

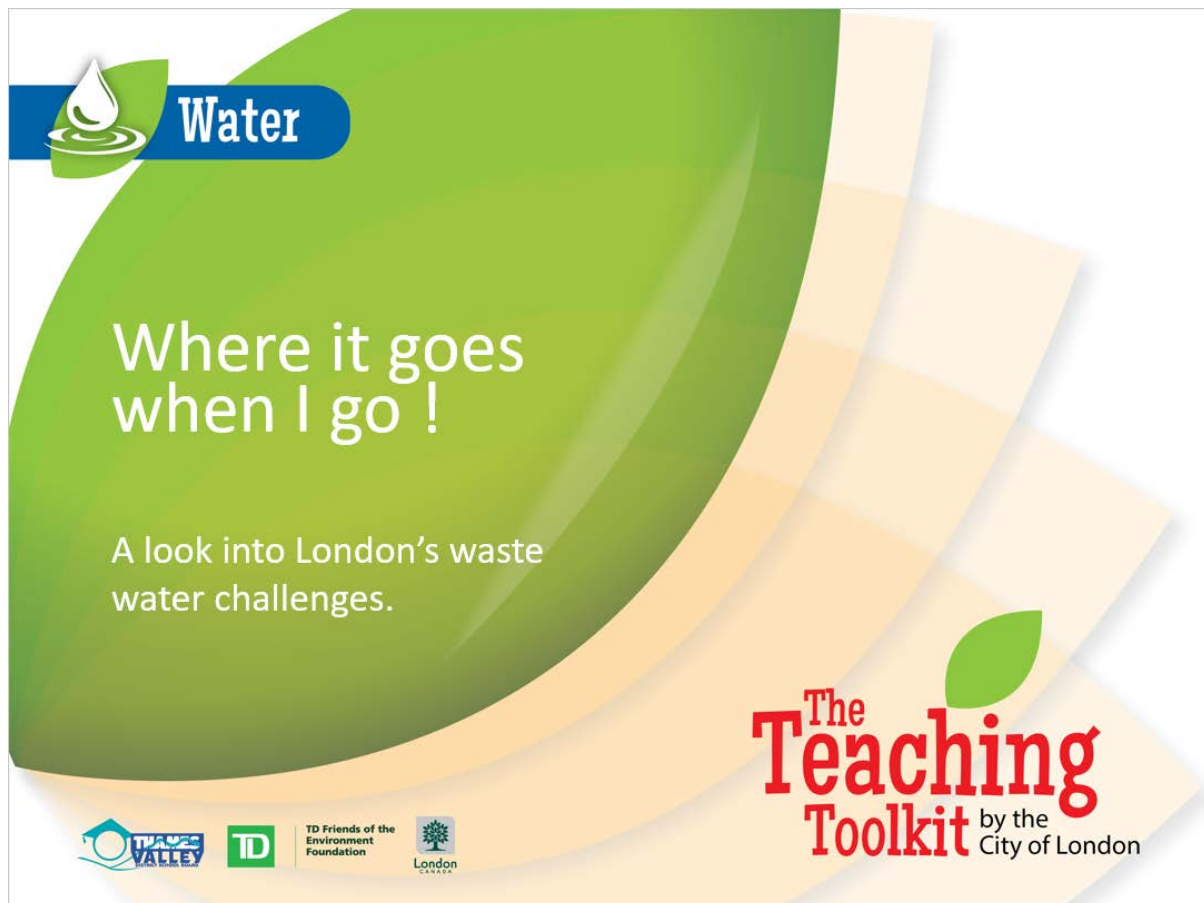
MODULE CODE: M2X9623
TITLE: Environmental Monitoring & Remediation

DATED: 22/09/2019
LEVEL: 5
CREDITS: 20

JACS CODE: D447
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Date: 01.10.2019

Source: City of London – The Teaching Toolkit



 **Water** ?? ?? ?? ??

Have you ever wondered what happens to waste that goes down the sink or toilet ?

