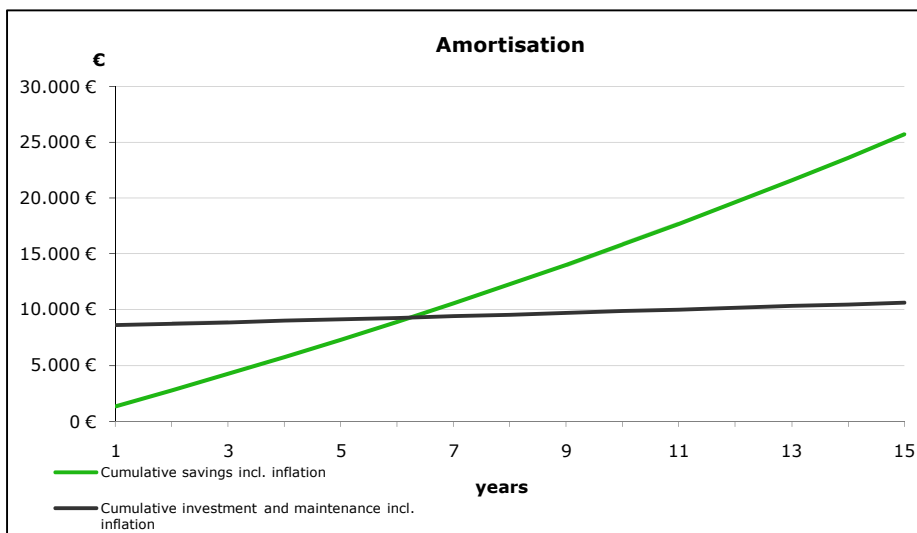
This sample calculation for amortisation is based on a greywater recycling plant with a daily treatment capacity of 800 l in a block of flats with 16 residents. The costs on which it is based include delivery and installation of a PowerClear Aquacell 800 indoor greywater recycling system including a pressure booster system and the additional pipe-laying work required. The figures used are based on a greywater recycling system that was actually implemented.

Amortisation calculation based on the following figures

| | |
|--|----------------------|
| Potable water costs | 1,8 €/m ³ |
| Wastewater costs | 3,2 €/m ³ |
| Service/maintenance | 125 €/p.a |
| Number of residents | 16 |
| Greywater yield from shower and wash basin from 16 persons | 800 litres per day |
| Greywater requirement for 16 persons | 736 litres per day |
| Potential potable water savings | 736 litres per day |

| Year | Cumulative investment and maintenance incl. inflation | Cumulative savings incl. inflation | Difference |
|------|---|------------------------------------|------------|
| 1 | 8.600 € | 1.345 € | -7.255 € |
| 2 | 8.732 € | 2.772 € | -5.960 € |
| 3 | 8.867 € | 4.242 € | -4.625 € |
| 4 | 9.003 € | 5.755 € | -3.247 € |
| 5 | 9.141 € | 7.315 € | -1.826 € |
| 6 | 9.281 € | 8.921 € | -361 € |
| 7 | 9.424 € | 10.575 € | 1.151 € |
| 8 | 9.569 € | 12.279 € | 2.710 € |
| 9 | 9.715 € | 14.034 € | 4.318 € |
| 10 | 9.864 € | 15.841 € | 5.977 € |
| 11 | 10.016 € | 17.703 € | 7.687 € |
| 12 | 10.169 € | 19.621 € | 9.451 € |
| 13 | 10.325 € | 21.596 € | 11.271 € |
| 14 | 10.483 € | 23.630 € | 13.147 € |
| 15 | 10.644 € | 25.726 € | 15.082 € |

Prices include 19% Tax



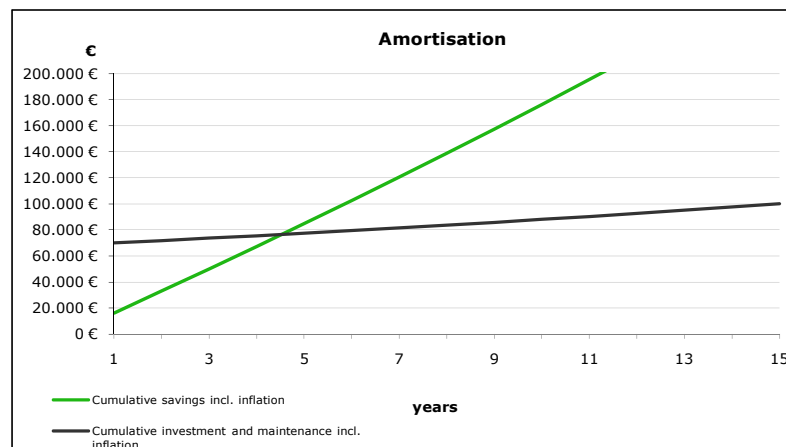
Amortisation

This sample calculation for amortisation is based on a greywater recycling plant with a daily treatment capacity of 10.000 l in a block of flats with 250 residents. The costs on which it is based include delivery and installation of a PowerClear Aquacell 10000 indoor greywater recycling system including a pressure booster system. The figures used are based on a greywater recycling system that was actually implemented. In this example washing machines were not connected.

