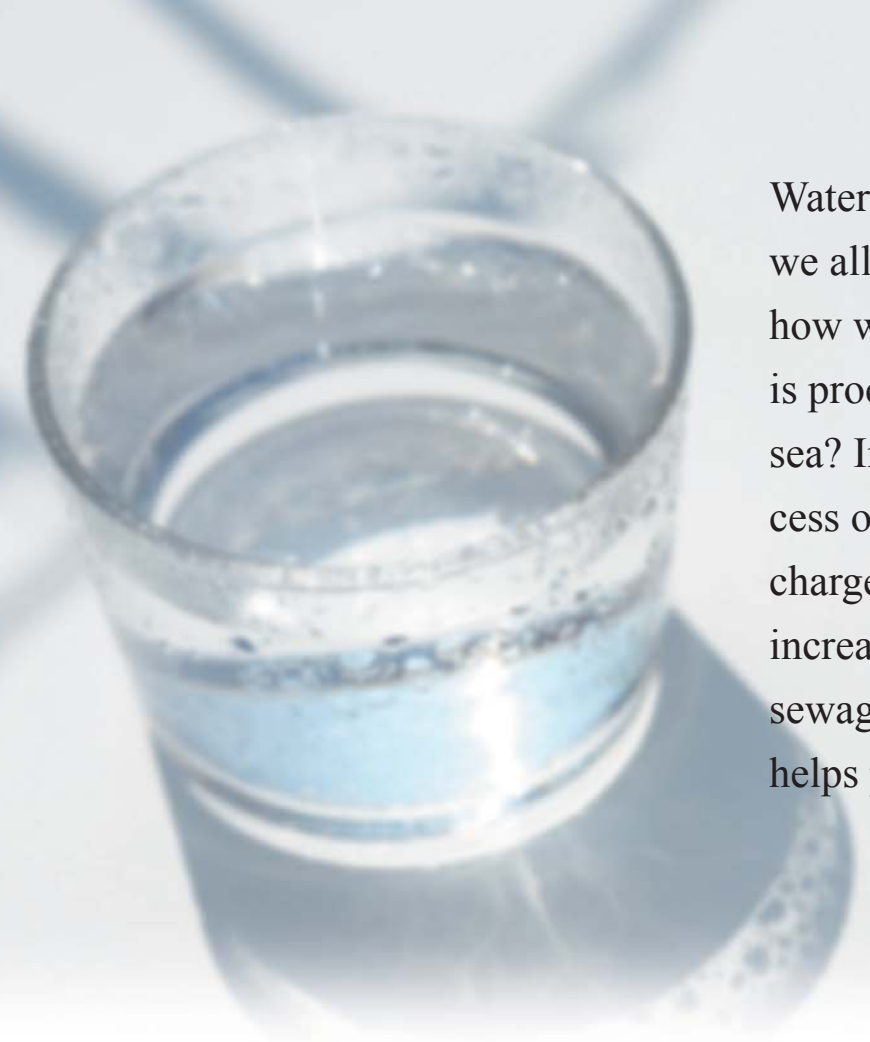
Welcome Back
Cleaner Water

水質でみる横浜の下水道

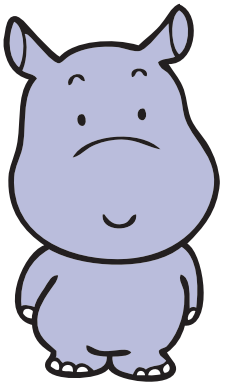
Sewage Water Quality in Yokohama City

OPEN YOKOHAMA



Water is indispensable in our lives and we all use it every day. Do you know how wastewater is distributed and how it is processed for return to rivers and the sea? In this booklet, we explain the process of wastewater treatment and discharge. We are hoping this booklet will increase the public's understanding of sewage and how its proper treatment helps preserve the aquatic environment.

Contents



Daichan: The mascot for the aquatic environment in Yokohama City.

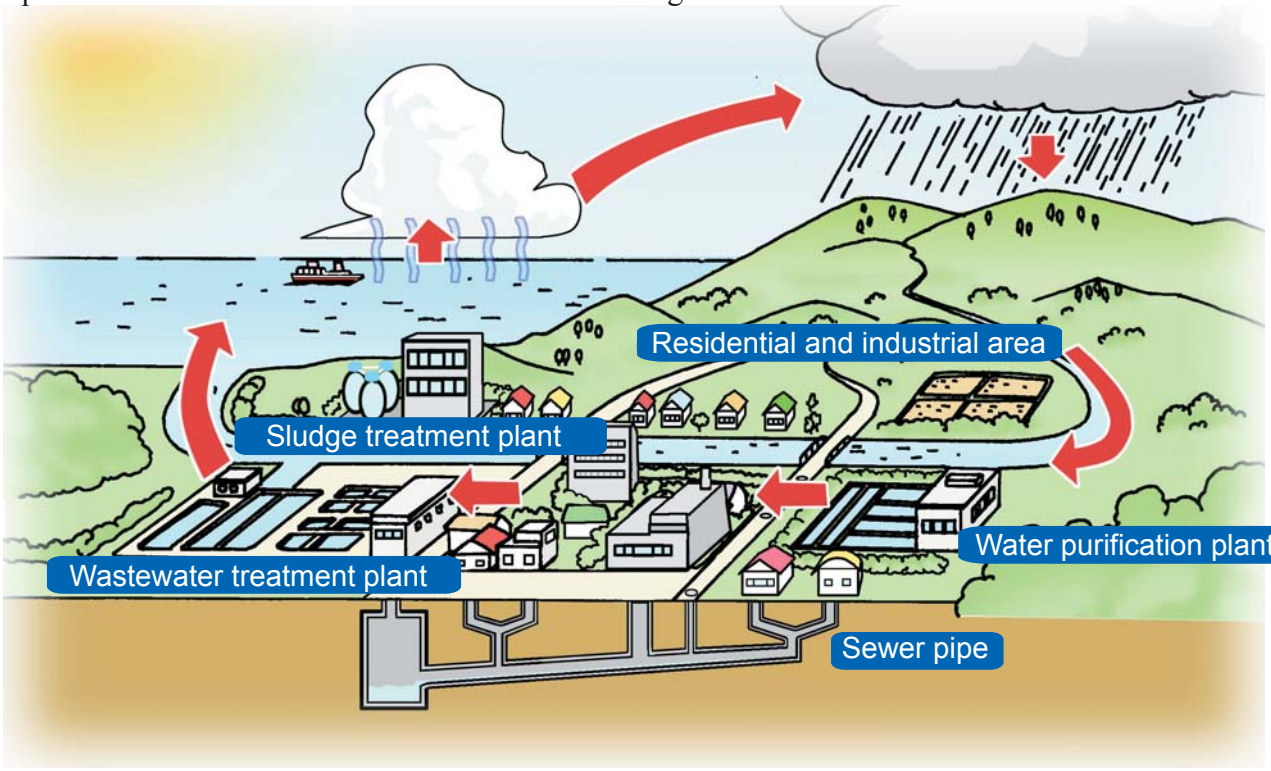
1 Water Circulation and Sewerage

Water Circulation

Water is continuously circulating on the earth's surface. Water evaporated by solar energy is incorporated into clouds and then returns back to the earth in the form of rainwater and snow. Runoff ultimately flows to the sea, and the water evaporates from the sea once again, in an ongoing cycle which we will refer to as "water circulation".

Water from rivers and lakes is initially purified and then used in our daily life activities, such as in the kitchen, bathtub, toilet as well as industry. The water used by the different activities is systematically collected through sewer pipes, and then sent to the wastewater treatment plant. After the treatment, treated water is discharged to rivers or the sea. Many of our life activities fully depend on water circulation, so the sewerage systems are an important part of water circulation.

In the wastewater treatment plant, we analyze sewage water quality almost daily, and the treated water with pollutant levels lower than the standards is discharged into a river or the sea.



Role of Sewerage System

1. Protect the natural environment
The treated water is returned to rivers or the sea so that the environment can be protected.

2. Protect the city from flooding
The rainwater is promptly discharged to a river or the sea via sewer pipes, so the sewerage system prevents floods.

3. Preserve a sanitary city
Rivers are kept clean so that public health is protected and the city remains sanitary.

4. Flushing toilet is available
Sewerage system enables us to use a clean and odorless flushing toilet.

2 How to Clean Sewage

1. Sewerage System in Yokohama City

Sewerage Facility

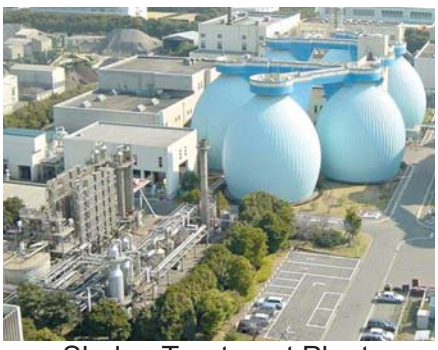
In Yokohama City, there are 11 wastewater treatment plants, 26 sewer pumping stations and two sludge treatment plants .
The entire area of the city is separated into 9 individual units according to geographical features, which are known as “sewage treatment divisions”. Most divisions have one wastewater treatment plant, while two of them have two plants.
These 11 wastewater treatment plants were established between 1962 and 1984, and have been continuously operated since then.

