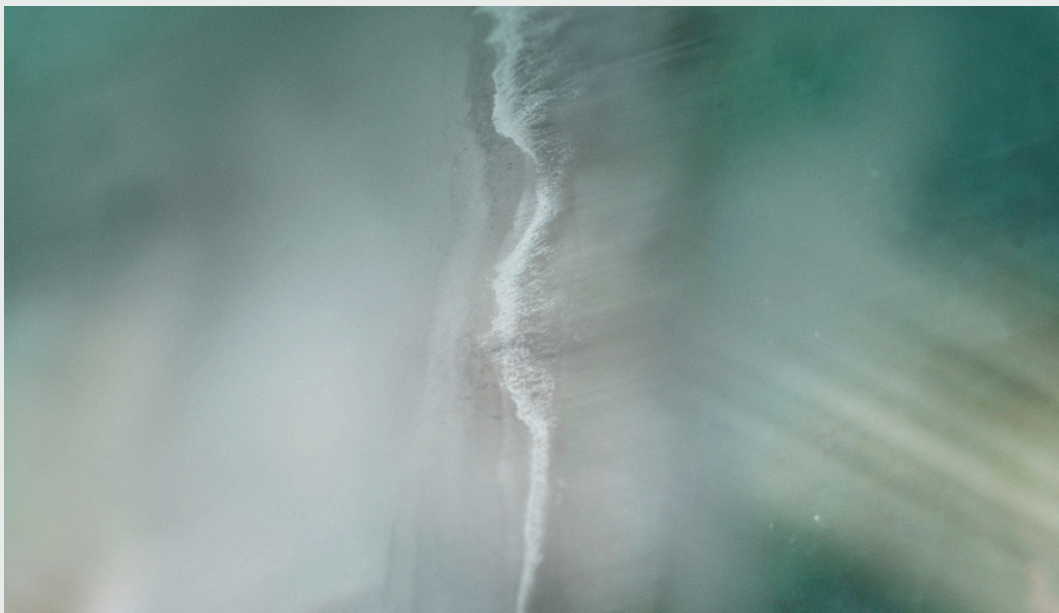




COMPREHENSIVE BEST
PRACTICES GUIDE FOR
OPERATING AND
MAINTAINING

WASTEWATER TREATMENT SYSTEMS



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COMPREHENSIVE BEST PRACTICES GUIDE FOR OPERATING AND MAINTAINING
WASTEWATER TREATMENT SYSTEMS

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80% OF THE WORLD'S WASTEWATER REACHES THE OCEAN UNTREATED

THIS IS HOW NP WATERKEEPER WAS BORN: OUT OF THE NEED TO GENERATE INFORMATION AND PROVIDE SOLUTIONS FOR LASTING CHANGE. **WITH 12 YEARS OF EXPERIENCE IN THE REGION**, WE ARE A NON-PROFIT ORGANIZATION DEDICATED TO MAKING A DIFFERENCE.

Nicoya Peninsula Waterkeeper is a **Costa Rican non-profit association**, member of the Waterkeeper Alliance, a network of 300+ grassroots organizations working daily to protect water resources worldwide.

Since October 2012, NP Waterkeeper has been protecting water from pollution, from the Northern tip of the Cabo Blanco Absolute Natural Reserve to the Southern border of the Caletas-Arío Wildlife Refuge.

Our four main areas of action:

- Solid waste management improvement
- Wastewater management improvement
- Education and awareness raising
- Advocacy and law enforcement

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WASTEWATER TREATMENT SYSTEMS

Nicoya Peninsula Waterkeeper (NP Waterkeeper) consistently works to measure the state of wastewater pollution on the beaches of Malpaís, Carmen, Santa Teresa, Hermosa, and Manzanillo, as well as the respective streams that flow into each of these beaches. Over the past few years, **we have observed an increase in pollution levels** caused by a deficiency in wastewater treatment systems, either because they do not exist, or if they do exist, they lack adequate design, use, and/or maintenance. **When we talk about untreated wastewater in a coastal area, we can expect direct pollution of the soil, rivers, and the ocean.**



With no centralized wastewater treatment system in the area, treatment relies on individual responsibility. Every house, restaurant, hotel, or business with a bathroom and/or a kitchen generates wastewater that must go through a treatment system. A study conducted in 2021 by NP Waterkeeper and the Inter-American Development Bank (IDB) estimated that 88% of the population in Santa Teresa and its surroundings have septic tanks as their wastewater treatment system and only 10% have a treatment plant -which removes pollution to a level that allows for water reuse in irrigation, making it the most recommended option.