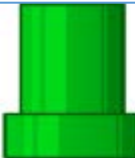
- I wonder what happens to my waste?
- Does it go out to the lake?
- Does it disappear into thin air?
- Does it just go down into the ground ?
- Does someone take it away and clean it?
- Do the fish eat it?
- What about my drinking water, do they mix?
- Where do all the pipes go?







 **Water**



So Where does it Go ?

It could go to the Adelaide Plant **It could go to the Greenway Plant**







Water

It could go to the Pottersburg Plant It could go to the Vauxhall Plant



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Water

It could go to the Oxford Plant It could go to the Southland Plant

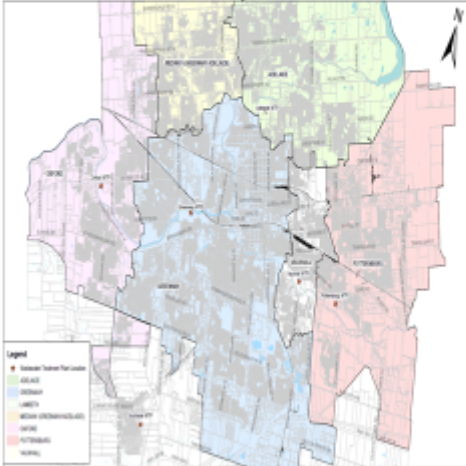


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Where does mine go ?

- Using the sanitary sewersheds map. Identify where you live and try to determine where your sewage and wastewater is sent.



London Sanitary Sewersheds

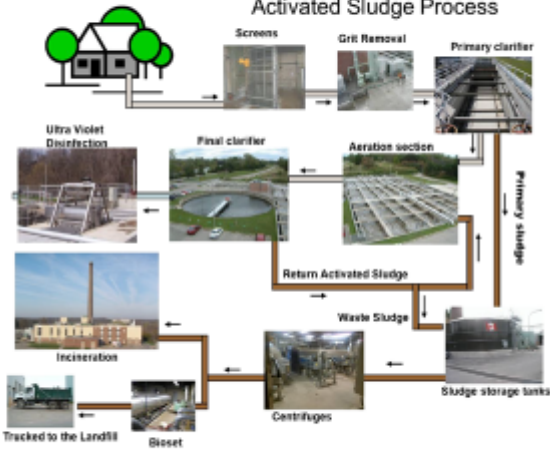
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What happens next ?

This is the process that all waste goes through upon arrival at a wastewater treatment plant.



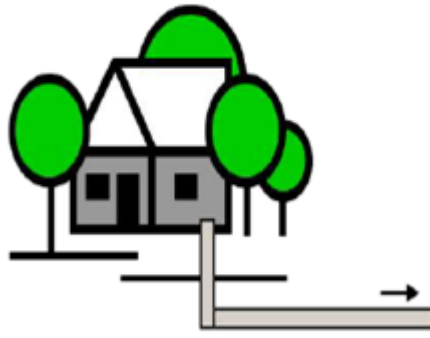
Activated Sludge Process

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Water

Step 1: Wastewater enters the pipes



- When we flush the toilet, do the laundry, brush our teeth, take a shower, and do the dishes or use the dishwasher we create "wastewater".
- Wastewater is a term used to describe any type of water that has been utilized in some capacity, during which its quality is negatively impacted.
- The average daily flow of wastewater to all of the treatment plants from the pipes is **186,000 cubic meters per day**.
- The flow from all of the pipes is generated **using gravity sewers or force mains** from **36 pumping stations** around London.

