CITIWATER TOWNSVILLE

MT ST JOHN WASTEWATER TREATMENT PLANT

Sewage (wastewater) is water that has been used in residential, commercial and industrial sites, which is no longer clean. After you have used water, the wastewater (or effluent) starts a journey through a series of pipelines, and pump stations, which we call the Sewerage System, where wastewater is pumped to the Wastewater Treatment Plant to receive treatment.

Important resources are generated from the wastewater treatment such as gases, sludge and effluent and these can be reused in many ways, for example for irrigation, generating electricity, mulching and top soil.

Wastewater may contain pollutants including human waste, paper, wood, grease, fats, plastic and chemicals from industrial locations. It may also contain dissolved nutrients, nitrogen, phosphorus, and a range of microscopic organisms such as bacteria and viruses, as well as low levels of oxygen. If this wastewater is released back into the environment with these harmful organisms together with low levels of oxygen it can kill species such as fish that live in the receiving waters, cause algae blooms, along with other environmental impacts. People may also be affected by being in contact with that water or using that environment.

Mount Saint John Wastewater Treatment Plant receives wastewater from many suburbs throughout Townsville. Some of them include Cranbrook, Heatley, Vincent, Garbutt, Mt Louisa and Pallarenda. It also receives sewage from suburbs in Thuringowa including Kirwan and the Upper Ross.

About 99% of sewage arriving at the Mt St John Treatment Plant is water. On a dry weather day, this Plant may treat between 11-13 million litres and during wet weather this flow can increase 3 fold. However, the majority of this will be rainwater and therefore the wastewater will be of a much lower strength than normal wastewater. Wastewater here receives primary, secondary and UV disinfection treatments.

Primary Treatment

The primary treatment starts at the Rotary Drum Screen which removes solids such as food particles, sand, rags, plastic, anything greater than 3mm. This solid material is taken to the dump by trucks 3 times a week. The wastewater now goes to the Aerated Grit Tank where the bubbling of the water helps to separate the remaining sand and grit from the organic material.

The heavier sand and grit settles into hoppers at the bottom of the tank where it is pumped out and buried on-site. The remaining wastewater (or effluent), still containing dissolved nutrients, organic matter, viruses and bacteria, goes to the Primary Flow Divider which splits the flow into two Primary Settling Tanks.

Rotary Drum Screen

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Primary Settling Tank

In the Primary Settling Tanks (also called Primary Clarifier), larger particles of organic matter (called raw sludge) settle to the bottom. These then are removed from the tanks by a Rotating Submerged Raking System to a central hopper and then it is discharged to a Raw Sludge Well. From the well, the sludge is pumped to two Anaerobic Digesters for further treatment.

Any floating material (scum) is also removed by a surface scraper on the Rotating Bridge and are also discharged in to the Raw Sludge Well. Cleaner effluent flows over vee-notches (v-shaped openings) of the Primary Settling Tank and onto the next stage where the flow is split between the front two Biofilters. Here is where the secondary treatment starts.

Vee-notches

Secondary Treatment

The secondary treatment consists of four Biological Trickling Filters that will work to kill viruses and bacteria, as well as remove traces of sludge which were not heavy enough to settle in the primary treatment.

The Biological Trickling Filters are circular concrete structures filled with a two meter deep bed of rocks (approximately 70mm in size) covered with a slime layer containing helpful micro-organisms (called zoogleal slime). The zoogloeal slime requires dissolved oxygen to live and reproduce. This process is called the “aerobic process“. Their function is to remove dissolved and finely suspended organic solids and to decompose these organic materials biologically, to form a cleaner product.

This biological community consists mainly of bacteria, fungi, protozoans, worms, insect larvae and snails. The effluent coming from the Primary Settling Tanks is discharged over the top of the filter stone media (Biofilter) by means of the Rotating Arms and trickles down through the slime covered stones. The purification process proceeds continuously provided that aerobic conditions (oxygen rich) are maintained within the bed of stones.

