SOUTH CROSS BAYOU
Water Reclamation Facility

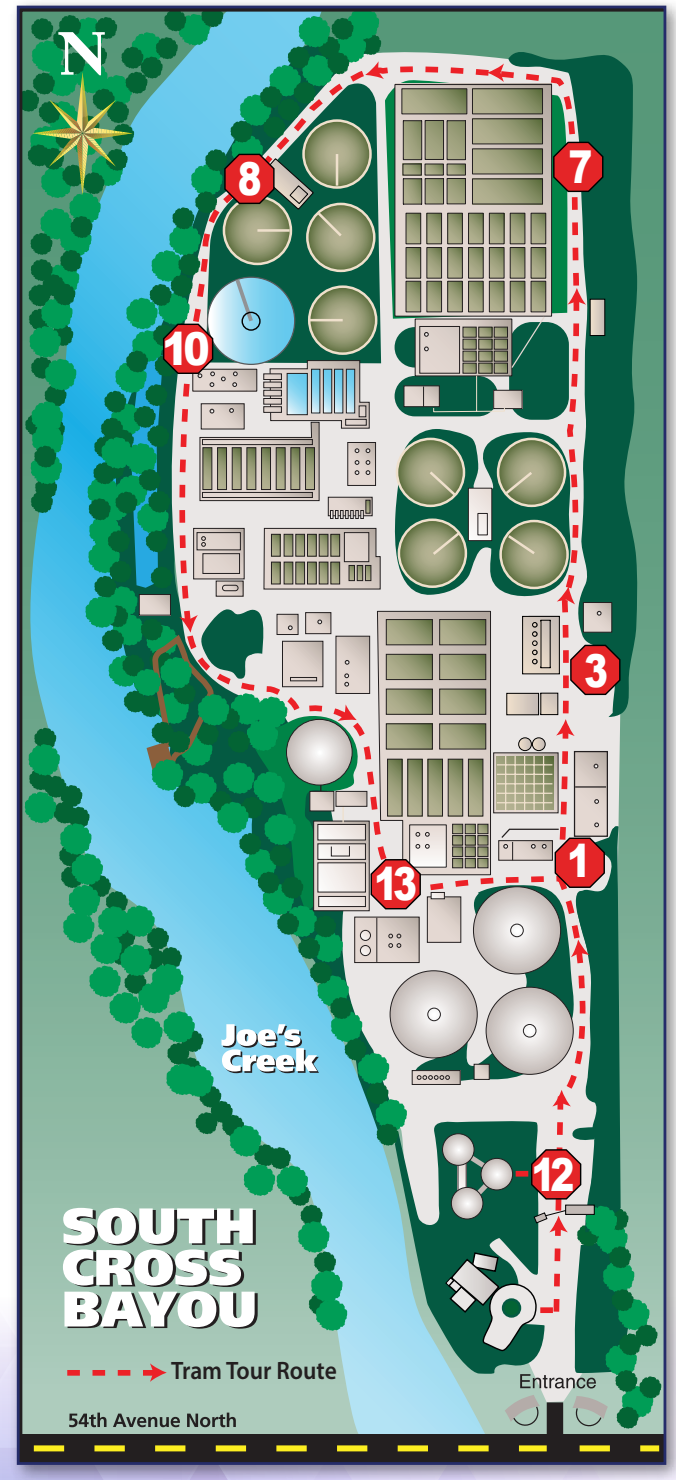
Resource Book

INNOVATE • CREATE • EDUCATE

Welcome To The South Cross Bayou Water Reclamation Facility

Tram Stops:
Listing by Station, not stop number

Station 1	Operations Center
Station 3	Headworks
Station 7	Aeration Tanks
Station 8	Mixing Facility & Secondary Clarifiers
Station 10	Disinfection
Station 12	Digesters
Station 13	Pelletizer Facility



HOW TO USE THE RESOURCE BOOK

This Resource Book was designed to provide instructors, students, and those interested in learning about the Advanced Wastewater Treatment Process a detailed, step by step explanation of the wastewater treatment process at **South Cross Bayou Water Reclamation Facility**.

The book follows wastewater as it travels through **stations** from the time it enters the facility through the influent pump station until it is sent back out into Pinellas County as reclaimed water for irrigation, discharged into Joe's Creek, or made into biosolids (fertilizer).

Look for underlined words in the text. These words can be found in the SCB Glossary on pages 23 - 25.

Look for this symbol when searching for tram stops. This symbol denotes the physical locations where the tram stops on tours. Please note, tour participants have the option to disembark the tram at select stations for an enhanced viewing experience.