The **purpose of this guide** is to share information and generate a greater understanding among the population about the correct use and maintenance of the most commonly used wastewater treatment systems in the Santa Teresa area, so that the population has the necessary knowledge to make informed decisions and take responsibility for the treatment of the wastewater generated in their homes and/or businesses.

GENERAL CONCEPTS

Wastewater

Water whose quality has been altered after being used and has added **impurities such as soaps, feces, urine, fats, oils, organic waste, etc.**

Blackwater

Water that has been used for toilets and urinals, with a **high content of feces and urine.**

Greywater

Water that has had **soaps and fats** added during human use. This includes water coming from washbasins, dishwashers, showers, laundry machines, etc.



Septic sludge

Is the **accumulation of the organic matter** that has been degraded by bacteria at the bottom of the septic tank.

Activated sludge

Is the **accumulation of organic matter** degraded by bacteria within the treatment plant.

Ordinary wastewater

Is the **wastewater generated by human domestic activities** (use of toilets, showers, washbasins, sinks, laundry, etc.).

Treatment system

Is a set of physical, chemical, or biological processes designed to improve the quality of the wastewater to which they are applied. It includes various stages such as **grease trap, septic tank, treatment plant, and drainage.**

STAGES OF A WASTEWATER TREATMENT SYSTEM

The usual treatment system in Costa Rica consists of a **series of stages that reduce the level of contamination in wastewater**. The first stage is the grease trap that receives only greywater. It subsequently joins the black water in the second stage, which could be a septic tank or a treatment plant. Once the water is treated, it goes to the final stage, which can be an infiltration/drainage system or reuse system (treatment plant). Figure 1 shows a diagram of a treatment system with a septic tank, and Figure 2 shows the diagram of a system with a treatment plant.

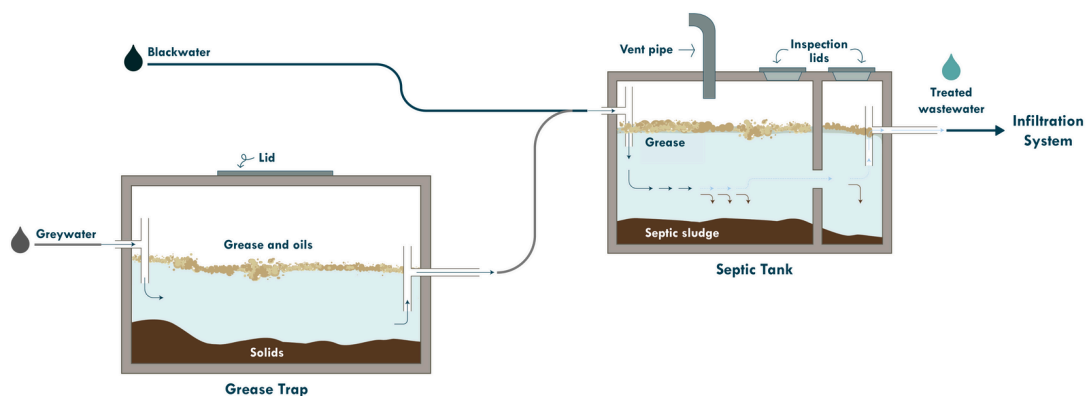


Figure 1. Septic tank treatment system

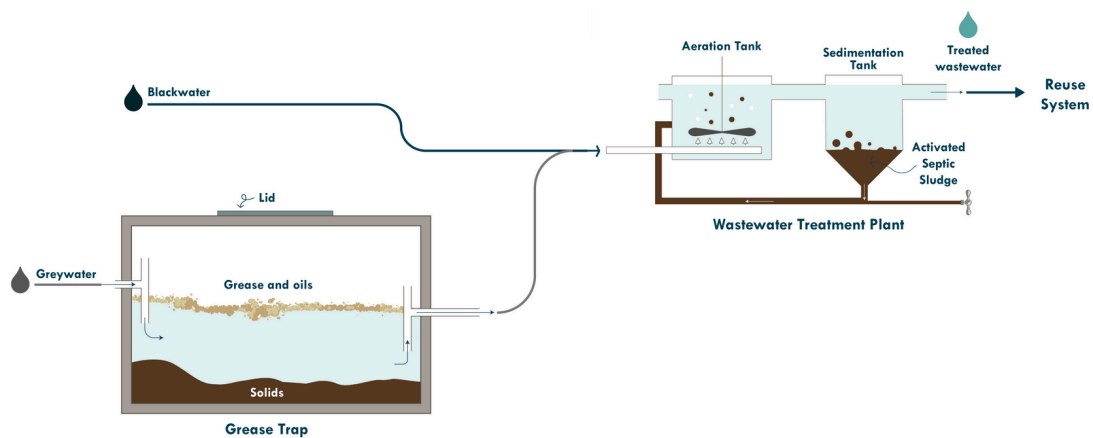
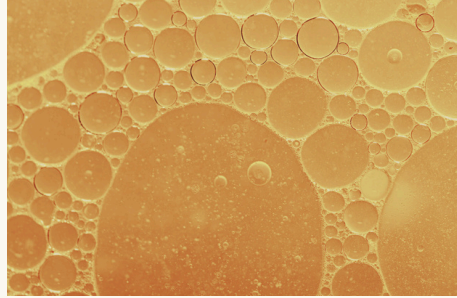