Amortisation calculation based on the following figures:

| | |
|---|-----------------------|
| Potable water costs | 1,8 €/m ³ |
| Wastewater costs | 3,2 €/m ³ |
| Service/maintenance | 1800 €/p.a |
| Number of residents | 250 |
| Greywater yield from shower and wash basin from 250 persons | 12.500 litres per day |
| Greywater requirement for 250 persons | 8.904 litres per day |
| Potential potable water savings | 8.904 litres per day |

| Year | Cumulative investment and maintenance incl. inflation | Cumulative savings incl. inflation | Difference |
|------|---|------------------------------------|------------|
| 1 | 70.000 € | 16.250 € | -53.750 € |
| 2 | 71.815 € | 32.991 € | -38.824 € |
| 3 | 73.676 € | 49.983 € | -23.692 € |
| 4 | 75.582 € | 67.231 € | -8.352 € |
| 5 | 77.537 € | 84.736 € | 7.199 € |
| 6 | 79.541 € | 102.505 € | 22.964 € |
| 7 | 81.594 € | 120.540 € | 38.946 € |
| 8 | 83.699 € | 138.845 € | 55.146 € |
| 9 | 85.857 € | 157.425 € | 71.569 € |
| 10 | 88.068 € | 176.284 € | 88.216 € |
| 11 | 90.335 € | 195.426 € | 105.091 € |
| 12 | 92.658 € | 214.855 € | 122.196 € |
| 13 | 95.040 € | 234.575 € | 139.535 € |
| 14 | 97.481 € | 254.591 € | 157.110 € |
| 15 | 99.983 € | 274.907 € | 174.924 € |



Checks

The manufacturer requires operators / users of the systems to perform periodic checks. These checks should include testing the operation of the plant and its components as well as testing the clarity (visible cloudiness) and smell of the service water.

Maintenance

Regular maintenance performed in accordance with the instructions of the greywater recycling plant's manufacturer contributes significantly to the operational safety of the system. It also increases its service life and energy efficiency. The typical maintenance interval should be one year.

Special operating conditions

Special care must be taken with biological recycling processes when they come to a standstill or are interrupted for any significant length of time to ensure that the active biomass is restored before supplies of service water are resumed.

Operating costs

Operating costs include costs for repairs, service, maintenance, service inspections, supplies such as electricity and potable water make-up as well as the costs of calculating and settling the use of service water.

Checks

Service checks are regular visual checks on the plant and result in log books or similar without direct maintenance or service work being required. Where users cannot perform the checks themselves at no additional cost, costs for checks can be minimised through the use of automation and remote monitoring.

Power consumption

Power consumption for greywater recycling including pressure boosting / feeding into the service water network can vary between 0.5 kWh and 2 kWh per cubic metre of service water depending on the method used.

What is greywater?

Greywater is a part of domestic wastewater that is free from faecal matter and highly polluted kitchen wastewater. It is wastewater from the shower, bath and wash basin. A household that geared towards saving water produces approximately 55 litres of greywater per person and day.

What is greywater good for?

Greywater can be recycled into clear service water and then used, for example, in toilets, washing machines or for watering the garden.

Can I run my washing machine using recycled greywater?

Yes. The water is also suitable for use in washing machines without any hygiene concerns.

Are there any risks relating to hygiene with recycled greywater?

No. The membrane plates used to filter the greywater have a pore size of 0.0005 mm, and this guarantees the complete retention of germs and bacteria (in comparison: the size of bacteria is 0.001 mm). After recycling, the clear water complies with the European Directive concerning the quality of bathing water and is odour- and germ-free..

Is it obligatory to register the greywater recycling system?

Yes. There has been an obligation to register greywater recycling systems with the local public health department since 2003.

How often must a greywater recycling system be serviced?

Maintenance depends on consumption, and the system indicates when maintenance is due. Maintenance must generally be performed once every 1 – 2 years.

Does installation of the system require 2 wastewater pipes?

Yes. The use of greywater requires wastewater from the shower, bath and wash basin to be fed into the greywater recycling system, while all other wastewater can be discharged into the sewer system in the usual manner.

Can I feed rainwater into the system?

Yes. Supplementing rainwater is an optimum way of saving costs for drinking and wastewater. Over 50 % of the water needed can be saved.

What happens when there is not enough clear water in the clear water tank?

If a rainwater cistern is connected to the greywater recycling system, rainwater can be fed into the clear water tank, otherwise potable water is fed into the tank from the potable water supply.

What are the capacities of the greywater and clear water tanks?

The tanks are designed individually for each construction project and correspond to at least one day's supply of service water.

Where can I install the plant?

In a cellar or technical equipment room. Underground installation is also possible for large systems.

Does a greywater recycling system have to be cleaned regularly?

No. As a result of the turbulence due to oxygenation the system cleans itself.

What are the warranty and guarantee periods?

We provide a 5-year warranty on the tank and we guarantee the components for 2 years.

What is the service life of the filter membrane?

The filter membrane must be cleaned or replaced every 1-3 years depending on the level of use and contamination.

What happens when aggressive cleaning agents find their way into the greywater recycling system?

We generally recommend the use of biodegradable cleaning agents. If aggressive cleaning agents are used in some cases, the membranes could become obstructed more quickly and require replacement sooner.



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