Look for this symbol when searching for the process times for each stage of the water treatment process. In other words, this is approximately how much time wastewater (or sludge) spends in each stage of the treatment process.

Look for the numbers on the upper right corner of each image. These numbers correspond to the descriptions found in the Image Glossary on page 26.

Look for this symbol to find examples of everyday applications of the Sciences, Technology, Engineering, and Mathematics (STEM) involved in wastewater treatment.

Did you know South Cross Bayou Water Reclamation Facility offers a plethora of **FREE** resources to educators and those interested in learning about the advanced wastewater treatment process such as:

- 90 minute tram-assisted tours of the 35-acre facility.
- Classroom speaker presentations.
- Classroom demonstrations and hands-on activities.
- Teacher resource guides that include standards and learning targets, 20-50-80 menus, and activity options for 6th grade comprehensive Science 1, 7th grade comprehensive Science 2, 8th grade comprehensive Science 3, Biology, Chemistry, Earth and Space Science, Environmental Science, Marine Science (1 and 2), Physical Science, and Physics.
- Pre and post field trip activities for students.

All teacher resources, including a digital copy of this Resource Book can be accessed at *www.pinellascounty.org/utilities/educational/teachers.htm*

To schedule a tour, speaker presentation, or classroom demonstration, visit us at *www.pinellascounty.org/utilities/educational/tours.htm*

For more information, contact our Education Staff at **(727) 464-5871**, or visit *SCBTOURS@pinellascounty.org*

Any written correspondences can be sent via the United States Postal Service to:

South Cross Bayou AWRF
Attention: Education Staff
7401 54th Avenue North
St. Petersburg, FL 33709

It's all about RESOURCE RECOVERY!

South Cross Bayou Water Reclamation Facility is a state of the art advanced wastewater treatment plant and resource recovery facility. When first constructed in 1962, the facility was a trickling filter plant treating 5 million gallons a day (MGD). Today, it is the largest wastewater treatment facility in Pinellas County, permitted to treat an annual average of 33 MGD!

The treated water is purified and returned to the community as a valuable and useful resource. Three and a half billion gallons of reclaimed water from South Cross Bayou is used for irrigation each year. The organic solids present in the wastewater are removed, processed and converted into over 6,000 dry tons of fertilizer pellets each year that are sold commercially for agricultural uses. Methane gas that is produced as a byproduct of the sludge treatment process is captured and used as a fuel source in drying the fertilizer pellets; generating and using methane on-site reduces the facility's energy and carbon footprint, while providing significant cost savings on natural gas expenses.

The South Cross Bayou Water Reclamation Facility exemplifies the applications of science and technology in turning human "waste" into beneficial and useful products, while still effectively protecting human health and the environment.

The information presented in this booklet is designed to familiarize the reader with the overall wastewater treatment process and the science behind resource recovery.

STATION 1 – OPERATIONS CENTER

Purpose: To monitor the wastewater treatment process and to adjust and control the stages of treatment as necessary to maintain the high standards of advanced wastewater treatment.

The plant operates 24 hours a day, 7 days a week, 365 days a year.

In the **control room**, plant operators can:

- Use computers to view graphical representations of the plant's process units to track equipment alarms, chemical feeds, and system performance.
- Make adjustments to the treatment process remotely in real time.
- Monitor over 150 pump stations throughout South County for equipment status and water levels.

In the **laboratory**, plant operators and chemists can:

- Run analytical tests on water samples taken from the treatment tanks to monitor the stages of the treatment process. Analyses performed in the South Cross laboratory are for process control and include:
    - Settling rates for solids
    - Volatile solids
    - Volatile acids
    - Microorganisms
    - Chlorine concentration
    - Nutrient concentration (nitrogen and phosphorus, etc.)
- Analyze data, monitor trends, and decide what adjustments are needed to maintain the high standards of advanced wastewater treatment.

STATION 2 – INFLUENT PUMP STATION

Process time: 15 minutes

Purpose: To continuously pump incoming wastewater from the sanitary sewer system to the plant headworks.

How it works:

Pump stations in the collection area transport wastewater through gravity lines to the influent pump station. The influent pump station consists of two separate sides each containing a grinder and three large pumps. One side receives wastewater from the city of Pinellas Park, and the other side receives wastewater from the South Cross service area (see page 27). The grinders protect the pumps by pulverizing any debris such as towels, rocks, children's toys, etc.

STATION 3 – HEADWORKS

Process time: 5 minutes

Purpose: To remove trash and other solid objects from the influent wastewater stream. Removing trash from the influent stream protects downstream equipment by preventing clogged pipes, pumps and valves.