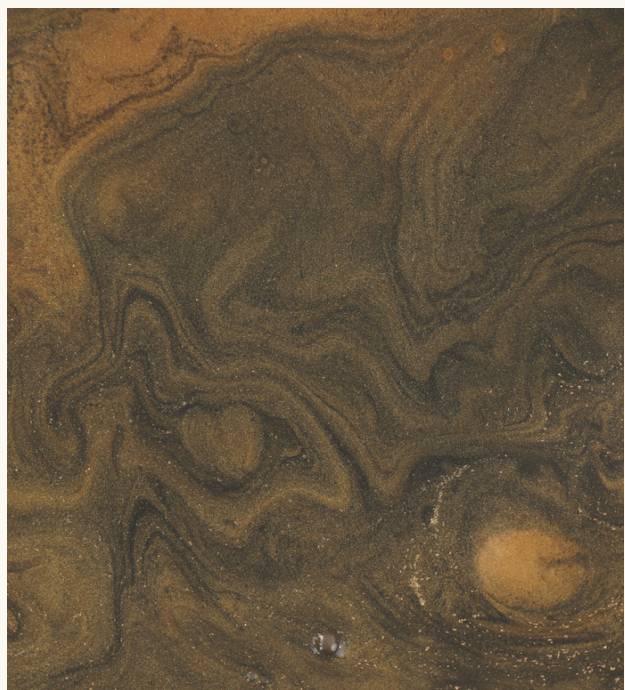
Figure 2. Wastewater treatment plant system



GREASE TRAP



This first stage is **crucial** for the proper functioning of the rest of the system's **stages** and to prevent blockages in the pipes.