Sewage from your home to final discharge

The wastewater released from our homes flows via sewer pipes under our houses and roads. The underground sewer pipes are laid inclined for natural sewage flow. In the pumping stations, the sewage is always pumped to move from higher elevations to lower. In addition, rainwater is promptly discharged from the pumping stations, protecting the city from flood-waters. Sewage collected via sewer pipes and pumping stations is treated in wastewater treatment plants. In order to discharge the treated water to a receiving water body, these wastewater treatment plants are located near these water bodies.
Sludge formation occurs during sewage treatment. This sludge is collected in two individual sludge treatment plants in Yokohama City.


Pumping Station


Wastewater Treatment Plant


Sludge Treatment Plant

Sewer Pipe

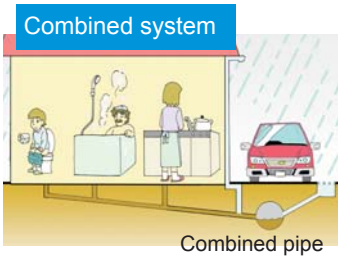
Sewer pipes about 20 cm in diameter are set under our homes. This network of pipes increase in size en route to the wastewater treatment plants, to allow for collecting increasing quantities of sewage, reaching a maximum size up to 8 m in diameter.

The sewer pipes in Yokohama City combine for a total length of 11,000 km, the distance between Yokohama City and New York City, USA.

There are two types of sewer pipe systems to collect sewage and runoff in Yokohama City: combined and separated systems. Combined systems collect both sewage and runoff for transport to wastewater treatment plants. Separated systems collect sewage and runoff separately, and bring them to treatment plants or the receiving water body, respectively. In Yokohama City, about 70 percent of the total sewage system is separated.

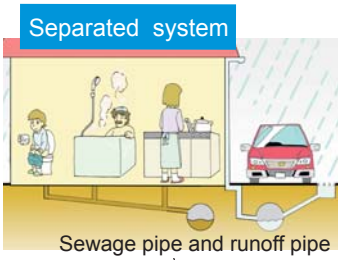
Sewer pipe 2 m in diameter

Sewer pipe 6.5 m in diameter



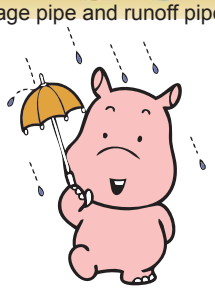
Combined pipe

Manhole of combined pipe



Sewage pipe and runoff pipe

Manhole of sewage pipe　Manhole of runoff pipe



Manholes of different

Volume of Treated Sewage (2013)

In Yokohama City, about 1,500, 000 m3 of sewage is treated per day. This quantity is five times the volume of Yokohama Stadium.

Wastewater treatment plant	Treated water (m3/day)	Population serviced by plant
Hokubu Daiichi	99,000	295,000
Hokubu Daini	109,000	121,000
Kanagawa	258,000	551,000
Chubu	64,000	110,000
Nambu	155,000	358,000
Kanazawa	168,000	389,000
Kohoku	201,000	504,000
Tsuzuki	186,000	613,000
Seibu	66,000	281,000
Sakae Daiichi	39,000	120,000
Sakae Daini	141,000	354,000
Total	1,486,000	3,696,000

Sewerage System and Finance

To treat and manage large quantities of sewage requires considerable funding. In Yokohama City, a wastewater treatment fee is charged by local authorities as a sewage service fee; although, a runoff management expense is covered by city taxes. Citizens pay a sewerage service charge every two months along with a water service charge. The sewerage charge is based on each individual's discharge volume.

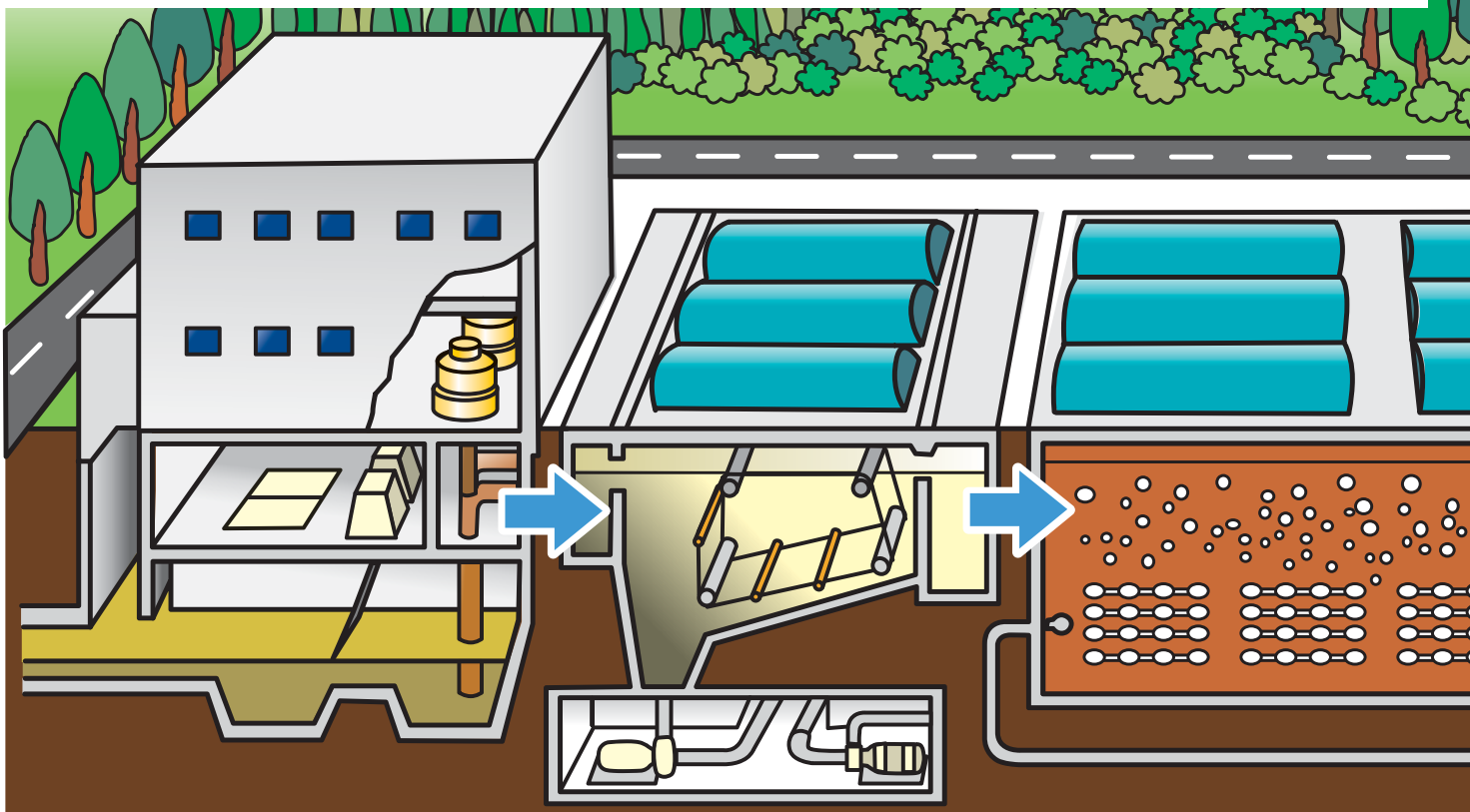
2 How to Clean Sewage

2. How to Treat Sewage

Sewage Treatment

Do you know how sewage is treated? First, foreign debris is removed by physical settlement, and then microbial activities decompose the organic matter present in wastewater. Ultimately, treated water is disinfected before discharge.

Among the different methods, the microbial activity is of paramount importance. The microbial treatment of sewage is very common, even in plants other than Yokohama City, because this process is suitable for treating large quantities of sewage. The activated sludge contains micro-organisms and organic matters, and looks very much like dirty mud. The formation of activated sludge is a major principle of sewage treatment, similar to natural water purification without using any chemicals.



1 Preliminary Settling Tank

Treatment time: 5 min

In this tank, large foreign debris and stones are settled and removed. A pH meter monitors the influent sewage. The influent sewage affecting activated sludge is monitored for twenty-four hours per day in some wastewater treatment plants.

2 Primary Settling Tank

1 - 2 h

The water flow rate is reduced to let smaller foreign debris and particles to settle down to the bottom of the tank. This settled material is ultimately removed from the tank.