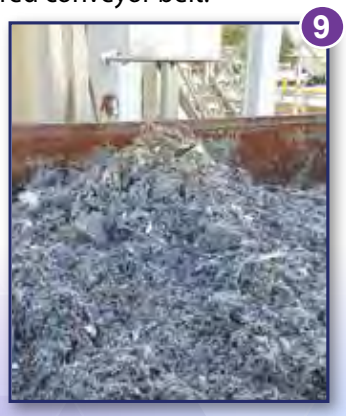
How it works:

Step 1: All wastewater received by the plant passes through bar screens which mechanically removes large objects and deposits them onto a covered conveyor belt.

Step 2: The debris is compacted and transferred through a chute into a dumpster.

Step 3: The debris is disposed of at a sanitary landfill.

Step 4: The wastewater passing through the bar screens continues to the next process.



Everyday STEM

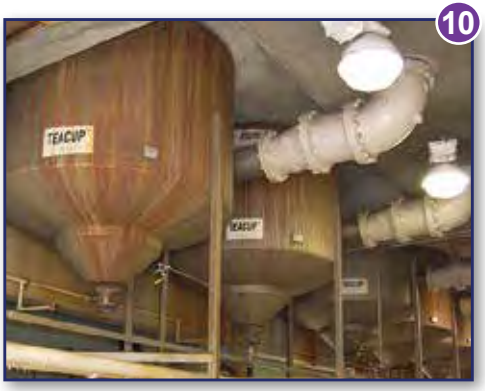
Every effort is made to reduce and control the odors associated with wastewater and the treatment processes at the plant. Foul air, as a result of odor-causing agents like hydrogen sulfide (H_2S), is collected from around the equipment and put through chemical scrubbing systems before it is released into the atmosphere.

TRAM STOP

STATION 4 – GRIT REMOVAL
4A – Teacups

Process time: 30 minutes

Purpose: To remove grit (ie. sand) and other small inorganic materials from the wastewater stream. Much of this grit is due to the sand infiltrating into the pipes along the beaches of Pinellas County. This sand/grit does not help the biological process and in fact can hinder the process by settling out in many of the treatment tanks downstream and therefore taking up volume (space) that could be utilized for the biological treatment process.

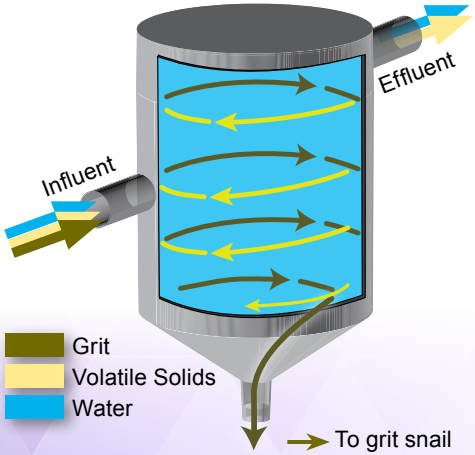


How it Works:

Step 1: The wastewater is fed tangentially into one of 14 teacups at a controlled rate and velocity.

Step 2: Due to the circular shape of the teacup, feeding in this manner will induce a vortex, or circular/spiral flow pattern within each teacup through the centrifugal force exerted by the side wall.

Step 3: This vortex results in the heavier particles being "pushed" towards the outer perimeter within teacup (similar to a gravitron ride).



Step 4: Once the heavier particles are in this outer boundary layer, they will then be pulled by the force of gravity downward towards the bottom of the teacup. The water containing fine particles (volatile solids) exits the top of the teacup where it proceeds to further treatment.

Step 5: The heavier grit particles that exit the bottom of the teacup are transported by pipes to the grit snail and are ultimately disposed of at a sanitary landfill.

Everyday STEM

Not all wastewater treatment facilities utilize teacups to remove grit. Some facilities use settling tanks for this purpose. The type of grit removal system used at a wastewater treatment facility is determined by such factors as grit characteristics, daily volumes and flow rates, processing time, and available space for the removal system.

4B – Grit Snail & Dumpsters

Process time: 10 minutes

Purpose: The grit snails separate the water from the grit and other solids. These materials are deposited into dumpsters for disposal at a sanitary landfill.

How it Works:

Step 1: The grit and water slurry flow through the grit pipes and is dumped into the hoppers of the two grit snails.

Step 2: The mixture falls to the bottom where a conveyor belt catches the solid materials, allowing the water to drain off.

Step 3: The gritty material is slowly carried upward at approximately 1 foot per minute, giving the water time to drain out. The drainage water is returned to the teacups.

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Step 4: The conveyor belt dumps the grit into a grit dumpster.