GREASE TRAP

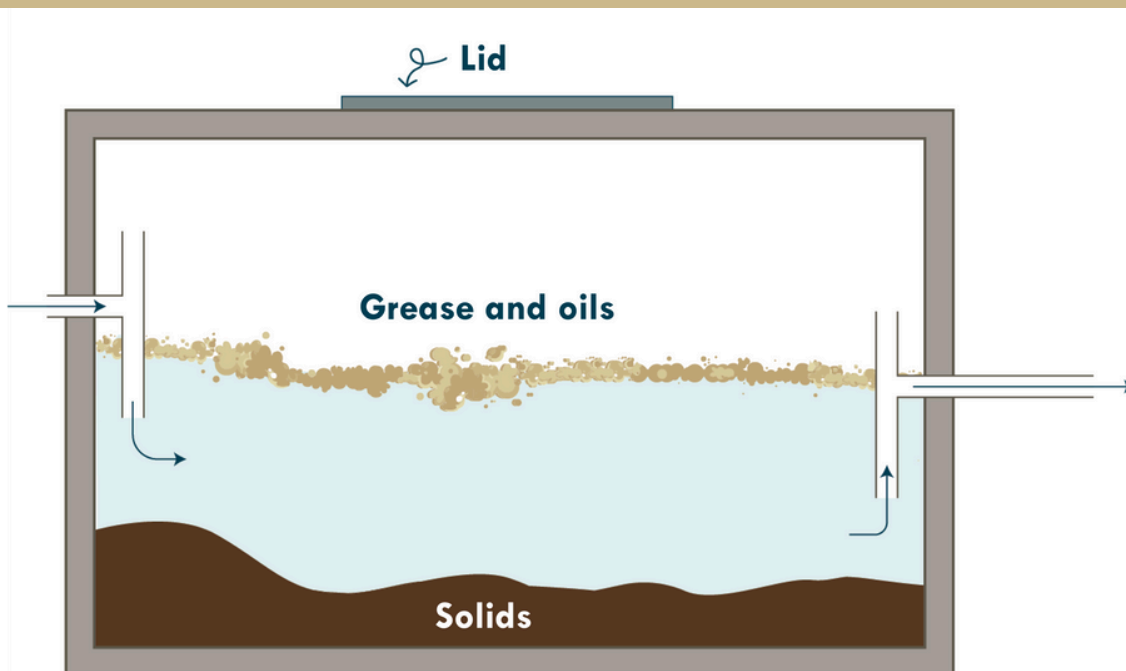


Figure 3. Grease trap representation

This first stage receives greywater from the kitchen and laundry. It traps fats and grease that accumulate on the surface and food particles that settle at the bottom (see Figure 3). **This stage is crucial for the proper functioning of the entire system and to prevent blockages in the T-pipes and potential overflows of polluted water.** Once the greywater passes through the grease trap, it continues to the next stage in the treatment process, either a septic tank or a treatment plant.

GREASE TRAP DESIGN

The design depends on the type and amount of greywater generated. Below are some design criteria that are important to consider when installing a grease trap:



RECTANGULAR SHAPE AND SUITABLE SIZE

A grease trap must have a rectangular shape and dimensions that facilitate the collection of grease and solids.



T-SHAPED PIPE

It must have a T-shaped pipe at the outlet so that only the water in the middle continues to the next stage of the system.



LIGHT AND DURABLE LID

The lid should be made of a light but durable material to facilitate access and constant maintenance.



TWO OR MORE GREASE TRAPS

Places that generate a large amount of grease, such as restaurants, should consider installing two or more grease traps to ensure no grease flows into the following stages.



EASILY ACCESSIBLE LOCATION

The location should be easily accessible for cleaning. They are usually located outside the house, behind the kitchen.



NOT FOR FECAL MATTER

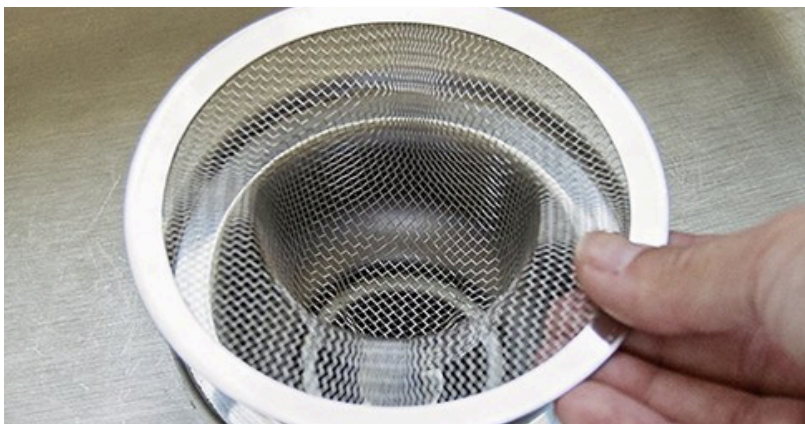
The grease trap should not receive fecal matter from toilets or other sanitary fixtures.

For more details regarding the design of a grease trap, consult the [Hydraulic and Sanitary Installations Code in Buildings](#).

GREASE TRAP USE AND MAINTENANCE

For a grease trap and the rest of the system to function correctly, **responsible use and constant maintenance are required.** Below are important steps to follow both in the kitchen and laundry (greywater generation points) and in the grease trap:

- **Cooking oil should not be poured down the sink.** Use a napkin to remove the remaining oil in the pan. If it is a large amount, it can be stored in a plastic bottle and handed over to an authorized grease management company.
- **Remove food scraps from dishes and kitchen utensils before washing** to reduce the workload on the grease trap. Organic matter reaching the grease trap will start to decompose and produce bad odors.
- Having a **grid or mesh for the kitchen sink** prevents a large part of the food waste from reaching the grease trap.



GREASE TRAP USE AND MAINTENANCE

- When doing laundry, it is recommended to **use cleaning product that have a lesser impact on the treatment system** and the environment.
- Use a **moderate amount of products such as detergent, fabric softener, and chlorine**, as they kill the beneficial bacteria that degrade organic matter in the grease trap and in the septic tank.
- The most important action in the grease trap is to **constantly remove with a strainer the fats accumulated on the surface and the food residues at the bottom**. This practice should be done at least twice a week.
- Store grease waste in a plastic container with a lid to avoid bad odors and possible spills when delivering to an authorized waste manager.
- NP Waterkeeper made an alliance with the company **Ecoreciclaje to provide a collection route for fats and used oils**. For more information contact arwaterkeeper@gmail.com.