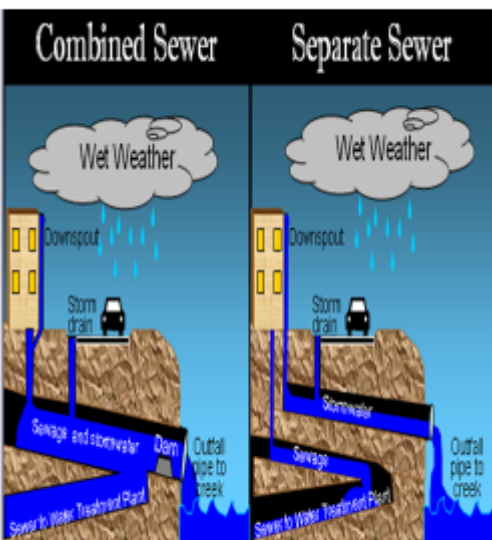
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Water

Step 1: Wastewater Enters the Pipes

- Once the material goes down the drain it enters into city sewers which are either **combined** or **not combined** with stormwater.
- London has **less than 5% of households** still hooked into combined sewer systems.
- There are **two forms of wastewater** that each household contributes:
 - Sewage water** (toilet)
 - Greywater** (shower, dishwasher, sink, washing machine)



The diagram compares two sewer systems during wet weather. In the **Combined Sewer** system, rain from a downspout and stormwater from a storm drain both enter a single pipe. This pipe leads to a **dam** where the water overflows into a **creek** before reaching the **Water Treatment Plant**. In the **Separate Sewer** system, rain from a downspout enters a pipe that leads directly to the **Water Treatment Plant**. Stormwater from a storm drain enters a separate pipe that leads to a **creek**.

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Step 2: Wastewater Enters the Plant through Screens

- Once the material is pumped into the wastewater treatment plant it enters **pre-treatment**.
- The first step in pre-treatment is called **"Screening"**.
- Screening occurs using steel screens with **2-19mm openings**.
- These screens remove larger materials such as paper and plastic, preventing the clogging of equipment further on in the treatment process.



Screens



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Water

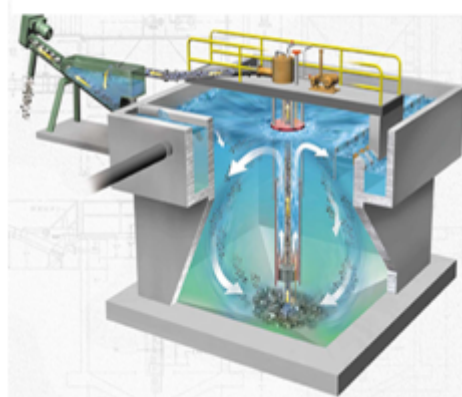
Step 3: Screened Wastewater Enters the Vortex System

- As the wastewater moves from screening, it still contains heavier organic solids such as dirt and stones.
- The vortex system is used in **"Grit Removal"**.
- The vortex system spins the waste water creating a **"vortex"** where the suspended grit settles to the bottom centre.
- The grit at the bottom of the system is free of organic material (sewage) and suitable for disposal at a **sanitary landfill site**.
- The vortex units are enclosed to prevent odor escape

Screens



Grit Removal



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Step 3: De-Gritted Wastewater Enters the Primary Settling Tank

- After the wastewater is de-gritted it flows into large settling tanks called **primary clarifiers**.
- These tanks are designed to remove the larger organic solids and grease.
- The **solids settle out by gravity** over time and the **grease floats on top of the wastewater**.
- Once the solids settle out they are raked into a **sludge well** where they are then sent to **sludge tanks** for storage.
- The grease on top of the water is skimmed off using a **skimmer arm** and sent into the scum outlet where it is then stored.

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Water

Step 3: De-Gritted Wastewater Enters the Primary Settling Tank

- As displayed on the right you can see that the primary clarifier has two pipes leading out of it
- The solids that settle to the bottom known as **sludge** are removed and sent to sludge storage tanks (where treatment will be discussed further on)
- The remaining wastewater is sent to **aeration tanks**