Step 5: The material in the grit dumpster is transported to a sanitary landfill for disposal. Some common items found in the grit dumpsters are sand, corn, plant seeds, coins, cigarette butts, and chewing gum.

Everyday STEM

Many plants have adapted a seed coat, a tough protective outer layer, to survive in acidic environments. This enables seeds to pass through the digestive systems of many animals, including humans, without being digested. This accounts for the various seeds that can be observed in the grit dumpsters. Animals such as seed-eating birds whose nutrition greatly depends on the digestion of seeds have adapted stronger digestive juices that can attack and break down the seed coats.

STATION 5 – PRIMARY CLARIFIER TANKS

Process time: 2-3 hours

Purpose: These tanks permit the settling of organic solids.

How it Works:

Step 1: Wastewater is received from the teacups.

Step 2: The heavier organic solids (sludge) settle to the bottom of the tanks.

Step 3: The sludge is collected by scrapers at the bottom of the tanks and pumped to the sludge holding tanks.

Step 4: Lighter, floating materials are skimmed off the top and also pumped to the sludge holding tanks.

Step 5: Clarified wastewater continues to anoxic tanks.

STATION 6 – ANOXIC TANKS

Process time: 2 hours

Purpose: Uses anaerobic microorganisms to begin the process of biological nutrient removal.

How it Works:

Step 1: Receives wastewater from the primary clarifier tanks and returns wastewater from other parts of the treatment process.

Step 2: The microorganisms work in an environment containing very low levels of free O_2 or dissolved oxygen in the water. To obtain the oxygen that they require for survival anaerobic microorganisms must use nitrate (NO_3^-), which results in the release of nitrogen gas (N_2). Wastewater is mixed using mechanical mixers to keep the solids suspended.

Step 3: Part of the influent water that enters the anoxic tanks is return activated sludge (RAS) from the aeration tanks and secondary clarifier tanks, which contains large amounts of nitrates.

Step 4: Wastewater from the anoxic tanks is transferred to the aeration tanks.

TRAM STOP

STATION 7 – AERATION TANKS

Process time: 10-12 hours

Purpose: To provide an (oxygen-rich) environment for microorganisms to break down or reduce the sludge particles and reduce nutrient concentrations.

How it Works:

Step 1: Wastewater is received from the anoxic tanks.

Step 2: Large quantities of compressed air are pumped down to the bottom of the aeration tanks through a network of pipes. The air is released through diffusers to create an oxygen rich (or aerobic) environment.

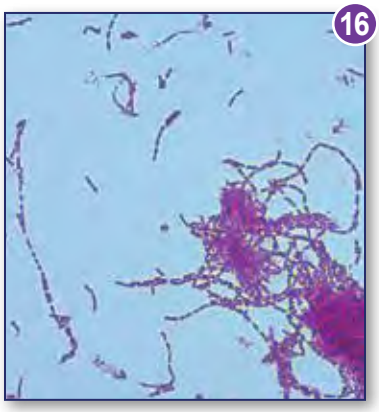
Step 3: The air supplies oxygen for the microorganisms and keeps the wastewater circulating in the tanks.

Step 4: A community of various aerobic microorganisms convert ammonia (NH_3) to nitrate (NO_3^-) through a chemical process called nitrification.

Step 5: The action of *Nitrosomonas* bacteria present in the wastewater convert organic ammonia (NH_3) into nitrites (NO_2^-). *Nitrobacter* bacteria then convert the nitrites (NO_2^-) into nitrates (NO_3^-).

Step 6: Through aerobic respiration, microorganisms feed on the sludge particles, breaking them down to smaller particles, carbon dioxide (CO_2), and water (H_2O).

Step 7: Some of the effluent from the aeration tanks is pumped into the secondary clarifiers, and some is returned to the anoxic tanks as return activated sludge (RAS).



Everyday STEM

There are many circular loops used in the treatment process. Nitrate laden water from the aeration tanks is returned to the anoxic tanks for de-nitrification and nitrogen gas release. This is also done to ensure that there is the proper balance between the microorganisms and the sludge particles. Operators monitor what is known as the F:M or food to microorganism ratio. If there are too many microorganisms for the amount of sludge particles, a portion of the microorganisms will die. If there are too many sludge particles and not enough microorganisms, the water will not be properly cleaned. Maintaining the correct ratio between the sludge and the microorganisms is essential in the advanced wastewater treatment process.

STATION 8 – MIXING FACILITY & SECONDARY CLARIFIER TANKS

8A – Mixing Facility

Process time: 15 minutes

Purpose: This fast mix station is used to add chemicals to the effluent from the aeration tanks before the wastewater is distributed to the secondary clarifier.