What happens when grease is not constantly removed from the grease trap?

- The pipes get **saturated** with grease.
- The **efficiency** of the other stages of the system, such as the septic tank or treatment plant, are **compromised**.
- It takes more work for septic bacteria to degrade grease since its molecules are more complex to digest.
- The subsequent infiltration system is compromised and saturated with grease.
- If wastewater is not properly treated, **it contaminates the soil and aquifers**.
- **Bad odors** are produced.

To consider

The use of bacteria for bad odors and fat reduction can be a useful tool to reduce bad odors or grease in the grease trap, but it does not replace the constant manual extraction of it. **Bacteria can act as a support**, but they are not the solution for grease. Once it gets digested by bacteria, it turns into a higher load of sludge inside the septic tank or treatment plant, generating the need for more consistent extractions.

SEPTIC TANK



The stage that **receives raw black water and greywater** from the grease trap.



SEPTIC TANK

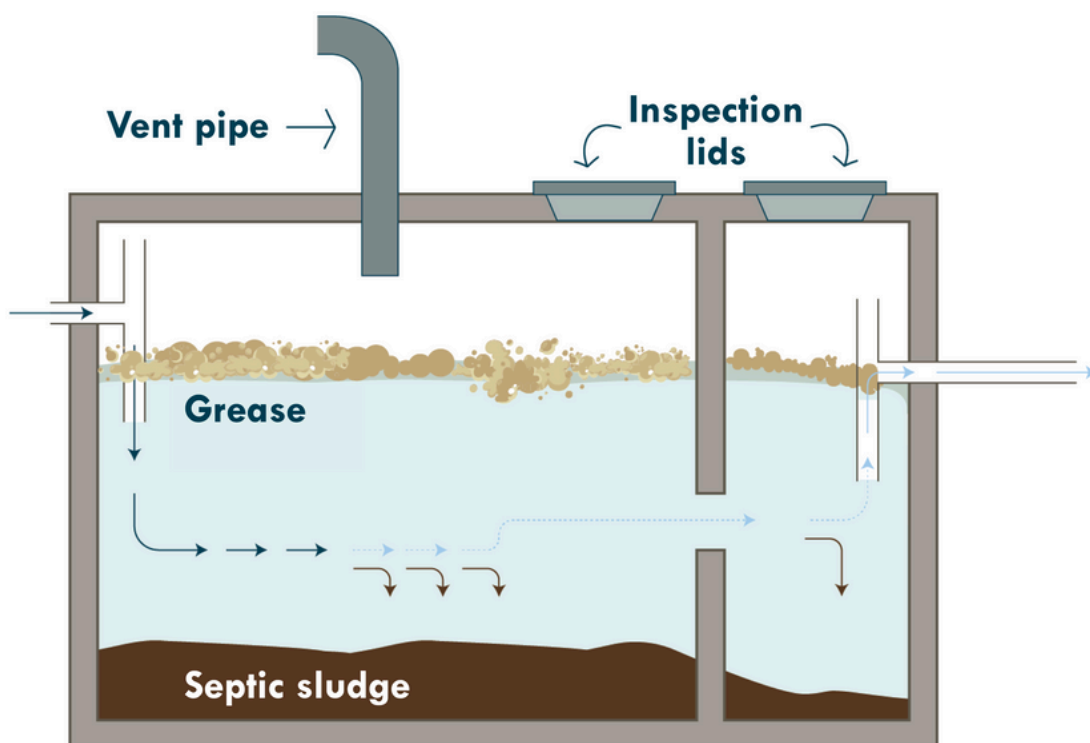


Figure 4. Septic tank representation

The septic tank (Figure 4) **is the stage that receives greywater from the grease trap and raw black water from toilets.** Its function is to retain the wastewater for a determined and sufficient time so the bacteria can digest a part of the organic matter in the water, transforming it into septic sludge that settles at the bottom. **The average septic tank removes about 50% of the organic matter, if it has an adequate design and maintenance.** After the septic tank, the water (still containing 50% of the organic matter that could not be degraded by the septic tank) passes to a soil infiltration system.