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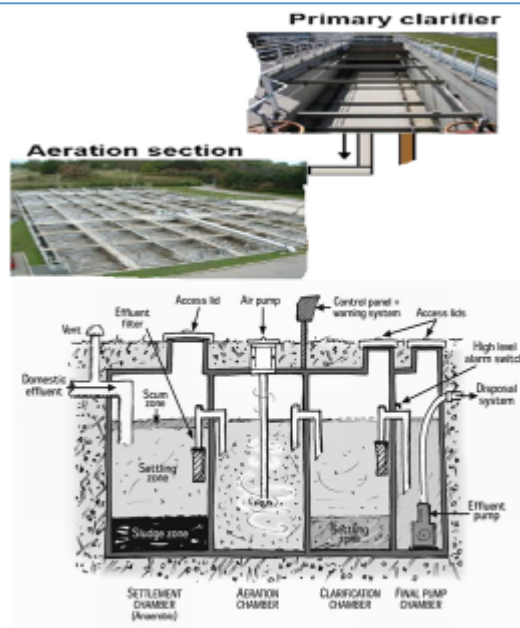
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Step 4: Clarified Wastewater Enters Aeration Tanks

- After the wastewater is clarified it is piped to aeration tanks using an **effluent pump**.
- In the aeration tanks the wastewater is treated biologically.
- The **biological treatment** involves the use of bacteria and other minute organisms which in the presence of air, utilize and consume the undesirable contents of the wastewater.
- The air is added to the waste water using dome shaped **diffusers** located at the bottom of the tanks.



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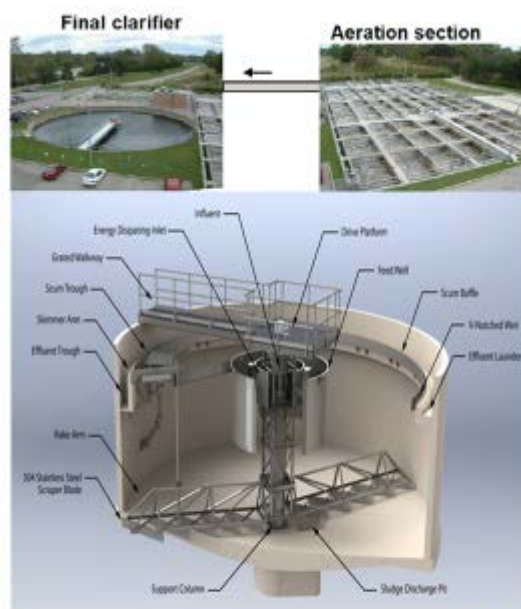
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Step 5: Aerated Wastewater Enters Final Clarifier

- After the wastewater is aerated it enters into the final clarifier as "**mixed liquor**".
- In the final clarifier, similar to the primary clarifier, the suspended solids settle out by gravity as **activated sludge** and are removed.
- The clear suspended liquid is then **decanted** over the **weirs** and is discharged to the **disinfection process**.



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Step 5: Aerated Wastewater Enters Final Clarifier

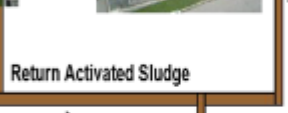


Final clarifier



Aeration section

- Part of the activated sludge is returned to the aeration tanks to maintain the mass of bacteria (activated sludge process)
- The remaining sludge or "waste activated sludge" is pumped to one of three **flotation units**, where the sludge is mixed with **polymer** and air to aid in the thickening process.
- The thickened sludge is then stored in the sludge storage tanks



Return Activated Sludge



Waste Sludge



Sludge storage tanks



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Step 6: Wastewater is Disinfected



Ultra Violet Disinfection



Final clarifier

- Before the treated wastewater is discharged to the river it needs to be disinfected.
- The disinfection process **only occurs between April 1st and September 30th**.
- The treated wastewater passes by **ultraviolet lights** in a channel which destroys and remaining **pathogenic bacteria**.
- The disinfection process is monitored by **intensity monitors** to determine if the ultraviolet rays are effective in killing off the bacteria.