How it Works:

Step 1: Aluminum sulfate $Al_2(SO_4)_3$ is added to bond the wastewater with the phosphorus in the water to produce a precipitate that will settle out to the bottom of the tanks with the sludge. This aids in nutrient removal from the water.

Step 2: NALMET, a chemical polymer, is added to the wastewater to bond with copper ions to form precipitates that will settle to the bottom of the tank, thereby removing copper from the water.

8B – Secondary Clarifier Tanks

Process time: 2 hours

Purpose: To facilitate settling of the sludge particles and microorganisms and to clarify the water.

How it Works:

Step 1: The wastewater from the mixing facility is distributed to one of four secondary clarifier tanks.

Step 2: The tanks have a calm environment, allowing most of the organic solids or sludge, to settle to the bottom of the tanks.

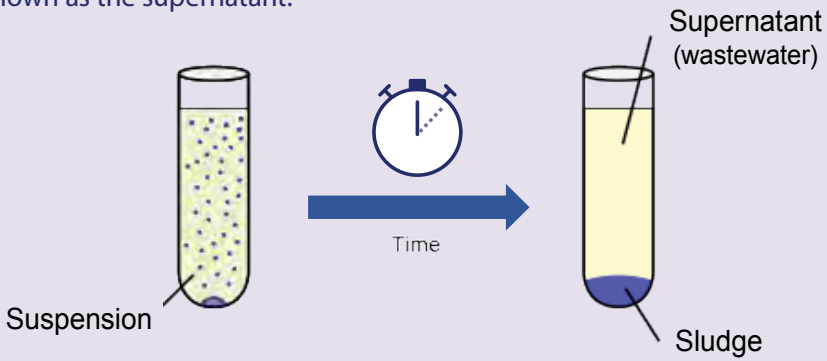
Step 3: A vacuum arm slowly rotating around the bottom of each secondary clarifier tank collects the sludge. Some sludge is pumped to a secondary sludge storage tank and some is returned to the anoxic tanks.

Step 4: A second arm rotates around the top of each tank skimming off lighter materials that have floated to the surface. These materials are sent to the sludge storage tanks.

Step 5: The supernatant is pumped to the denitrification filters for treatment.

Everyday STEM

A simple way to separate liquid wastewater from sludge solids in the wastewater treatment process is based upon Stoke's Law. The denser the sludge solid, the faster it settles to the bottom of the tank. The accumulation of sludge on the bottom of the tank creates what is known as a sludge blanket. The water above the blanket becomes clearer and clearer with time as more and more particles settle out of suspension. This almost clear layer of water is known as the supernatant.



STATION 9 – DENITRIFICATION FILTERS

Process time: 6 hours

Purpose: To eliminate nitrogen compounds from the water before it is discharged into Joe's Creek. Excess nitrogen in lakes and streams can cause plants and algae to grow at an accelerated rate. When these algae and plants die, aerobic microorganisms decompose them, and dissolved oxygen levels in the water drop below normal. The process is known as eutrophication, which can include catastrophic environmental effects such as algal blooms, fish kills, and anoxic conditions.

How it Works:

Step 1: The supernatant is received from the secondary clarifiers.

Step 2: Methanol is added to the wastewater to provide an energy source for the anaerobic bacteria. These bacteria living in the sand break down nitrates (NO_3-) and release the nitrogen (N_2) as a gas.

Step 3: The supernatant flows over the sides of the filters down into a deep layer of sand and gravel which traps and filters out most of the suspended solids.

Step 4: The treated wastewater is now ready for disinfection either through the chlorine tanks or the UV system.

Everyday STEM

The removal of nitrogen and other nutrients is part of the tertiary treatment phase in advanced wastewater treatment. The colonies of anaerobic bacteria that are responsible for the removal of nitrogen depend on the input of methanol (CH_3OH) from the nearby methanol feed facility. The methanol is used by the bacteria as their source of energy. $6NO_3- + 5CH_3OH \longleftrightarrow 3N_2 + 5CO_2 + 7H_2O + 6OH^-$. Nitrogen gas, carbon dioxide, water, and hydroxide are produced as byproducts of this metabolic reaction.

TRAM STOP

STATION 10 – DISINFECTION

10A – Chlorine Contact Tank

Process time: minimum of 15 minutes

Purpose: To ensure that the chlorine is evenly distributed throughout the water and has enough contact time to destroy any harmful disease-causing microorganisms.

How it Works:

Step 1: Water received from the denitrification tank flows into the chlorine contact tank.

Step 2: The water flows in a serpentine pathway around baffles (walls that extend approximately half way across the path). These baffles slow down the flow of the water, causing it to swirl. This swirling motion ensures the chlorine is evenly distributed throughout the water.