Settled sludge (waste product)

3 Reaction Tank

6 - 8 h

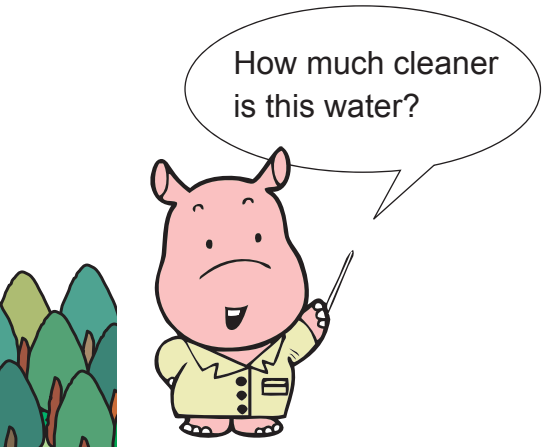
This tank is the "heart" of the sewage treatment process, particularly for the biological treatment (secondary treatment) of wastewater. The required oxygen is supplied via aeration to encourage microbial activity inside the tank. Air is required not only for microbial activity, but also for mixing sewage with activated sludge. Aerobic microorganisms decompose various contaminated organic matter. In the plant, the concentration of activated sludge and air supply are monitored and continuously controlled to maintain the microbial activities.

Sewage flow

Sludge flow

Pumping to sludge treatment plant

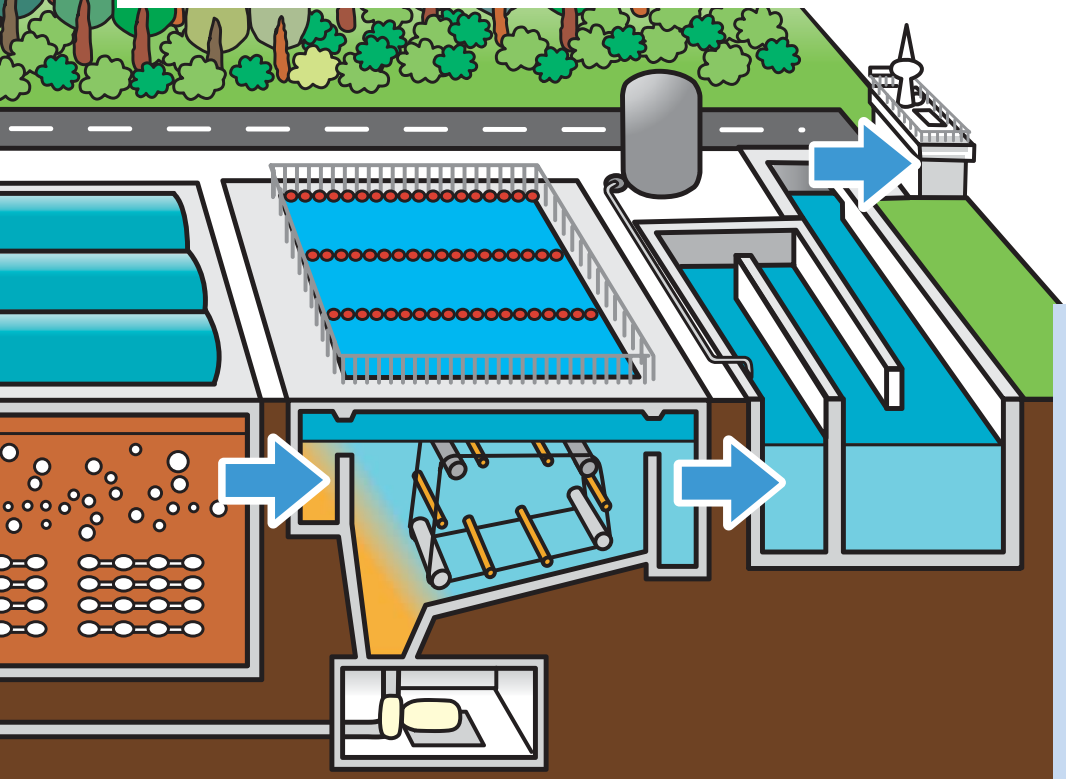
In some wastewater treatment plants, an advanced treatment method has been adopted to remove more total nitrogen and phosphorus from the sewage.
In addition, As a result, this advanced treatment water may be reused as “reuse water” in public toilets and landscape irrigation, for example in parks and small artificial streams etc.

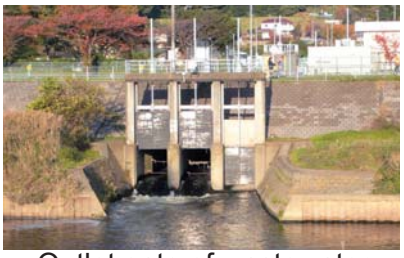


Influent sewage
(Inlet in WTP)

Primary effluent
(Water before entering the reaction tank)

Discharged water
(Discharge to rivers and sea)





Outlet gate of wastewater treatment plant

5 Chlorination Tank

15 - 30 min

The treated water from the secondary settling tank is chemically disinfected with sodium hypochlorite. This disinfected water is then discharged. The hypochlorite levels in discharge water are carefully adjusted.

4 Secondary Settling Tank

3 - 4 h

In this tank, the activated sludge and water are separated. To settle the activated sludge, flow rates are greatly reduced, and the clear supernatant is sent to next tank. The settled sludge is reversed once again to the reaction tank, although the remaining portion is sent to the sludge treatment plant for further treatment.

Precipitated activated sludge

Pumping to sludge treatment plant

Sludge treatment plant

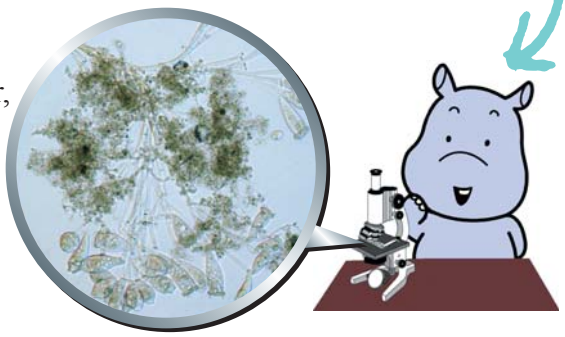
2 How to Clean Sewage

Micro-organisms in Sewage Treatment

In the plant, different micro-organisms play a vital role in treatment. The microbial community within the activated sludge gets energy by decomposing the contaminated organic matter, resulting in their explosive growth inside the reaction tank.
A diversity of bacteria and fungi (<1 μm (0.001 mm) in size) initially treat the various contaminants in sewage, and then several protozoans utilize these microbes as prey. There are many kinds of microbes in the community, including bacteria, fungi, and protozoans.
Different physical conditions, such as influent sewage condition, water temperature and aeration in the reaction tank all affect the microbial growth and diversity. Any changes in the microbial community will affect sewage treatment. For example, in winter, microbial growth and activity decrease reducing treatment quality. Similarly, if oxygen is lacking in the reaction tank, filamentous microbial communities increase and adequate settlement of activated sludge is not possible in the secondary settling tank. Quality of discharge water is thus reduced. Therefore, microbial numbers and diversity are regularly examined in the plant, and processes are adjusted to achieve optimum treatment.

Reaction tank

Settled activated sludge



Microorganisms present in activated sludge

Active Microorganisms in Sewage Treatment

Observation of microorganisms are carried out using a compound microscope. The microorganisms present in activated sludge are briefly introduced below.

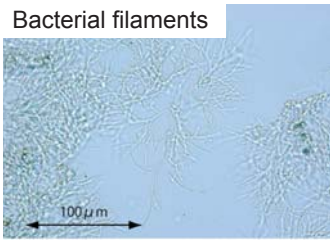
Ant

Macrobiotus (Water bear or Kumamushi)

Aspidisca

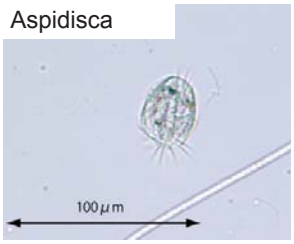
Filamentous microbes

Bacterial filaments



Protozoans

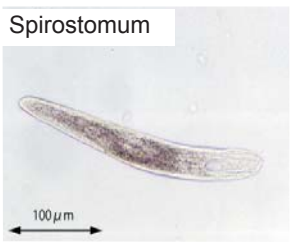
Aspidisca



Vorticella

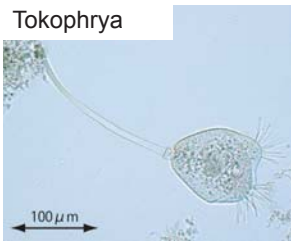
Blepharisma

Spirostomum



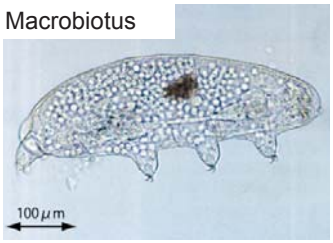
Amoeba

Tokophrya



Metazoans

Macrobiotus



Chaetonotus

3 Advantages of Sewage Treatment

1. Water Quality

Water Quality Test

In the wastewater treatment plant, water quality tests performed at every stage, influent sewage, primary effluent (treated water in the primary settling tank) and discharge water.
An effluent standard has been set according to water pollution control laws, and we carry out water quality tests to confirm whether water quality meets the standard. In addition, these water quality tests reveal the treatment effects at every stage, so that adjustments can be made before discharge.