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 **Water**

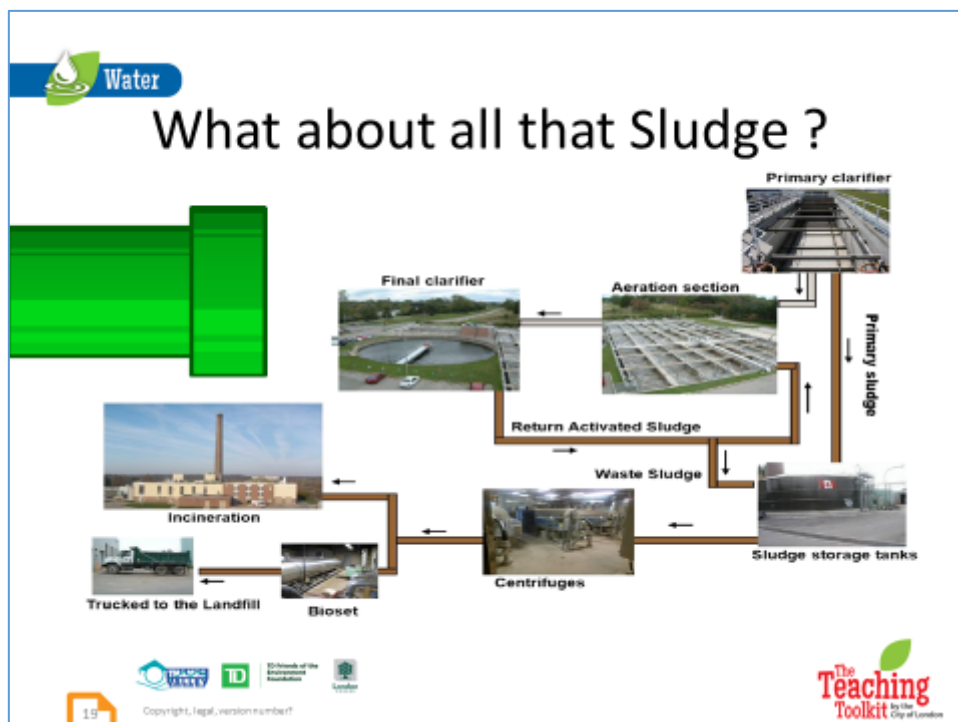
Step 7: Disinfected Waste Water is Discharged to the Thames River.



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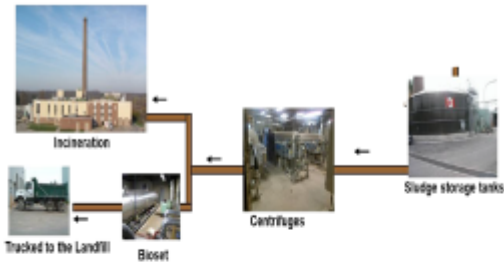




 **Water**

Step 8: Sludge Disposal and Treatment

- The sludge that is generated from all the sewage plants is hauled by tanker truck to the Greenway pollution control centre
- The trucked in sludge is mixed with the Greenway sludge in holding tanks
- The sludge from these tanks is then pumped to belt presses where it is mixed with polymer and **dewatered**
- After the sludge is dewatered it is pumped to a **fluid-bed incinerator** where it is burned
- The **fly ash** produced from the burning of the sludge is then sent to landfill or reused at cement companies



 **Water**

How much sludge is produced each day ?

Sludge produced average day	Cubic metres (normalized to 3% solids)
Adelaide	293
Greenway	1,030
Oxford	100
Pottersburg	243
Southland	2
Vauxhall	105



Water

Three Main Goals for Wastewater Treatment

1. Remove the majority of the carbonaceous (organic) and nitrogenous (ammonia) impurities in order to reduce the oxygen demand of the plant
2. Reduce the phosphorous levels
3. Reduce the amount of suspended solids prior to the plant discharging to the Thames River



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Water

Field Trip



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Water

Individual Activity

- Reflect on why it is important to treat our waste water, emphasize the importance of treating the waste water before releasing it
- Highlight any positives with the treatment system the City of London currently uses as well as any negatives.
- Write a one page newspaper article highlighting why wastewater treatment is important and how ordinary people can contribute to better water treatment. (i.e; what they flush down the toilet or dump down the drain)

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Water

What did you think about the lesson?

- What did you learn?
- What did you love?
- What do you want to learn more about?
- What was boring?
- How would you make the lesson better?

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