SHIBAURA WATER RECLAMATION CENTER

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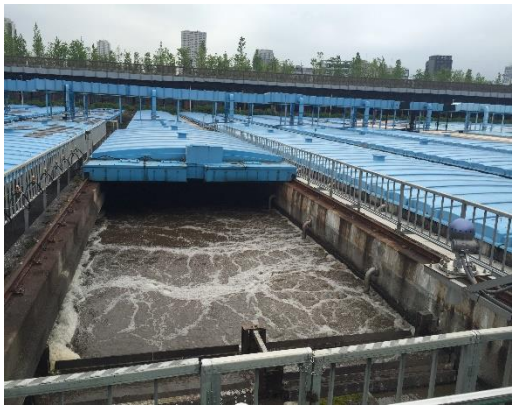
The Graduate School of Global Environmental Studies visited the Shibaura Water Reclamation Center managed by the Tokyo Metropolitan Government on June 15, 2016 to learn about waste water treatment technologies. This center started operations in 1931, making it the third oldest water treatment facility in Tokyo. It treats the waste water from most of Chiyoda, Chuo, Minato, Shinjuku and Shibuya wards. The site area is roughly **199 m^2** and the treating capacity is **9.6 m^3/s**. Its amazing facilities include primary, secondary and even tertiary water treatment. Let's take a look at what happens in the process.

The first step is to collect the wastewater. As explained by the experts there are two different types of collection systems in urban sewerages. The first type is combined sewer system. This system collects the wastewater from domestic/industrial operations and joins this stream with rainwater collected in the city in a common pipe. The second system has separate pipelines for domestic/industrial wastewater and rainfall water. At the moment Tokyo operates with a combined sewer system. The wastewater and rainwater are collected together in a complex vein type pipe system. Small diameter pipelines meet together in collectors. Collectors are big diameter pipeline systems that collect the water from all sources and usually send it through gravity to pumping stations. Piping systems may have diameters that range from 25 cm to 8.5 m, and they are made of either PVC or tiled pipes.

The second step is sending the collected water to reclamation centers. To maintain the sewerage system at a recommended depth it is necessary to use **pumping stations**. Pumps also help prevent floods by pumping large amounts of water in the event of heavy rainfall. So the purpose of pumps is to elevate the water level to continue the natural flow through gravity.

The third step consist of what is known as **primary water treatment.** Primary wastewater treatment removes suspended solids from the water. Wastewater from the pumping stations is send to **Grit Chambers**. Here coarse solids are removed. Shibaura facility has over 14 grit chambers to deal with coarse solids. Its facility is built under ground level, which prevents bad odors coming from the wastewater and maximize the space utilization. This facility consists of screens to remove debris and big tanks to lower water velocity in order to reach sedimentation. After passing through the grit chamber water is pumped again to a **primary sedimentation** tank. This tanks sediment suspended solids which have a lower diameter. The water passes through slowly for 2 to 3 hours. Sludge is collected at the bottom of the tank and send to sludge treatment facilities.



The next step is the **secondary treatment**. Here the treated water from previous steps flows to reaction tanks that operate with the activated sludge technology. This tanks have air diffusers to dissolve oxygen in the water. The oxygen in the water incubates bacteria such as *nitrobacter* and *nitrosomonas* that consume organic matter turning it into CO_2 and bio mass (more bacteria). After this step the water is send to a **chlorination tank**, where sodium hypochlorite is added in proper amounts to disinfect and kill all harmful pathogens still present in the water such as *e.coli*. Finally the clean water is discharged to Tokyo bay.

A portion of the treated water is send to **tertiary wastewater treatment**. Here the waste water is passed through a series of filtration steps, which include sand and membrane filters to remove the remaining solids. After disinfection with chlorine the water is re used in toilets within the Shibaura waste water facilities and in the building Shinagawa Season Terrace. Secondary treatment does not remove nutrients such as NO_3^- and phosphorous from the wastewater, which are the pollutants responsible for **eutrophication**. Thus there is a project to implement **A_2O method** to effectively deal with these contaminants.

The last step is sludge treatment. All the sludge recovered from the treatment is send to sludge treatment facilities where it is first collected in **thickeners**. This tanks serve the purpose of removing the excess water from the sludge making it thicker as the name suggests. Then it is send to a **dewatering machine**, which removes the remaining water from the sludge. Then depending on the case it is send to **anaerobic digesters**, where bacteria that operate without oxygen consumes excess organic matter generating CH_4. The methane produced is burned to generate electricity for the plant and the remaining sludge is finally sent to incinerators where it is burned.

Here ends the treatment, which shows an efficient way of dealing with wastewater in a highly densely populated city, where the lack of space requires these facilities to be installed near commercial areas. The primary and secondary treatment is completely covered, minimizing bad smells. All waste generated is treated, and water is returned to its natural cycle preventing harms for the human health and ecosystem.

Image by Google maps June 21, 2016.