SEPTIC TANK DESIGN

The design of a septic tank is **based on the number of users, the volumen, and the type of wastewater generated.** For a better understanding, visit Annex 1 of the [Regulation for the underground disposal of ordinary treated wastewater](#) and the [Hydraulic and sanitary installations code in buildings](#). The main design criteria includes:

- It must have a **grease trap** beforehand for greywater.
- It must have a rectangular shape with a minimum **length-to-width ratio of 3:1** to allow the sedimentation of degraded organic matter at the bottom of the tank.
- The material can be **concrete or prefabricated plastic** with the appropriate design.
- It is **illegal to use concrete culverts** as septic tanks.
- It must have **impermeable bottom and walls.**
- Its location must allow easy access for the extraction of septic sludge, with a **distance of 40 m from any water well.**
- It must have an **accessible inspection lid** for when extracting septic sludge.
- It must have a **vent pipe** to prevent bad odors.
- According to the design, **it can have two or more compartments for better separation of organic matter and remaining grease.**
- It must have a subsequent **infiltration system for the treated water.**

Structural changes: When a house becomes a restaurant, the treatment system must be adapted if it implies a considerable increase in the volume of wastewater generated.



SEPTIC TANK USE AND MAINTENANCE

The correct operation of the septic tank is mainly influenced by the type of contaminants present in the wastewater. Below are the most important aspects to consider in the use and maintenance of a septic tank.

- Use **cleaning products that have a minor impact** on the treatment system.
- Replace or use a **moderate amount of chemical products** such as **chlorine** or unclogger, as they affect the populations of beneficial bacteria that degrade organic matter and reduce the septic's efficiency.
- Do not pour waste or solid items down the toilet, such as **toilet paper, condoms, sanitary pads, or medications, etc.** These wastes **compromise the proper functioning of the septic tank.**
- **Constantly remove grease from the grease trap** so that the septic tank receives a minimal amount.
- **Septic sludge should be extracted every two years**, when there is an adequate design and correct use. Make sure to hire a responsible septic sludge management company to ensure it goes to a treatment plant. Annex 2 shows a list of responsible septic sludge collection companies.

SEPTIC TANK

SEPTIC SLUDGE MANAGEMENT

How to verify if a **septic sludge collection company** manages this waste properly?

Many companies visit the area, charge for the septic sludge collection service (a cheaper amount than responsible collectors), and then dump it on beaches, rivers, farms, etc. Therefore, it is of the utmost importance to **be aware and responsible when hiring a septic sludge management company and ensure that the extracted sludge is disposed in a wastewater treatment plant.**

The **main recommendations for hiring this service** include:



- Verify that the collection truck is properly labeled as **“Recolección de lodos sépticos”** which means **“Septic sludge collection”**.
- Ask for their **Sanitary Operating Permit** and verify that it is valid.
- Check that the **outlet pipe is sealed with a seal or “marchamo”**; this is a wire with a specific code provided by the wastewater treatment plant that will manage the sludge.
- Ask for a **delivery receipt** from the destination septic sludge treatment plant.
- If possible, **verify with the treatment plant if the collection company regularly delivers septic sludge.**



SEPTIC TANK

Can a septic tank be used in a coastal area?

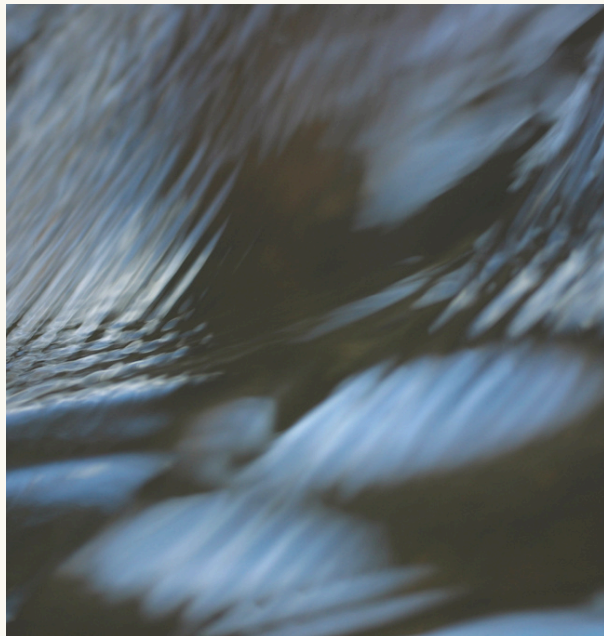
Although the law in Costa Rica allows it, certain soil conditions near the coast, such as a high water table, limited infiltration capacity, and saturation during the rainy season, affect the correct functioning of a septic tank. It is important to remember that the septic tank system, under ideal conditions, with adequate design and maintenance, **removes only 50% of the organic matter from wastewater**, leaving the other 50% of the process to the subsequent drainage stage. If there are doubts regarding the design and performance of the septic system and the soil conditions are not ideal, then the septic tank, although legal, **is NOT a suitable system to treat wastewater in areas close to the sea.**



WASTEWATER TREATMENT PLANT



Any site that consumes more than 190 m³ of water per month must have a treatment plant.