Step 3: If the path and/or the rate of flow needs to be adjusted, the tank contains gates that may be raised or lowered.

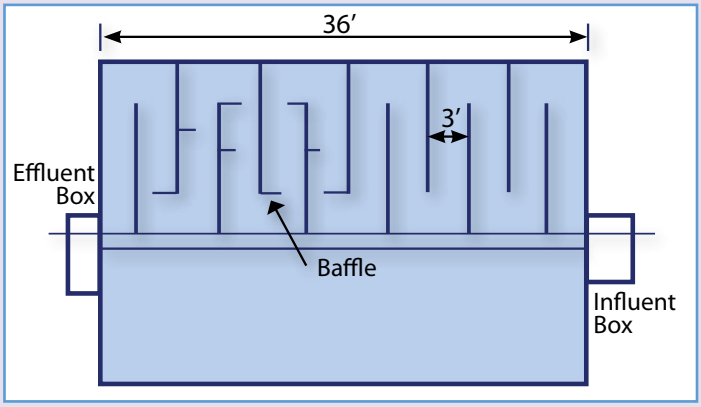
Step 4: When the water exits the chlorine contact tank, it goes to one of two areas:

A portion of this treated wastewater is pumped into one of three reclaimed water storage tanks, which have a total storage capacity of 18 million gallons. An average of 12 MGD of reclaimed water is distributed from the South Cross Bayou facility each day.

The other portion is dechlorinated with sulfur dioxide and then discharged into Joe's Creek after passing through the outflow cascade.

Everyday STEM

To ensure proper disinfection of the water entering the chlorine contact tank, the tank is designed with baffles. A baffle is a device used to restrain the flow of fluid, gas or loose material. In this case, it's fluid – water, and the devices are walls that are staggered and extend about half way across the tank. When you look at the chlorine contact tank from above, it looks somewhat like a maze. As chlorine is injected into the water, the water travels in the tank back and forth around the walls or baffles, sometimes creating small swirls or vortexes in the water that aids in mixing. This action slows down the travel time of the water, which ensures maximum contact time and allows a thorough reaction of the chlorine with any pathogens present. It's significant to note that the tank's baffles are designed at a length-to-width ratio of 40:1 to provide a minimum of 15 minutes of contact time at peak hourly flow.



10B – UV System

Process time: minimum of 15 minutes

Purpose: To ensure that pathogenic or disease-causing bacteria, viruses, and protozoan cysts are inactivated/destroyed before the water can be released into Joe's Creek.

How it Works:

A maximum of 10 MGD of wastewater flows through one of two channels in the UV disinfection area where it is exposed to UV light before proceeding to the outflow cascade for discharge into Joe's Creek. The UV light transfers electromagnetic energy through the microorganisms' cell wall, damaging its DNA (or RNA) and retarding its ability to reproduce.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STATION 11
OUTFLOW CASCADE

Process time: 15 minutes

Purpose: The outflow cascade is designed to aerate all the dechlorinated and UV treated water that will be released into Joe's Creek to ensure that there is enough dissolved oxygen (minimum 5.0 parts per million or ppm) present to support fish and other forms of wildlife.

How it Works:

Step 1: Water from the chlorine contact tank is dechlorinated using sulfur dioxide (SO_2), which is injected in the pipe to neutralize the chlorine.

Step 2: The dechlorinated water meets the UV treated water at the outfall cascade.

Step 3: The combined water tumbles down a stepped ramp inside the cascade device. This tumbling process mixes air with the water.

Step 4: The water flows out through a pipe at the bottom of the cascade and into the discharge area.

Step 5: Water from the discharge area drains out over a weir (retaining wall) and into Joe's Creek.

Everyday STEM

When sulfur dioxide (SO_2) is added to the chlorine contact tank effluent water, it reacts with the chlorine on a one-to-one basis. This results in very weak forms of hydrochloric and sulfuric acids from the combination of sulfur dioxide, chlorine and water. The acids produced are too weak to impact the pH level of the release water, which stays around the neutral point of 7.0 on the pH scale. The facility's Natural Pollution Discharge Elimination System requires the release water to be between a pH of 6 to 8.

TRAM STOP

STATION 12 – DIGESTERS

Process time: 18-24 days

Purpose: To provide an optimal environment that promotes the continuous circulation and decomposition of sludge by anaerobic microorganisms. These anaerobic microorganisms produce methane (CH_4) as a byproduct of respiration which is used as an energy source at the facility.

