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Japan and water.

Japan is an island nation that is surrounded by the Pacific Ocean, with rivers, and lakes playing a key role in its landscape and peoples daily life in Japan. Japan is known for its clean water and its water conservation as well as its sustainability, they manage the water resources carefully due to its problems like climate change, and its human activity as we'll explain more in this essay.

Water Science & Properties

7 Chemical and physical properties of water. In the lab we tested several properties of water and here's what was found out. Water has 3 states: solid, liquid, and gas. The gas state has the most energy of all 3. Water is made of 3 parts 1 part oxygen 2 parts hydrogen. Water is a solvent, it dissolves most polar and ionic solutes but isn't very good at dissolving non polar solutes. This was tested by putting salt into a beaker of water until it is supersaturated (full of solutes and cannot dissolve any more). Water also has a lot of surface tension and this is what holds it together. This was tested by putting a water drop on a glass plate and seeing form a bubble shape, as well as flipping the plate upside down the droplet stayed in place. This is because of water's hydrogen bonds which like to stick to each other. Water is also a good heat conductor, and is used in a variety of applications for that property. Such as coolant for a nuclear reactor, or a coolant for a computer. Finally water has a density of 1 gram per milliliter.

17 Japan's water quality related to SDG 6. Japan’s water is really good and is probably one of the best countries for water quality. According to the UN 99% of their population is drinking clean water. The only thing they lack in is ambient water quality. 57% of their water has good quality which isn’t bad but it isn’t great either. Good ambient water quality is defined as water that doesn’t damage the ecosystem or human health. here are general statistics for Japan’s water quality. The nitrogen level is a maximum of 10 mg/L. E coli could not be detected in their 2015 report. Dissolved oxygen in Japan's water is roughly around 0.0224 mg/L. Chloramines level is 0.1mg/L Turbidity Japan's water Turbidity between 5-20 NTU.

18 In Japan, water testing protocols follows strict standards set by the ministry of health, Labour and welfare, they mainly focus on monitoring a wide range of parameters including chemicals, bacteria, and any physical properties that may be found in the water, with the utilities required to regularly test their supply against these standards. Japan does regular testing for any bacteria that may be found. They also test for pH, turbidity and color, other chemicals that Japan tests are chlorine, nitrate, fluoride,arsenic, heavy metal, lead, and mercury and much more. Most of the water samples that are tested are taken from water treatment plants and distribution systems as well as the frequency of the sample may depend on the size of the water supply and local regulations. They also taste for wastewater quality that may have been discharged from an industrial and must meet specific limits to the contaminants as most commonly found in them are BOD, COD, pH, and suspended solids or SS and various chemical pollutants. These types of protocols ensure that the water quality is safe for the public to drink in japan.