WASTEWATER TREATMENT PLANT

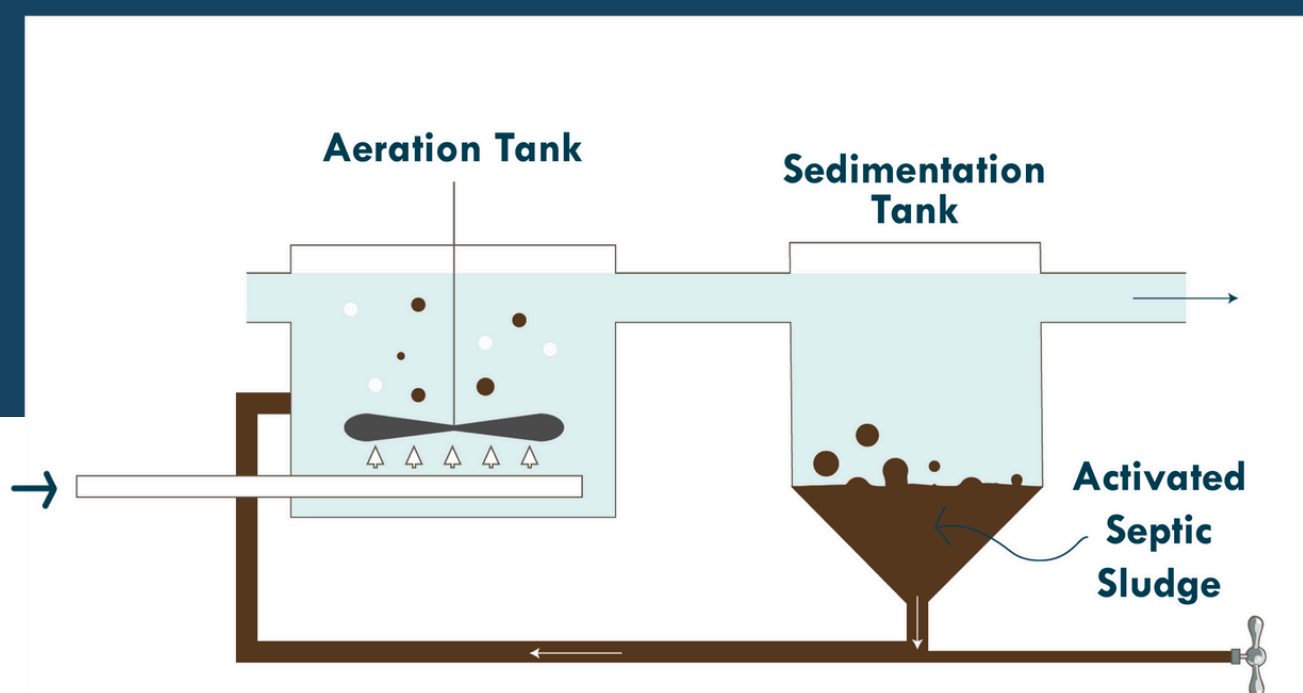


Figure 5. Wastewater treatment plant representation

A typical treatment plant consists mainly of two parts: **an aeration tank and a sedimentation tank** (Figure 5). In the first tank (aeration), oxygen is injected to promote the growth of bacterial colonies that degrade organic matter. In the second tank (sedimentation), the water rests, and the degraded organic matter -known as activated sludge, accumulates at the bottom. This activated sludge is recirculated to the first tank to be digested again by the bacteria. Once the treatment plant has reached its maximum recirculation capacity, it is time to extract and manage the sludge; which can be left to dry and then reintegrated into the soil.



WHO SHOULD HAVE A WASTEWATER TREATMENT PLANT?