Secondary Flow Divider

Effluent leaves the system by a series of openings at the bottom of the outer wall which also serves to let air into the stone bed to maintain aerobic conditions and passes onto the back two Biological Filters. The wastewater from the front two filters is transferred by pumps to the Secondary Flow Divider where it is split between the back two Biological Filters. This works in the same manner as the front two filters but because the effluent goes through two filters in series, there is more breakdown of organic material and therefore increased efficiency.

Biological Trickle Filter

The trickling of the wastewater down through the stone bed results in some flushing effect and slime particles are continuously removed from the filters and pass onto the Secondary Settling Tank as humus sludge particles. The Secondary Settling Tanks remove these humus sludge particles from the filter effluent by a Rotating Hydraulic Raking System and is discharged to the Sludge Well and from this is pumped back to the Plant inlet.

The final cleaner effluent, flows over the vee-notches of the Secondary Settling Tanks and is discharged by gravity to a drainage channel on the western boundary of the Town Common which is connected to a tributary of the Bohle river several kilometres from the Plant.

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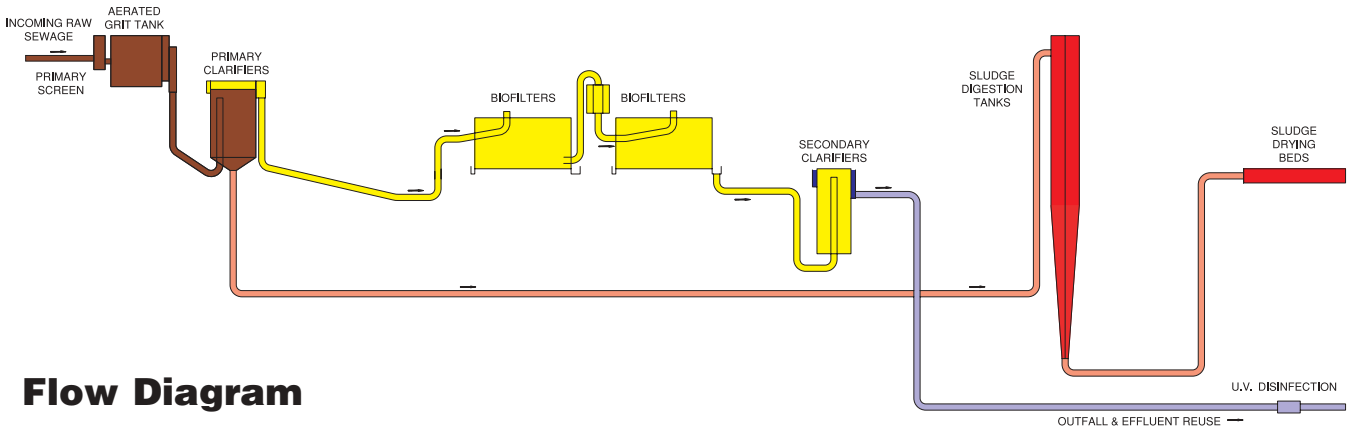
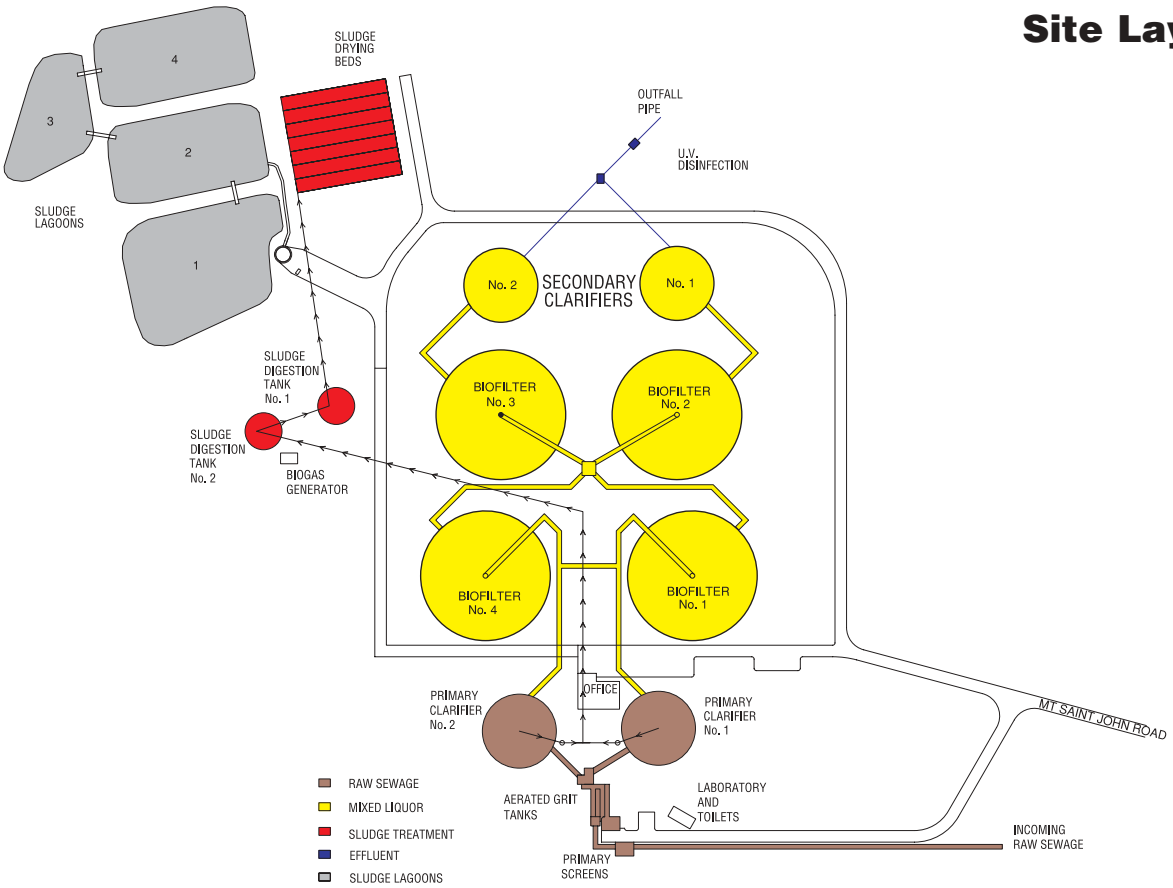
UV Disinfection