How it Works:

Step 1: Sludge from the blend tank is pumped to the rotary drum thickeners, where a polymer is added to thicken the sludge to approximately 4% solids and 96% water.

Step 2: Thickened sludge is pumped to the two egg shaped digesters where the sludge undergoes continuous thermal circulation.

Step 3: Anaerobic microorganisms break down the sludge and help to reduce the volatile solids by approximately 25-40%.

Step 4: Methane gas is produced as a by-product of the anaerobic respiration performed by a special kind of bacteria known as methanogens. Carbon dioxide gas is also produced and these gases accumulate at the top of the digesters.

Step 5: The processed sludge and gases are transferred to the large, round storage tank adjacent to the digesters known as the gas and sludge holding tank.

Step 6: The sludge is pumped from the storage tank to the pelletizer facility where it is thickened by high speed centrifuges and processed into fertilizer pellets.

Step 7: The methane gas is piped to the pelletizer facility to be used as part of the fuel mix in the gas furnace – a recovered resource!

Step 8: The carbon dioxide gas is discharged into the atmosphere.

Step 9: Excess methane gas is eliminated by burning it in a cylindrical structure known as the flare that is located near the digesters and storage tank.

Everyday STEM

A large portion of each digester tank extends underneath the ground, and the sides slope inward to form an apex, or blunt point. The shape of the digesters is like an egg standing on the pointed end with a slight bulge in the middle. The reason this is an ideal shape for the digesters is there are no dead zones or "pockets" to impede the continuous thermo-driven circulation of the sludge.

TRAM STOP

STATION 13
PELLETIZER FACILITY

Purpose: To convert the biosolids mixture received from the sludge digesters into fertilizer pellets.

13A – Dewatering Centrifuges

Process time: 15 minutes

Purpose: To partially dewater the biosolids mixture received from the sludge digesters.

How it Works:

Step 1: The dewatering facility receives the biosolids mixture (digested sludge) at approximately 95.5% water and 4.5% solids.

Step 2: A polymer is added to thicken the solids.

Step 3: Much of the water is extracted through the spinning motion of the high speed centrifuges.

Step 4: The dewatered biosolids mixture is conveyed over to the pelletizer facility at 20% solids and 80% water.

13B – Pelletizer

Process time: 35 minutes

Purpose: To dry out, or desiccate, the biosolids mixture and sterilize the remaining solids through a high temperature process.

How it Works:

Step 1: The dewatered biosolids from the adjacent dewatering facility are received.

Step 2: The dewatered biosolids are then mixed with tiny dry pellets from the pelletizer recycle bin. This increases the solid content to approximately 55%.

Step 3: This mixture then drops down a chute into a large, rotating dryer drum. A gas furnace maintains the internal temperature of the dryer drum between 1200 to 1300 degrees Fahrenheit.

Step 4: The mixture inside the dryer drum follows a path that causes the material to pass down the entire length of the drum three times before exiting. The detention time of the sludge inside the drum is approximately 20 minutes.

Step 5: The high temperature inside the dryer drum evaporates the water from the biosolids and sanitizes the product.

Step 6: The dried out biosolid particles must then pass through sizing screens. Oversized pellets are sent through a crusher and then to the recycle bin. Undersized pellets are sent to the recycle bin. Correctly sized pellets are transported to the outside storage silos.

Step 7: As needed, liquid nitrogen from an adjacent storage tank passes through an evaporator unit and is converted into nitrogen gas. The cold nitrogen gas is inserted into the pellet storage silos to keep the pellets cool and to create an inert environment inside the silos. This prevents the pellets from overheating and possibly undergoing rapid spontaneous combustion.

Step 8: The pellets from the storage silos are conveyed to the loading dock and then loaded onto large hauling trucks.

Step 9: The pellets are sold to commercial fertilizer companies that either 1) blend the pellets with other fertilizer components, or 2) use them as an organic soil amendment.

Currently, the three major users of the fertilizer pellets produced at South Cross Bayou are orange groves, palm nurseries and sod farms.

The pelletizer facility is operated by Synagro, a private company. Pinellas County Utilities and Synagro have a partnership arrangement for the production of the fertilizer pellets, and they share the profits derived from the sale of the pellets.

Everyday STEM

The gas-fired furnace that connects directly to the dryer drum burns a mixture of methane and natural gas. The methane gas is produced in the two sludge digesters as a result of the sludge decomposition. However, the methane gas cannot be used as the sole fuel source for the furnace because it does not burn hot enough (measured in BTUs) to produce the high temperatures needed by the dryer drum to dry out and sanitize the biosolids. The use of the methane gas helps to reduce the fuel costs for operating the pelletizer furnace.