The Regulation for the subsurface disposal of treated ordinary wastewater establishes that **any site that consumes more than 190 m³ of potable water per month must have a treatment plant.**

Although the wastewater from a **restaurant** can be categorized as ordinary wastewater, it is important to highlight **the amount of grease they generate.** For this reason, it is **essential to have a good grease collection system and a treatment plant if required.**

DESIGN

The design of a wastewater treatment plant is specific to each scenario. There are various companies in the market that provide suitable and specific designs for homes or businesses. When hiring a company for the design and construction of a treatment plant, it is recommended to:

- **Research the company's history**, look for references on previous works and **hire companies with good recommendations to avoid having to incur in future extra investments** due to poor initial work. NP Waterkeeper has contacts of recommended companies detailed in Annex 2.
- Ensure that the **design complies with the setback distances** stated in the Wastewater Treatment Systems Approval Regulation. It is highlighted that for water sources such as wells, a minimum setback of 40 m must be respected.
- Ensure that the design includes **grease traps with easy access for maintenance**.
- Consider the **investment** in a treatment plant as a long-term solution, with the benefit of the possibility of water reuse and the assurance of minimal pollution.
- Verify that the design **includes a purge line or access** for when sludge needs to be extracted to prevent system overload.

WASTEWATER TREATMENT PLANT USE AND MAINTENANCE

It is extremely important to understand that a treatment plant is not a machine that just needs to be plugged in. This system **requires constant attention to ensure correct treatment**. Therefore, the first step towards proper maintenance is to have a general understanding of how the treatment plant works and of the specifications indicated by the company who installed it.

These are some of the **recommended practices** to monitor the operation of a wastewater treatment plant:

- Follow the recommendations for the maintenance of the grease trap.
Grease compromises the operation of the treatment plant.
- Carry out **water quality analysis constantly** (every 6 or 3 months). These analyzes allow to monitor that the water is being treated correctly and are a requirement for the Operational Report (RO) that must be submitted to the Ministry of Health. The frequency is defined according to the average monthly flow. When this is less than or equal to 100 m³/day, an RO must be submitted every 6 months, while if it is greater than 100 m³/day, it must be submitted every 3 months ([Regulation on Discharge and Reuse of Wastewater](#)). Annex 2 shows the contact of a certified laboratory that visits the Santa Teresa area constantly.
- Be **aware of any possible blockage, leak, or bad odor**.
- Maintain contact with the company that installed the treatment plant for any failure or query.



How can I verify if my treatment system is working correctly?

The three most important factors in any treatment system are **design, use, and maintenance**. When we perceive **bad odors or leaks**, it is clear that the system is **not functioning correctly**. However, there may be **failures that go unnoticed but are causing pollution**.

Therefore, it is **important to understand the treatment system we have in our home or business, as well as the use and maintenance that is being carried out**. A way to verify if the treatment system is functioning correctly is through the following questions:

1. What is the **current system**?
2. Where is **each stage of the system located**?
3. **When was it installed**?
4. What is the **design and capacity of the system**? Is it evidenced in the plans? Is it still being used for that same design capacity?
5. Does it have a **grease trap**? Is the grease constantly extracted and delivered to an authorized waste management company?

In the case of a septic tank:

1. What **material** is it made of? (concrete, prefabricated plastic, etc.).
2. Does it have a sealed bottom and impervious walls?
3. When was the last time septic sludge was **extracted**?
4. Does it have an **escape pipe or vent**?



In the case of a treatment plant:

1. When was the last time **water quality analysis** was performed at the outlet, and what were the results?
2. Is there a maintenance record for the treatment plant?
3. Does the water at the outlet look **clear and odorless**?
4. When was the last time **maintenance** was performed **on the pumps**?

For waste or by-products, meaning, grease from grease traps, used oil, septic sludge or activated sludge:

1. What is the **final destination of the waste**? Is there any contact with the treatment plant that will receive this waste to verify that they actually received it (especially for septic and activated sludge)?
2. Does the company have and show the **Sanitary Operating Permit with an updated date**?
3. Is the **transport** of septic sludge **properly labeled**?

Once you have the answer to these questions, **you can have a better idea of the state of your treatment system and make more informed decisions.**



Conclusion

Wastewater treatment is a matter that involves us all. Every action related to a better treatment system significantly impacts everyone. **There is an individual and collective responsibility that determines the quality of water and the environment in which we all live.**

We hope this guide gives you the information you need for you to do your part.



Annexes

Annex 1.

Regulation for the underground disposal of ordinary treated wastewater.

Hydraulic and sanitary installations code in buildings.

Annex 2.

Click here for contact list regarding wastewater treatment plant construction companies, master builders or private consultants, responsible septic sludge collection companies, grease and oils management, and certified laboratory.

Disclaimer:

NP Waterkeeper has no financial or legal involvement or commitment with any of these companies. The list of recommended contacts is based on their expertise, technical judgment and local availability. This list is subject to constant updating and improvement, so we appreciate you sharing any feedback regarding hiring the service of any of the contacts to the email arwaterkeeper@gmail.com.

QUESTIONS?

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