Water Quality Data

Below are shown representative 2013 water quality results, with average values for 11 individual waste-water treatment plants in Yokohama City.
Monitoring for various contaminants, such as cadmium, mercury, agricultural-chemicals, volatile organic compounds (VOC), PCB, dioxins, etc. is regularly performed in these water samples. The test results are in the outer cover. Thus far, no contaminant level in treated water has exceeded effluent standards.

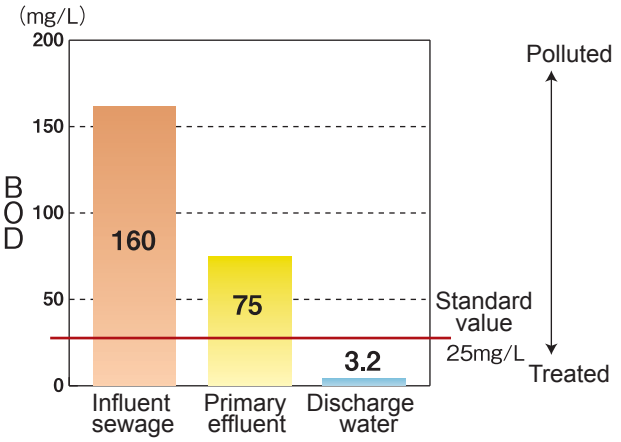
pH (potential Hydrogen)

pH indicates the acidic and basic nature of the water. A pH value of 7 indicates neutrality, while values lesser or greater indicate more acidic and basic characteristics, respectively. A strongly acidic or basic influent can adversely affects activated sludge. Therefore, a neutral pH needs to be maintained in both influent sewer and discharge water.

	pH value
Influent sewage	7.3
Primary effluent	7.3
Discharge water	7.1
Standard limitation value	5.8~8.6

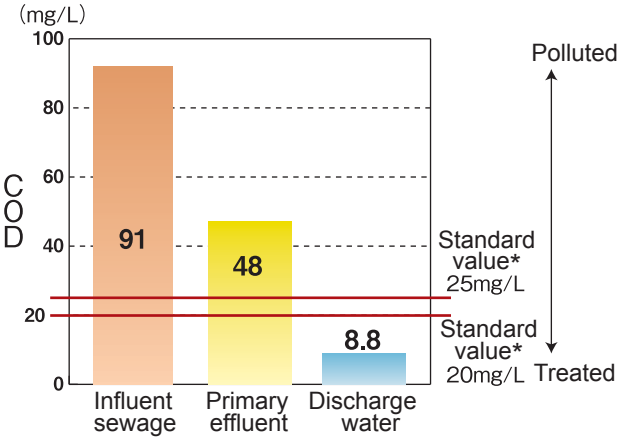
BOD (Biochemical Oxygen Demand)

BOD indicates the required amount of oxygen for microbial decomposition of polluted organic matters in water. This value reveals the degree of organic pollution in the water.
The BOD of discharge water is 3.2 mg/L.



COD (Chemical Oxygen Demand)

COD indicates the required total amount of oxygen for chemical oxidation of organic matter in the sewage. The total required oxidation is converted into the amount of oxygen, as in BOD.
The COD of discharge water is 8.8 mg/L.



COD laboratory determination

* COD standards have different values depending on whether water is discharged into rivers or the sea.

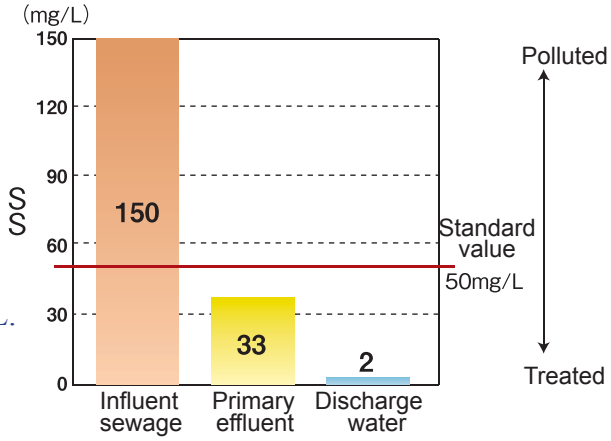
3 Advantages of Sewage Treatment

SS (Suspended Solids)

Suspended solids are colloidal materials present in the sewage, indicating the water quality of wastewater. The suspended solids are detected by filtering the water through filter paper of known pore-size. The weight of solids retained on the paper is then calculated.

The average value for SS in discharge water is 2 mg/L.

SS laboratory determination

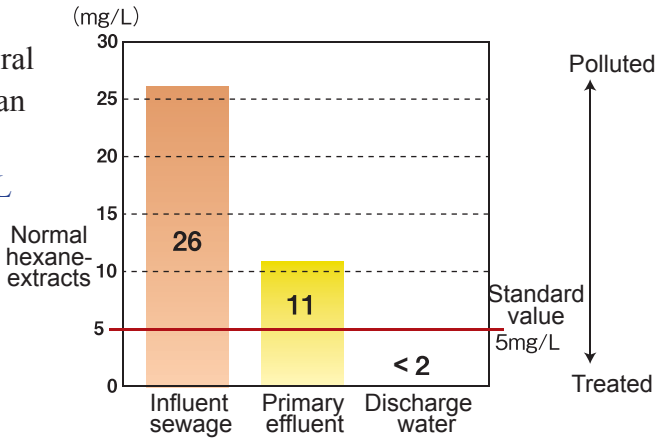


n-Hexane Extracts

Normal hexane is used to extract oils from sewage (mineral oil, and fats from plants and animals). Total oil content can be determined using this analysis.

The average value for oils in discharged water is <2 mg/L

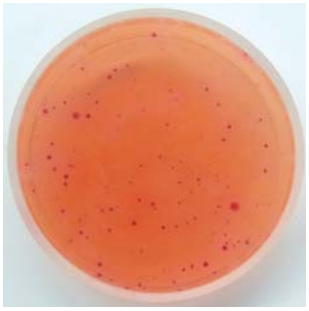
Laboratory techniques for oil extraction

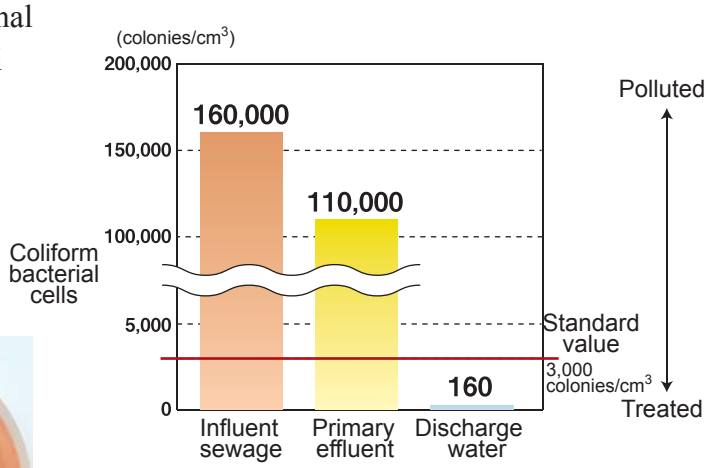


Coliform Bacterial Count

Coliform bacteria are the general name of the intestinal tract bacterial community, including Escherichia coli (E. coli). The treatment of wastewater containing intestinal tract fecal pathogenic bacteria (like dysentery-causing Bacillus) is determined by colony count analysis.

The average value for total coliform bacteria in discharged water is 160 colonies/ cm^3.





Left: Laboratory coliform bacteria test
Right: Cultured colonies of coliform bacteria on agar culture medium
("Culture medium" provides nutrients for bacterial growth. "Colony" means the number of reproducing bacterial cells.)

Total Nitrogen (T-N)

Total nitrogen (ammonium, nitrite, nitrate and organic nitrogen) contained in wastewater is determined in the laboratory. Although nitrogen is indispensable for the growth of living things, excess nitrogen in discharge water may result in eutrophication of the receiving water body.