SCB GLOSSARY

Activated sludge – sludge that has been aerated and may contain aerobic microorganisms.

Advanced wastewater treatment – wastewater treatment process that includes primary treatment, nutrient removal, and disinfection.

Aeration – adding air to wastewater.

Aerobic – with oxygen; oxygen rich.

Anaerobic – in the absence of oxygen.

Anoxic – very low level of oxygen.

Biosolid – organic matter recycled from sewage, especially for use in agriculture.

BTU – British Thermal Units; the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit at a specified temperature (as 39°F).

Carbon dioxide (CO_2) – a gas formed in the digesters.

Cascade – tumbling/falling, aerated water.

Centrifugal force – inward pull caused by a spinning motion.

Chlorine (Cl_2) – chemical used to kill harmful microorganisms in wastewater.

Denitrification – removal of nitrogen from wastewater by conversion of nitrate/nitrite to nitrogen gas.

Digesters (Anaerobic) – large egg-shaped tank where sludge is broken down by anaerobic microorganisms.

Discharge – to release or send out treated effluent to a body of water.

Disinfection – process of deactivating microorganisms.

Effluent – treated wastewater that flows out of a treatment plant.

Flare – a large cylindrical structure where excess methane gas from the digesters is burned.

Gravity – force that pulls objects down toward the earth.

Grit – small, loose particles of sand (sand is 0.06mm – 2mm in size).

Inert – chemically unreactive. Inert chemicals are used to prevent undesirable chemical reactions (i.e. spontaneous combustion, food spoilage, etc.).

Influent – wastewater that flows into a treatment plant.

Inorganic – non-carbon based chemicals. Examples include nitrite, nitrate, ammonia, sulfur dioxide, and chlorine.

Joe's Creek – a tidal creek that contains brackish water; the water level is influenced by the rise and fall of the tides. Joe's Creek joins the Intracoastal Waterway which is connected to the Gulf of Mexico.

Methane (CH_4) – a gas that can be burned as a fuel source.

Methanogens – bacteria that live in oxygen-free environments, such as sewage or digestive tracts of mammals, and produce methane gas.

Microorganism – microscopic living organisms such as bacteria, protozoans, fungi, and some algae.

Neutralize – to counteract the effect of another chemical.

Nitrate (NO_3-) – a nitrogen compound found in wastewater. It can be used by plants as a fertilizer source for nitrogen.

Nitrification – the conversion of ammonia to nitrate/nitrite.

Nitrite (NO_2-) – a nitrogen compound found in wastewater that can be toxic to fish.

Organic – carbon-based chemicals. The science of organic chemistry deals with the structure, properties, and reactions of carbon containing compounds.

Outflow – area where the water flows out into a surface water body.

Oxygen – a gas without color or odor that forms about one fifth of the atmosphere.

Parts per billion (ppb), or micrograms per liter (ug/L) – one part by weight of analyte to 1 billion parts by weight of water sample. (not in current text)

Pelletizer – equipment (large round drum) used to dry the sludge and process into pellets.

Polymer – a chemical compound that is made of small molecules that are arranged in a simple repeating structure to form a larger molecule.

Reclaimed water – non-potable, highly treated wastewater used for irrigation and some fire hydrants.

Sludge – solid, heavy organic particles present in wastewater.

Sludge blanket – thick layer of settled sludge particles.

Supernatant – after the sludge layer has settled to the bottom of a basin, the mostly clear water remaining at the top.

Suspension – a mixture of small particles (solid materials) floating in a fluid.

Virus – an infectious agent that replicates inside of a living organism, often causing malaise or disease to its host. Viruses are smaller than bacteria.

Volatility – the tendency of a substance to vaporize or turn into a gas. A substance that is volatile and can vaporize more readily.

Image Glossary

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Back Cover: *Tour Tram*


SOUTH CROSS BAYOU
WATER RECLAMATION FACILITY
SEWERSHED
GULF OF MEXICO
OLD TAMPA BAY
Belleair
Belleair Beach
Belleair Bluffs
Belleair Shore
Indian Rocks Beach
Indian Shores
Largo
Pinellas Park
Seminole
Redington Shores
N Redington Beach
Redington Beach
Madeira Beach
Kenneth City
South Cross Bayou Water Reclamation Facility
St Petersburg
Treasure Island
Gulfport
South Pasadena
St Pete Beach
SOUTH CROSS BAYOU
Water Reclamation Facility
LEGEND
PINELLAS PARK SEWERSHED
BOCA CIEGA SEWERSHED
MADEIRA BEACH SEWERSHED
SOUTH CROSS BAYOU SEWERSHED
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RESOURCE RECOVERY AT WORK

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