Approximately 50% of the incoming sewage is treated using UV disinfection. The UV disinfection system comprises a series of special fluorescent tubes that generate ultra-violet lights. These UV rays kill viruses and bacteria contained in the final effluent. UV disinfected effluent from Mt St John is reused to irrigate the Rowes Bay Golf course, RAAF Base, the Pallarenda foreshore, as well as the Treatment Plant grounds. In fact, treated effluent is an environmentally friendly and valuable resource that can, and should be reused for many purposes, including irrigation of parks, public gardens, pastures and agriculture, for example. By reusing treated effluent we are conserving clean freshwater from our catchment, among other benefits. Citiwater is committed to evaluate and adopt sustainable alternatives, such as the reuse of resources generated by the wastewater treatment.



Flow Diagram

Site Layout



Wastewater Test Lab

Effluent Quality

Constant monitoring, testing and sampling are important activities of the wastewater management system. Wastewater, at this Treatment Plant, is tested every two weeks, in the laboratory, by professional Citiwater chemists. Samples are taken from the incoming raw (untreated) wastewater, after the primary, secondary treatments and UV disinfection. Mt St John Treatment Plant has a licence to discharge, issued by the Environment Protection Agency. This licence sets the quality and quantity of the final product.

Sludge

At Mt St John around 50,000 litres of sludge is removed daily. The sludge and scum collected in the Raw Sludge Well is pumped at intervals to Anaerobic Digesters (no oxygen) where the obnoxious raw sludge is broken down by acid-forming and methane-forming bacteria. This breakdown of raw sludge simplifies disposal problems because a substantial overall reduction in the volume of digested sludge to be disposed of in the Drying Beds is achieved. The digested sludge is poured onto sand beds where further water is removed by evaporation and seepage. After several weeks the dried sludge is picked up by a tractor and stockpiled. This is later taken to the dump as landfill.