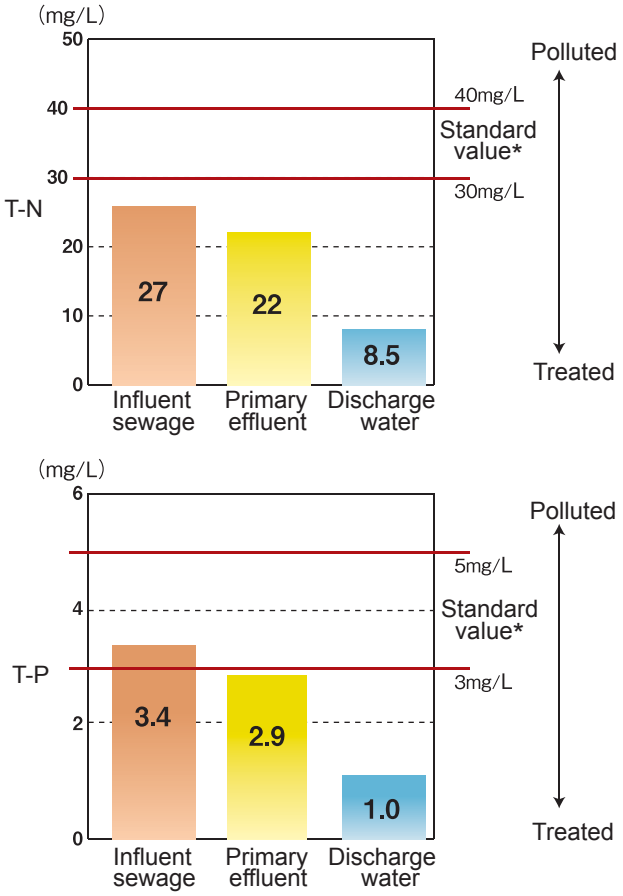
The average value for total nitrogen in discharge water is 8.5

Total Phosphorus (T-P)

The amount of total phosphorus contained in wastewater is also determined. Like nitrogen, phosphorus is a required nutrient of both plants and animals, but excess amounts in discharge water may also result in eutrophication.

The average value for total phosphorus in discharge water is 1.0 mg/L.

Laboratory determination of total phosphorus.



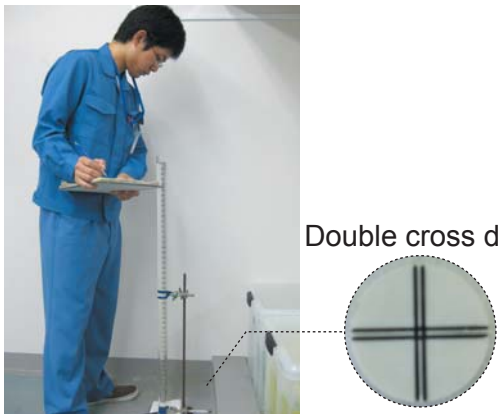
* The standard value of T-N and T-P means the level of nitrogen and phosphorus in water discharged from treatment plants to Tokyo Bay.

In addition to the analyses required by law, we perform other analyses to confirm the effectiveness of wastewater treatment.

Transparency

As shown in the photograph, treated water is poured in the long cylindrical tube, which has double cross painted on a disk set in the bottom. The sides of the tube are measured in a scale from 0 to 100 cm. Turbidity values are determined by adding water to the tube, and when the "X" can no longer be seen when viewed from the top of the cylinder the reading on the scale is the turbidity value.

The average value for turbidity of discharge water is 98 cm.



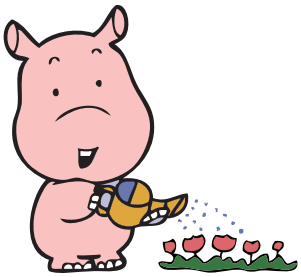
Double cross disk

Laboratory turbidity test

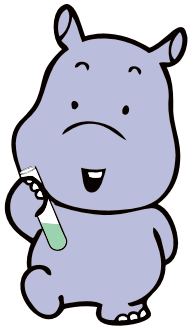
Laboratory settings for various water quality tests

3 Advantages of Sewage Treatment

Effluent Standards for Discharge Water



To preserve the aquatic environment of rivers and the sea, standard levels of contaminants has been established for discharge water from wastewater treatment plants as well as for effluent from industries. Throughout all of Japan, the government has set standard levels for different contaminants in effluent wastewater and treated water through the “Sewerage Act” and the "Water Pollution Control Law". In addition, Kanagawa Prefecture and Yokohama City, have established additional strict standards on discharge water, to protect the aquatic environment in receiving water bodies.



As mentioned in pages 7-9, adequate treatment of contaminants is readily carried out along with activated sludge treatment. However, the complete treatment of various pollutants is not possible when levels of contaminants are excessive in influent sewage or the influent contains substances harmful to activated sludge. Therefore, there is a need for enforcement of standard contaminant values for factories that discharge to wastewater treatment plants.

Sewerage-Related Events

Yokohama City conducts different events to enhance public knowledge of the sewerage system. In these events, participants can experience different aspects of sewage and sewage treatment by direct observation, smelling and testing.

In the City, we conduct several environmental events where we introduce how to treat sewage and the roles of microorganisms. These types of events include ones for parents and children during summer vacation and a lecture in elementary school. Here, the participants would learn basic facts about water quality analyses and microbial observation. In addition to these events, each wastewater treatment plant is open anytime for the public to visit and learn more details.

Parents and children involved in environmental events

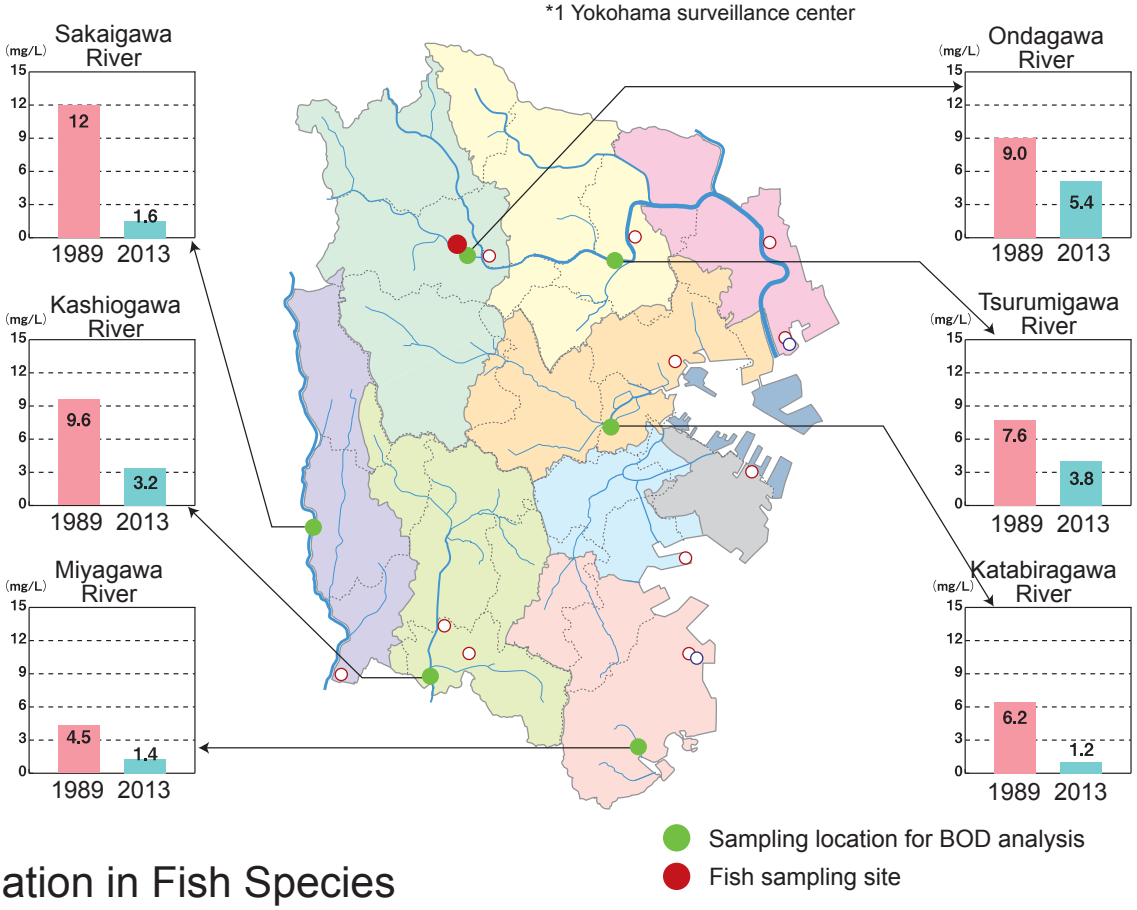
(2) Improvement of a River Environment

Improvement of Water Quality

In Yokohama City, the percentage of the population connected to the sewerage system has increased from 85 to 99.8% from 1989 to 2013. Similarly, the quantity of sewage treated has also gradually increased, but the direct disposal of untreated sewage to the river has been completely avoided.

Below is plotted the graph for BOD values*1 for waters of the main rivers inside Yokohama City. BOD values have been reduced from 50 to 83% from 1989 to 2013, indicating improved water quality. This, of course, results in improved water quality in the sea. This indicates that wastewater treatment can have great benefits in the protection of water quality of the rivers and the sea.

