Tertiary treatment

Ultraviolet (UV) disinfection

Wastewater information sheet 6

The final or tertiary stage of the land-based wastewater treatment system is disinfection, using ultraviolet (UV) light. In this process, clarified effluent from the reactor/clarifiers is passed through the disinfection plant. The plant, which is one of the largest in the southern hemisphere, features the very latest disinfection technology designed to eliminate pathogens (bacteria and viruses) from the treated wastewater.

Filtration

Prior to UV treatment, the clarified wastewater is first passed through the adjacent filtration plant which contains 10 large filter blocks. The filter blocks are substantial concrete structures, 10.8 by 11.2 metres and nine metres deep. They contain media to a depth of nearly two metres. The media consists of a uniform 1.6 millimetre (+ or - 0.05 millimetre) layer of fine granular anthracite, a very hard form of coal. This is placed over a 115 millimetre deep base course of industrial garnet. The clarified effluent is passed through the filters which remove particles larger than 15 microns (15 thousandths of a millimetre) prior to it entering the UV gallery. This ensures high water clarity to enable maximum UV ray penetration.

UV disinfection

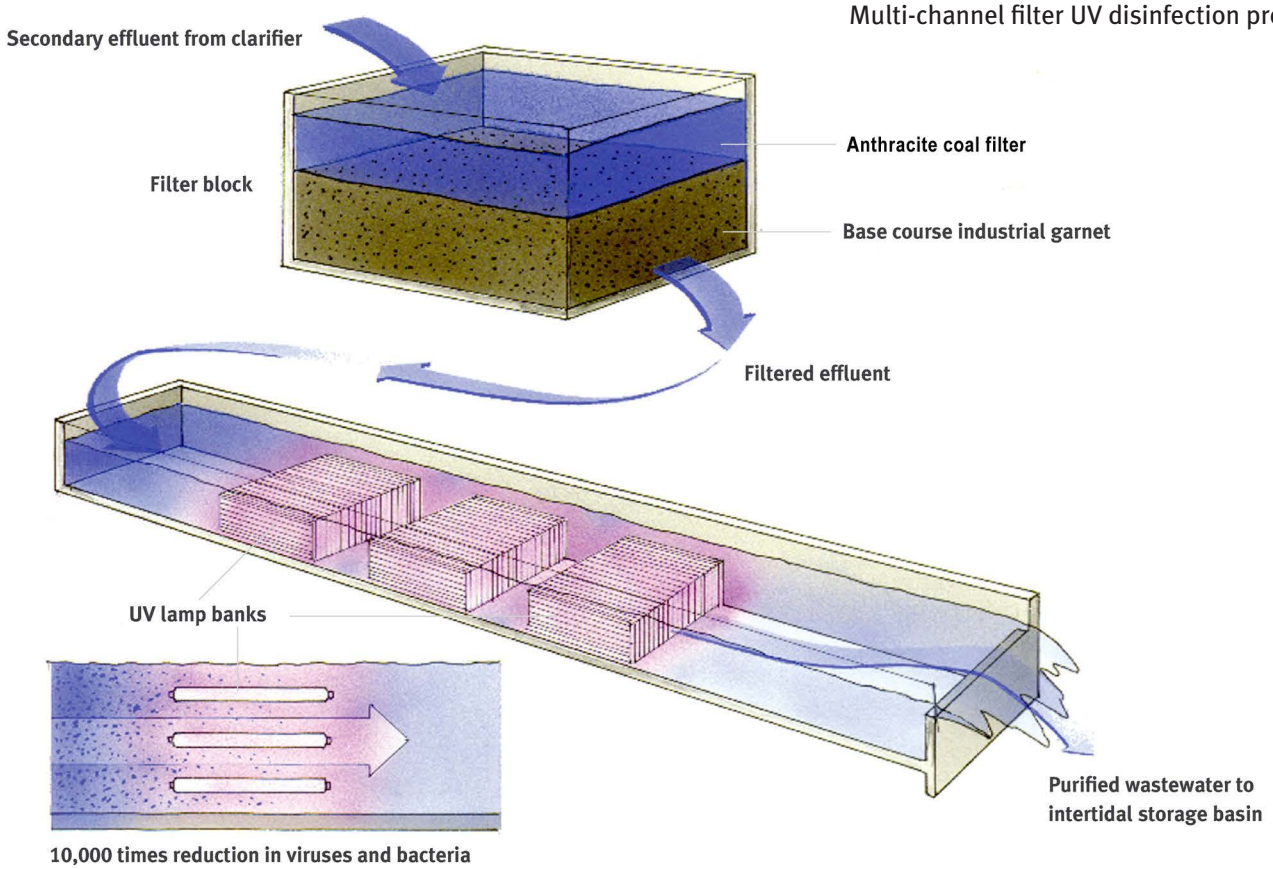
In the UV gallery, the filtered wastewater passes through twelve parallel channels. At the heart of the UV system is a high performance mercury vapour lamp rated at 300 watts covered with a hard quartz tube. Each lamp has an operational life of 12,000 hours. There are 7776 lamps in the UV plant. Three banks of UV lamps – each bank holding 216 lamps – are installed in each channel. The banks are submerged in the channels lengthwise along the direction of flow.