Sludge Digester Tanks

Biogas

Methane gas is also produced in the Sludge Digester and is used to power an electricity generator. This in turn heats the digesting sludge to an optimum temperature between 35°C and 37°C for good bacteria to live and reproduce, and thus to break down the sludge.

Townsville Biogas

The electricity generator uses 100% of the methane produced and is capable of powering 90% of the electricity needed to run this Treatment Plant. Methane is a greenhouse gas which contributes to global warming. By reusing this gas to produce electricity, we are cutting methane emissions into the atmosphere, thus keeping the air clean.

Treatment of wastewater at Mount Saint John Wastewater Purification Plant is in accordance with standards set by the Department of Environment. Citiwater operates an International Quality Management System that complies with the requirements of ISO 9002. By adopting a professional and best practice approach to manage Townsville's water and wastewater business, Citiwater is fulfilling its commitment towards the community and the environment.

Technical Data

Influent Characteristics
- BOD_5 : 240 mg/L
- Suspended Solids: 300 mg/L
- Ammonia: 37 mg/L
- Organic Nitrogen: 5.5 mg/L
- Total Phosphorus: 6.9 mg/L

Effluent Requirements
- BOD_5 : 30 mg/L
- Suspended Solids: 30 mg/L

Plant Capacity
- Equivalent Population: 40,000 EP
- Dry Weather Flow rate: 11-13 ML/Day
- Wet Weather Flow rate: 33-39 ML/Day

Commission Dates:
- Module 1: December 1972
- Module 2: February 1980

Unit Operations Details

Rotary Drum Screen
- Screen Capacity 36 ML/d
- Wedgewire Slot width: 3.0 mm

Aerated Grit Removal Tank
- Depth: 3000 mm
- Width: 3600 mm
- Length: 11500 mm
- Detention:
  - Average Hour Flow: 10.5 minutes
  - 3 x Average DWF: 5.8 minutes
  - Pump Rate: 5.3 minutes

Primary Clarifier (each)
- Number: 2
- Diameter: 19800 mm
- Depth: 2740 mm
- Detention:
  - Average Hour flow: 2.9 hours
  - Maximum 6 Hour Flow: 2.5 hours
  - 3 x Average Flow: 1.6 hours
  - Pump Rate: 1.4 hours
- Surface Settling Rate: 25 Kl/m^2/day
- Overflow Velocity: 124 Kl/m/day
- BOD Removal (35%): 760 Kg/day
- Suspended Solids Removal 60%: 1630 Kg/day

Biological Trickling Filter (Each)
- Number: 4
- Diameter: 36000 mm
- Depth: 1680-1980 mm
- Volume Media: 1920 m^3
- Applied BOD_5 : 0.18 Kg/ m^3/day
- Hydraulic Loading: 3.72 Kl/m^2/day

Secondary Clarifier (each)
- Number: 2
- Diameter: 15850 mm
- Depth: 3200 mm
- Detention:
  - Average Hour Flow: 2 hours
  - Surface Settling Rate: 40 Kl/m^2/day

Secondary Treatment (4 Filters Plus 2 Clarifiers)
- BOD_5 Removal (87%): 1240 Kg/day
- Suspended Solids Removal (85%): 820 Kg/day

Outfall (Each)
- Number: 2
- Diameter: 600 mm
- Length: 866 mm
- Gravity Capacity: 764 Kl/hour

Sludge Digestion Tank (each)
- Number: 2
- Diameter: 12200 mm
- Volume: 1132 m^3
- Operation: two stage heated

Sludge Drying Beds
- Number of Units: 12
- Area: 186 m^2

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A Business Unit of the Townsville City Council ABN 81 143 904 097

INTERNATIONAL QUALITY MANAGEMENT SYSTEM ISO 9001 NATA CERTIFIED

GARBUTT OPERATIONS CENTRE

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