*1 Yokohama surveillance center

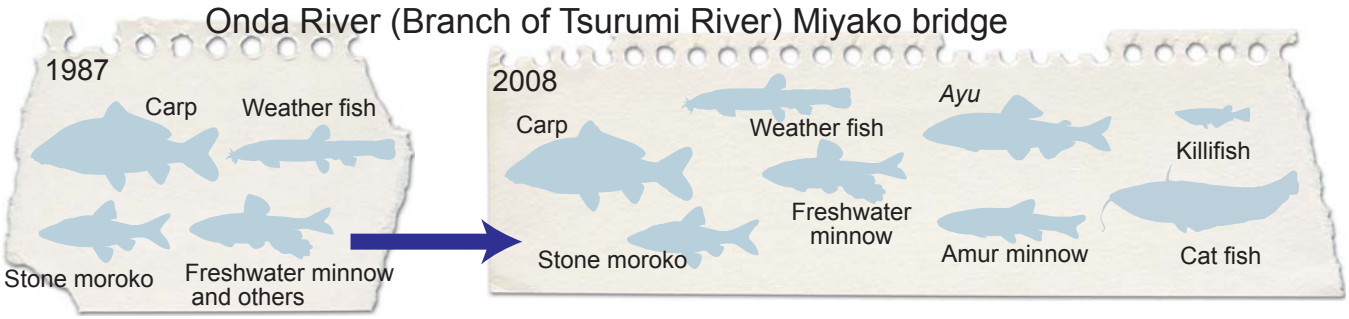


Variation in Fish Species

An increase in fish species diversity has been observed. Fishes such as Killifish, Salmon, Fresh-water Minnow were observed in the river after adequately treated water was discharged.

In our previous investigations, no ayu (sweet fish) was observed in the river until 1993, and every study since then has confirmed their increase in number. Interestingly, in 2008, spawning of ayu was confirmed in some rivers.

*2 Publication of The Yokohama Environmental Research Center (The living creatures in rivers and the sea in Yokohama City)



4 Toward Cleaner Water

Measurement of Eutrophication in Tokyo Bay

The nutrient salts of nitrogen and phosphorus accumulate in lakes and the sea through the river water input. When levels of these nutrients become sufficient for excessive plankton growth, this is known as eutrophication.
In Tokyo Bay, red tide, a 'bloom' of toxic plankton, is becoming a major problem and is likely due to eutrophication. In order to remove nutrients, Yokohama City introduced advanced treatment.

Advanced Treatment Process

An advanced treatment process for nitrogen and phosphorus reduction is the same as the process used to produce activated sludge except that aeration is totally avoided in one of the reaction tanks. In this reaction tank, anaerobic and aerobic contribute to remove nitrogen and phosphorus to levels lower than the standard process.
In Yokohama City, an advanced treatment process has been promoted by constructing new tanks or modifying existing tanks with a goal of improving water quality of Tokyo Bay.

Normal water in Tokyo Bay

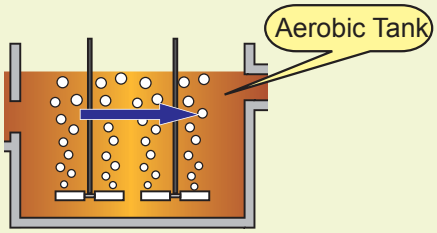
Red tide in Tokyo Bay

How to Treat Water Using Advanced Treatment Process

The structural differences in reaction tanks are shown below. Although there are many types of advanced treatment, here we show only one type of advanced treatment.

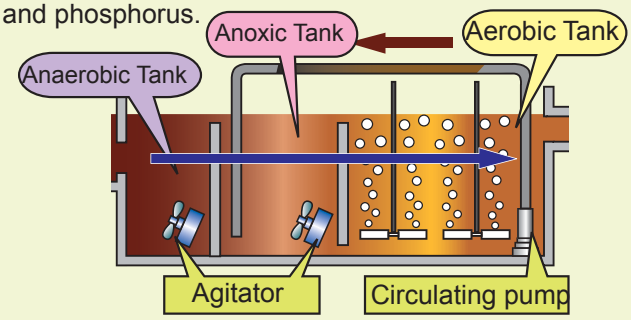
Standard Treatment Process

Polluted organic matter removal is the main goal of this process. When air is supplied and mixed with activated sludge, the oxygen supply is boosted for aerobic microbial activities.



Advanced Treatment Process

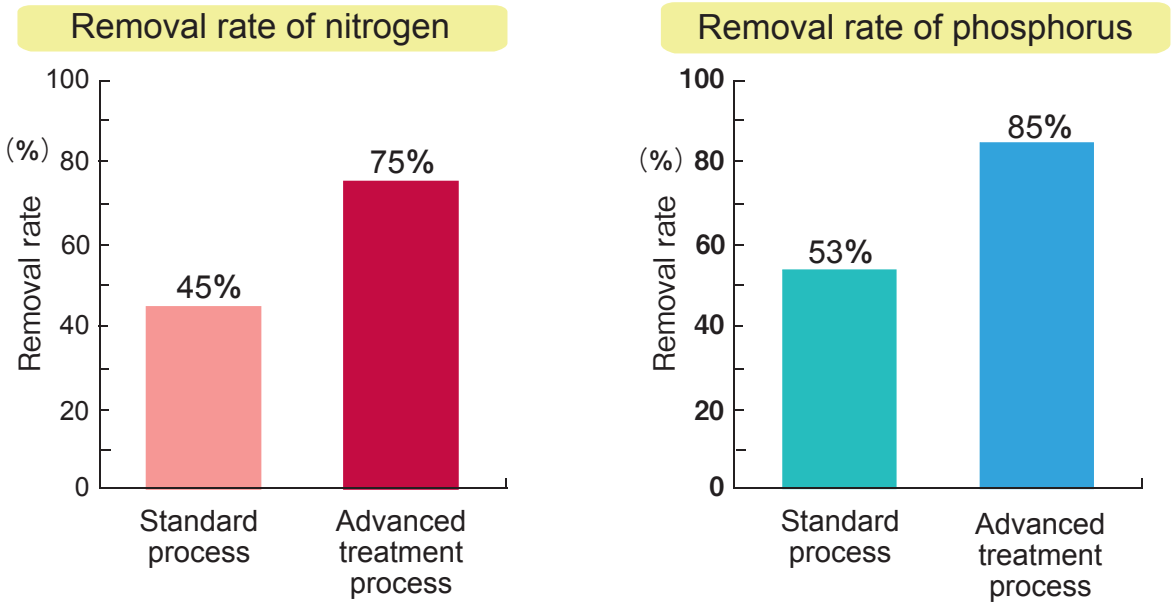
The reaction tank is separated into three parts with anaerobic, anoxic and aerobic condition to treat not only the polluted organic matter but also most of the nitrogen and phosphorus.



*Aerobic Tank: Oxygenated with air supply
*Anaerobic Tank: No air supply and water from the anaerobic tank mixes with water circulated back from the aerobic tank
*Anoxic Tank: Tank without oxygen and no air supply

Improvement in Nitrogen and Phosphorus Removal

The total nitrogen and phosphorus removal rates through standard treatment process and advanced treatment process is indicated in the graph. It is clear that nitrogen and phosphorus removal rates are enhanced during the advanced treatment.

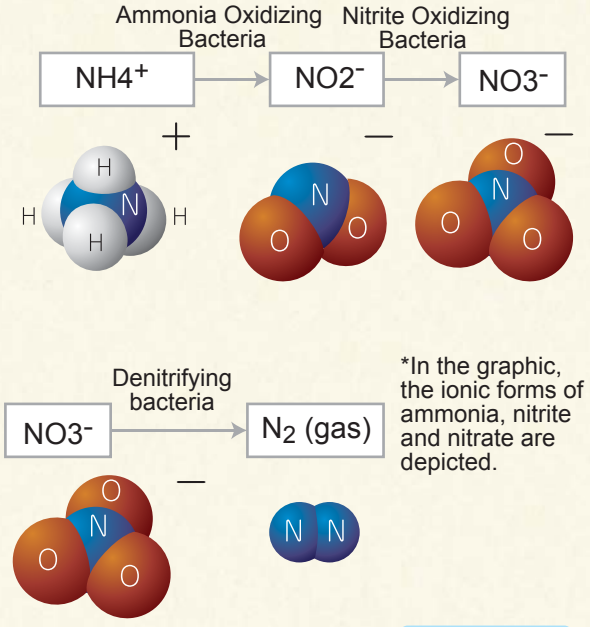


Principles of Nitrogen Treatment

In the influent sewage, ammonia is the major source of nitrogen. The subsequent two-step reactions of nitrification and denitrification change the ammonia into different forms, which is then ultimately removed.