UV light wavelength is situated on the electromagnetic spectrum between visible light (blue) and the x-rays (200-400 nanometres). UV rays peaking at 254 nanometres kill micro-organisms by penetrating cell walls and damaging cellular material (including DNA and RNA). This prevents cell reproduction or causes death of the cell.

In tandem with the secondary BNR process, the disinfection plant is designed to achieve a 4 log (10,000 times reduction) in pathogens in the wastewater discharging into the harbour.

The UV disinfection plant is designed to process a dry weather flow of about 3.3 cubic metres per second – a similar rate to that of Watercare's water treatment station at Ardmore.

Multi-channel filter UV disinfection process



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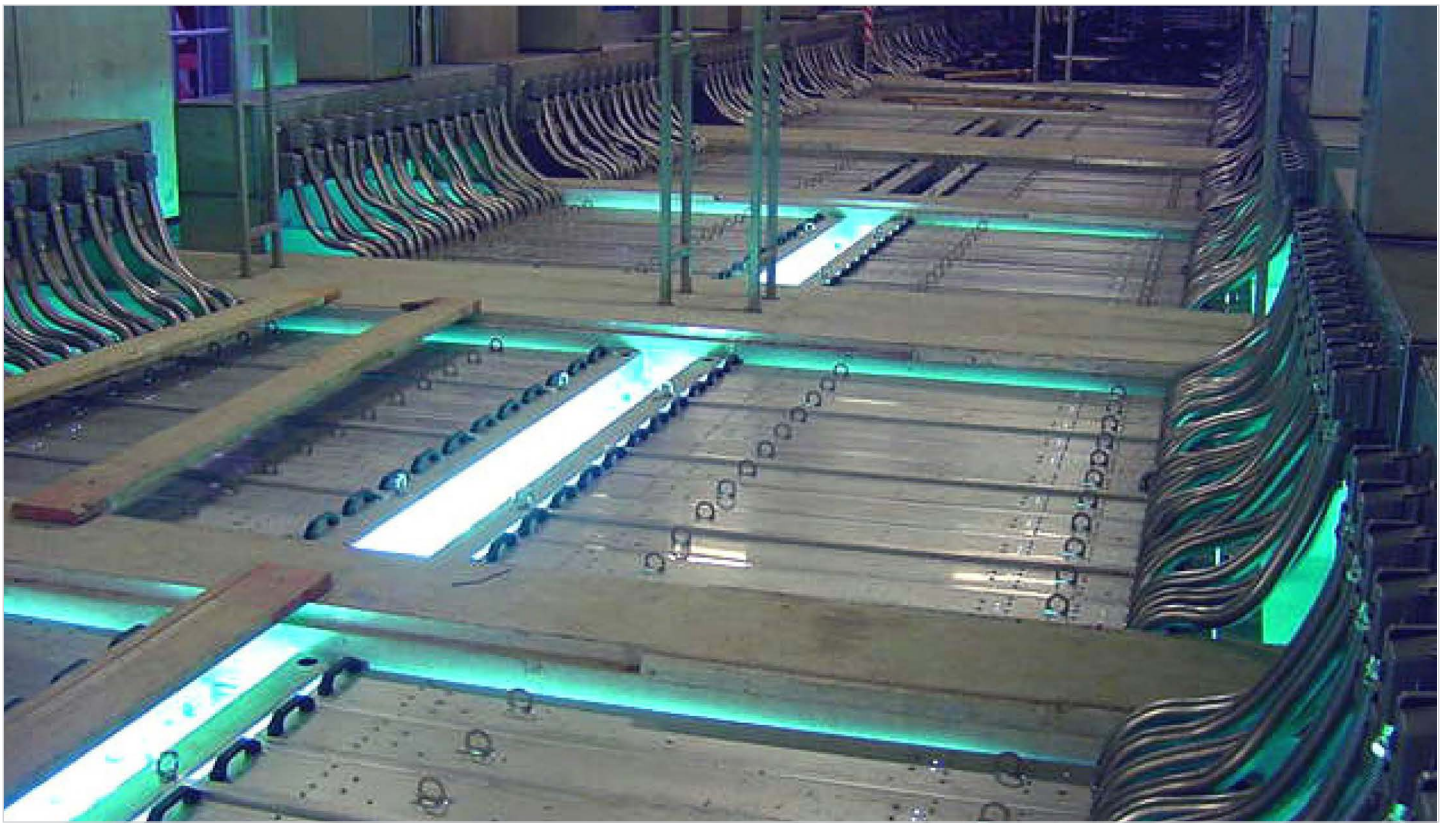