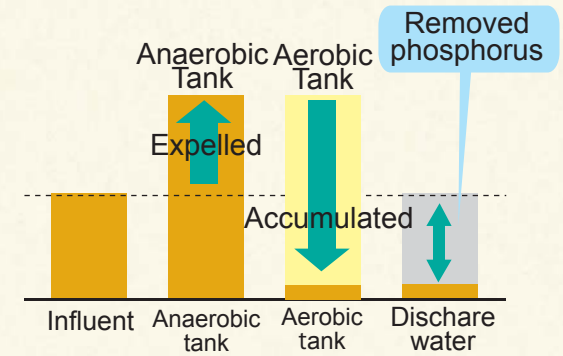
○ Nitrification
In the aerated tank, ammonia is subsequently changed into nitrite and nitrate. This reaction is completed by oxygen-utilizing bacteria, known as "nitrifying bacteria". In this process, bacteria oxidize the ammonia, and this reaction is called nitrification.

○ Denitrification
The nitrate produced from reduction reaction is changed into atmospheric nitrogen in the anoxic tank, and then released into the air. Denitrifying bacteria decompose the nitrate to produce nitrogen gas, and this reaction is called denitrification.



Principles of Phosphorus Treatment

Phosphorus accumulating bacteria (organisms) are utilized to remove phosphorus from sewage. In the anaerobic tank, these bacteria expel the accumulated phosphorus from within their cells, coincident with storage of organic matter in the cell. Then, in the aerobic tank, these bacteria utilize the energy from the stored organic matter. Here, the resting energy is utilized to re-accumulate phosphorus in greater amounts than previously expelled in the anaerobic tank.



The change in phosphorus concentration in the water

5 Effective Utilization of Reclaimed water

Reclaimed water

Treated wastewater is a precious water resource. In Yokohama City, some of the treated sewage is usually re-treated via ozonization and sand filtration, and then used as “re-treated water”. Ozonization treatment is done in three wastewater treatment plants, although sand filtration treatment has been operating in all wastewater treatment plants.

Egawa stream

Reclaimed Water Utilization

Ozonized water is used in toilets and artificial small streams as well as air to water heat pump/air conditioning systems.

In addition, sand filtered water is used to clean the wastewater treatment plants and plant toilets. This water is also sold to clean sewer pipes and construction utilities. Wastewater treatment and reuse provides for improved urban areas and provides excellent waterfront views in Yokohama City. In addition, flood prevention and preservation of water during droughts are additional benefits.

Reclaimed water supply station

Examples of reclaimed water

Water type	Purpose	Quantity Supplied (m^3/year)	Area Supplied
Ozonized	Small Streams	3,500,000	Egawa stream, Iriegawa stream, Takinogawa stream, Futoo Minami Park stream and others
	Toilet, heating source of A.C.	251,000	Yokohama Arena, La La Port Yokohama, Shin Yokohama chuo Building and others,
Sand filtered	Inside facilities	5,884,000	Wastewater Treatment Plants, Sludge Treatment Plants
	Drainage pipe cleaning	128,000	Recycled water is sold to Contracted Trading Company

Water Quality of Reclaimed Water

Technically determined water quality standard for reclaimed water from sewage treatment.

Technically determined water quality standard for re-treated water from sewage treatment

(Ministry of Land, Infrastructure, Transport and Tourism “Manuals of water quality standard for reclaimed water from sewage treatment”)

Application	E. coli	Coliform (CFU/100ml)	Turbidity	pH	Overall appearance	Color (degree)	Odor	Residual Chlorine (mg/L)
Landscape water	—	<1,000	< 2	5.8~8.6	N. U.	< 40	N. U.	—
Flush water (toilet)	N. D.	—	< 2	5.8~8.6	N. U.	—	N. U.	Free:0.1 Ionic: >0.4
Irrigation water	N. D.	—	< 2	5.8~8.6	N. U.	—	N. U.	Free:0.1 Ionic: >0.4

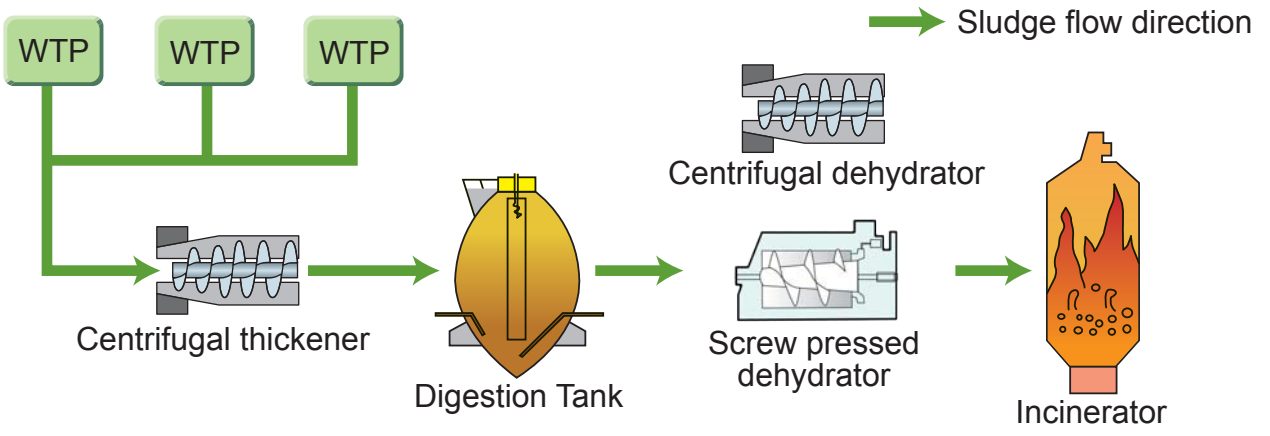
6 Sludge Formation in Sewage Treatment

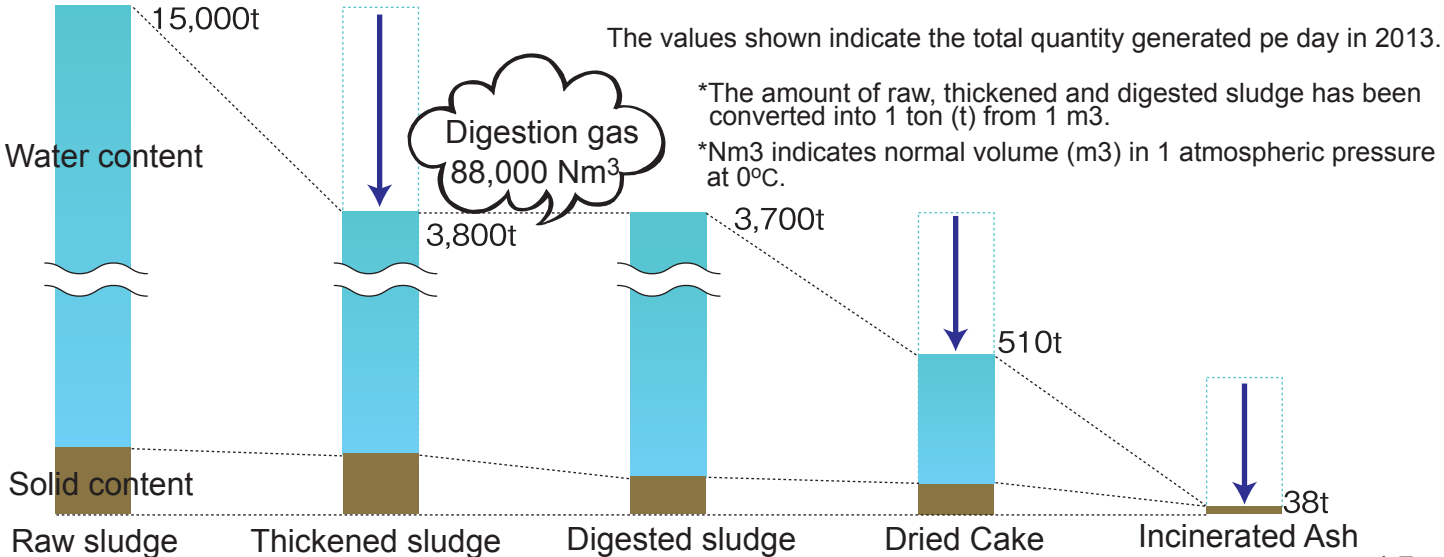
Sludge Treatment

The sludge formed during sewage treatment is subsequently treated by thickening, digestion, and dehydration processes, with the intent of reducing weight and ultimate incineration. In Yokohama City, the sludge generated in 11 plants is fed and centralized to two sludge treatment plants. The intensive sludge treatment contributes to an overall cost reduction of construction, operation and maintenance. In addition, the gas generated by digestion has been effectively utilized as well as the ash after incineration.

How to Treat Sludge

The raw sludge sent by the plants to the sludge treatment plant contains considerable water, which is initially removed using a centrifugal thickener. Thereafter, the digestion treatment method is applied to organic matter and enhances stabilization. After dehydration, the sludge is incinerated and turned into ash, with great reduction in volume.
During this treatment process, the total weight of the raw sludge is reduced four hundred times, resulting in an odorless, hygienic product.





The values shown indicate the total quantity generated pe day in 2013.

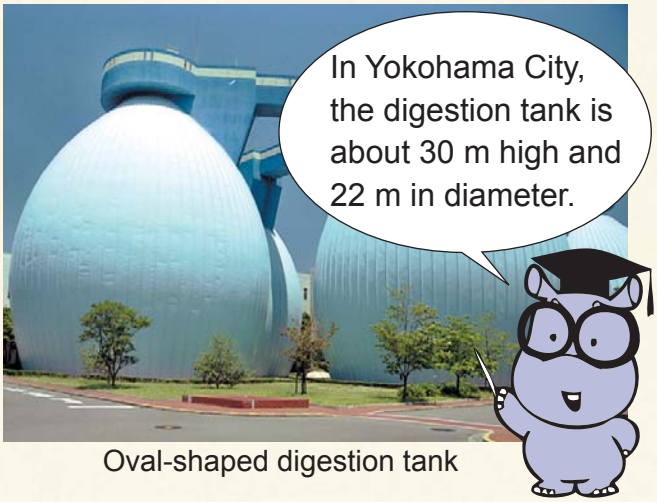
*The amount of raw, thickened and digested sludge has been converted into 1 ton (t) from 1 m3.

*Nm3 indicates normal volume (m3) in 1 atmospheric pressure at 0ºC.

6 Sludge Formation in Sewage Treatment

Digestion means...

After thickening the sludge using a thickener, it is stored and continuously stirred for 20 to 30 days at 36 °C in a digestion tank with an internal storage capacity of 58,000-82,000 m^3. In the digestion tank, conditions are anaerobic and anaerobic microbes decompose organic matter. This process is called digestion, and microbial decomposition of organic substances generates gas and water.



Oval-shaped digestion tank

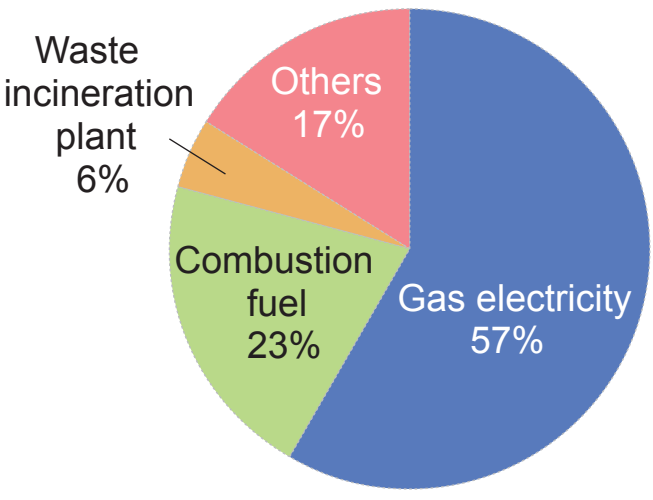
Effective Utilization of Digested Gas

Digested gas is about 60% methane and 35% carbon dioxide and some impurities, including toxic hydrogen sulfide. Therefore, a desulfurizer is added to the absorbent to absorb and remove hydrogen sulfide.

The digested gas has been used as a power source for electricity generation in the sludge treatment plant as fuel in the sludge incinerator and as a supplemental fuel in a waste incineration plant. The total electricity generation by digested gas is about 42,000 MW/year, enough to supply about 12,000 households for a year.

Absorbent in desulfurizer

Gas generator for electricity generation running on digestion gas



Use of digested gas

7 We Can Control Sewage Pollution

Avoid Placing Oil in Sewage

The oil present in sewage is detected by oil extraction using normal hexane. The results of this test indicate whether the plant may have to treat to remove oil.
However, when the oil is added to sewage, it attaches to the inner wall of the sewer pipes, as shown in the photo. When oil cools, it coagulates on the pipe walls and can cause blockage and unpleasant odors.
In addition, the accumulated oil breaks free during heavy runoff and 'oil-balls' then flow out with runoff water. A certain portion of this oil cannot be treated in the plant and thus may be discharged to the receiving water body, resulting in oil pollution. Therefore, we caution the public to never place oil in the sewerage system.

Sewer pipe blocked with oil

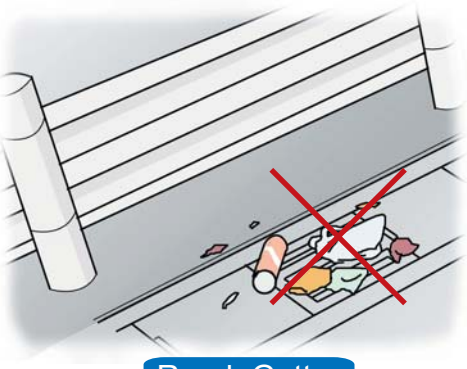
Oil-ball

In Your Household: How to Reduce Oil Pollution in Sewage

1. Don't dump oil down drains.
2. Wipe off tableware before washing.
3. Coagulate the used oil using a coagulant, and then dispose of on old newspaper or rags.

Other Ways to Control Oil Pollution in Sewage

1. Follow directions in detergent use and avoid using more than necessary.
2. Avoid throwing garbage in sewage drains or ditches.
3. Don't dump garbage in the street. If garbage blocks the gutters, flooding may result.



The water quality test for influent and effluent sewage and their standard in wastewater treatment plants (2013)

Wastewater treatment plants	Effluent standard				Test results
	Kanagawa, Tsuzuki, Kanazawa, Seibu, Sakae Daini	Hokubu Daiichi, Kohoku, Sakae Daini	Hokubu Daiichi	Chubu, Nambu	Average
Application	Discharge to river		Discharge to sea		—
	New establishment	Old establishment	New establishment	Old establishment	
pH	5.8-8.6				7.1
BOD	25 (Daily Average 20)		25		3.2
COD	25		25 (Daily Average 20)		8.8
SS	70 (Daily Average 50)				2
Normal Hexane Extracts					
Mineral oil	5	5	5	5	2
Animal and vegetable oil and fat	5	10	5	10	
Cadmium and its compounds	0.1				<0.005
Cyanide compounds	1				<0.1
Organic phosphorus compounds	0.2				<0.1
Lead and its compounds	0.1				<0.02
Hexavalent Chromium	0.5				<0.04
Arsenic and its compounds	0.1				<0.001
Mercury and its compounds	0.005				<0.0005
Alkyl mercury compounds	Not detectable				*1
PCBs	0.003				<0.0005
Trichloroethylene	0.3				<0.001
Tetrachloroethylene	0.1				<0.001
Dichloromethane	0.2				<0.001
Carbon Tetrachloride	0.02				<0.001
1,2-Dichloroethane	0.04				<0.001
1,1-Dichloroethylene	1				<0.01
cis 1, 2-Dichloroethylene	0.4				<0.001
1,1,1- Trichloroethane	3				<0.01
1,1,2-Trichloroethane	0.06				<0.001
1,3-Dichloropropene	0.02				<0.001
Thiram	0.06				<0.006
Simazine	0.03				<0.003
Thiobencarb	0.2				<0.02
Benzene	0.1				<0.001
Selenium and its compounds	0.1				<0.001
Boron and its compounds	10		230		<0.5
Fluoride and its compounds	8		15		<0.2
Ammonia, Ammonium compounds, Nitrite and Nitrate compounds *2	100				7.6
Phenols	0.5				<0.01
Copper	1	3	1	3	<0.01
Zinc	1	2	1	2	0.04
Dissolved iron	3	10	3	10	0.03
Dissolved manganese	1				0.03
Chromium	2				<0.02
Coliform groups	3,000				160
Nickel and its compounds	1				<0.01
1,4-Dioxane	0.5				<0.005

*1: Mercury, alkyl mercury and other compounds were not detected in the sample. Therefore, the alkyl mercury compounds were not analyzed.
*2: The total ammonium nitrogen that is multiplied by 0.4 indicates the total nitrogen present in nitrite and nitrate.

Wastewater treatment plants		Effluent standard			Results
		Seibu, Sakae Daiichi, Sakae Daini	Chubu, Nambu, Kohoku, Tsuzuki	Hokubu Daiichi, Hokubu Daini, Kanagawa, Kanazawa	Average
Application		Discharge other than Tokyo Bay	Discharge to Tokyo Bay		—
			Without recycled flow	With recycled flow	
Nitrogen content	Tolerant limitation	—	40	50	
	Daily average value		30	40	8.5
Phosphorus content	Tolerant limitation	—	5	7	
	Daily average value		3	5	1.0

Wastewater treatment plants	Effluent standard		Results
	Hokubu Daiichi, Chubu, Nambu, Seibu, Sakae Daiichi	Hokubu Daini, Kanagawa, Kanazawa, Kohoku, Tsuzuki, Sakae Daini	Average
Application	No discharged from industries	Discharged from industries	—
Dioxins content (pg-TEQ/L)	—	10	0.0017

Water Quality of Sewage in Yokohama (Published in March, 2016)
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