Some of the 7776 ultraviolet (UV) lamps in the UV gallery.

Cleaning the cleaners

In order to achieve the maximum reduction of pathogens, it is important that the effluent be as clear as possible. The anthracite filters are themselves cleaned by backwashing, using recycled filtered wastewater and compressed air.

This periodically blown through the filter media, separating out the waste material from the media discharging it back into the input to the treatment plant. In the UV disinfection plant, to ensure the UV lamps are kept clean at all times, each lamp has a surrounding wiper ring which travels back and forth periodically self-cleaning the quartz tube.

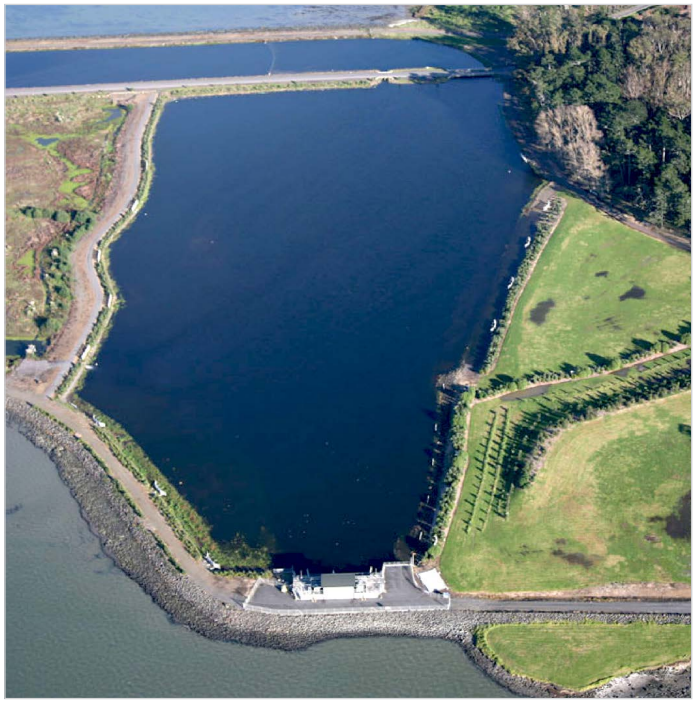
The intertidal storage basin

After filtration and ultraviolet disinfection, the treated wastewater is conveyed via the distribution channel to the intertidal storage basin. The 17-hectare basin is situated on the northern side of the Island Road causeway, by the eastern foreshore of Puketutu Island. The basin is designed to hold 370,000 cubic metres of treated wastewater – sufficient to accommodate resource consent discharge requirements including storm flows.

Shoreline discharge station

The discharge station is located at the north-western side of the storage basin. Twice daily five high powered pumps (plus one back-up pump) each capable of pumping five cubic metres of liquid per second, will discharge the highly treated wastewater on the out-going tide into the Purakau Channel.

The wastewater discharged into the sea will meet very high standards. Outside of a small area of mixing adjacent to the discharge point, the water should be of sufficient quality to allow contact recreation. This means that, given time for the area to re-establish itself, a return to safe shell fish gathering and swimming over a substantial area of the upper harbour – which for decades has been off-limits to the public – is possible.



The distribution channel conveys treated wastewater into the intertidal storage basin where it is then discharged via the pump station.