19 Here is the most recent full water quality report.

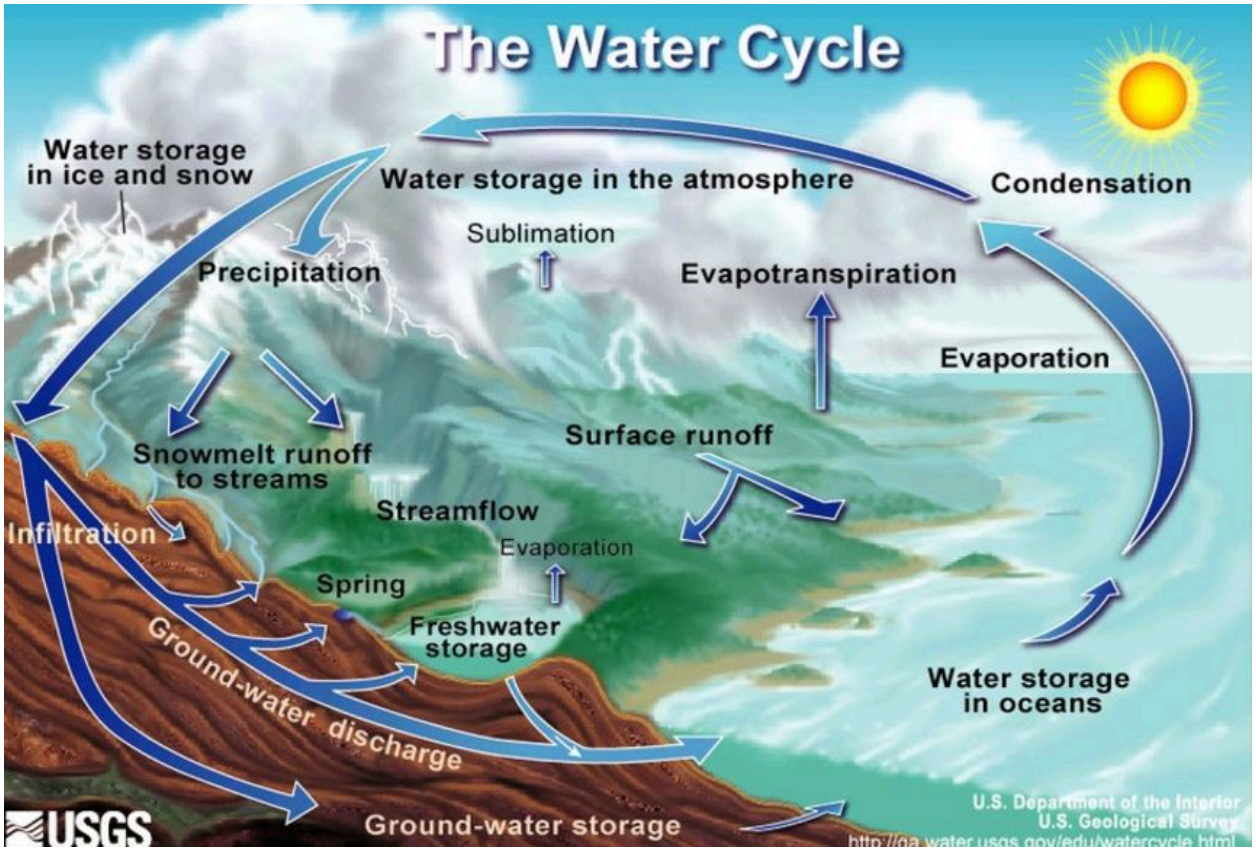
No.	Items	Standard Value
1	Common Bacteria	100 per 1 ml
2	E. coli	Not to be detected
3	Cadmium	0.003mg/L
4	Mercury	0.0005mg/L
5	Selenium	0.01mg/L
6	Lead	0.01mg/L
7	Arsenic	0.01mg/L
8	Chromium (VI)	0.05mg/L
9	Nitrite nitrogen	0.04mg/L
10	Cyanide ion and Cyanogens chloride	0.01mg/L
11	Nitrate and Nitrite	10mg/L
12	Fluoride	0.8mg/L
13	Boron	1.0mg/L
14	Carbon tetrachloride	0.002mg/L
15	1,4-dioxane	0.05mg/L
16	cis-1,2-Dichloroethylene and trans-1,2- Dichloroethylene	0.04mg/L
17	Dichloromethane	0.02mg/L
18	Tetrachloroethylene	0.01mg/L
19	Trichloroethylene	0.01mg/L
20	Benzene	0.01mg/L
21	Chlorate	0.6mg/L
22	Chloroacetic acid	0.02mg/L
23	Chloroform	0.06mg/L
24	Dichloroacetic acid	0.03mg/L
25	Dibromochloromethane	0.1mg/L
26	Bromate	0.01mg/L
27	Total trihalomethanes (Total of Chloroform, Dibromochloromethane, Bromodichloromethane and Bromoform)	0.1mg/L
28	Trichloroacetic acid	0.03mg/L
29	Bromodichloromethane	0.03mg/L
30	Bromoform	0.09mg/L
31	Formaldehyde	0.08mg/L
32	Zinc	1.0mg/L
33	Aluminium	0.2mg/L
34	Iron	0.3mg/L
35	Copper	1.0mg/L
36	Sodium	200mg/L
37	Manganese	0.05mg/L
38	Chloride ion	200mg/L
39	Calcium, Magnesium (Hardness)	300mg/L
40	Total residue	500mg/L
41	Anionic surface active agent	0.2mg/L
42	(4S, 4aS, 8aR)-Octahydro-4,8a-Dimethylenaphtalene-4a(2H)-ol (Alias: Geosmin)	0.00001mg/L
43	1,2,7,7 - Tetramethylbicyclo[2,2,1]Heptane-2-ol (Alias: 2-Methylisobolneol)	0.00001mg/L
44	Nonionic surface active agent	0.02mg/L
45	Phenols	0.005mg/L in terms of Phenol
46	Organic substances (Total Organic Carbon) (Note 2)	3mg/L
47	pH Value	5.8 ~ 8.6
48	Taste	Not abnormal
49	Odor	Not abnormal
50	Color	5 degree
51	Turbidity	2 degree

Water Sources & Availability

2 Japan's main sources of water are surface water like rivers,lakes and reservoirs as it makes around 70-80% unlike groundwater which has issues on water quality and pollution uses,

Groundwater is only used 20-30%. Major rivers that are being used are Tone river, Arakawa river, and Tamagawa river are used for drinking in Tokyo, while Osaka is using Yodo river, and lake biwa as a source of fresh. An interesting thing is that japan also depends on snowfall that helps replenish rivers and reservoirs and is an important factor for them.

3 The water cycle precipitation consists of water movement, usually in the form of stores and flows. The water cycle is the flow of water from these stores to different stores. The way water flows follows the cycle below.



First precipitation, this can be in the form of snow, hail, rain, or sleet. It involves water in any of those forms falling from the sky from water build up. When the water goes into the ocean it just

continues from there and gets moved by winds and currents. Water falling into a river just becomes a part of the stream flow. Rain that falls near a river will usually just flow to the river or ocean nearby, this is called surface runoff. Snow and ice that melt runoff to streams usually joining rivers or lakes. Then there's water that just hits the ground which can be captured by plants it hits which is called interception. After water hits the gound it can runoff to a nearby water storage or it can infiltrate the ground and percolate through it. Percolating is when water

11 Japan's fresh water. Japan's water mostly comes from surface water, 45% from reservoirs, 25% from rivers, 1% from lakes, 4% from river beds, and 23% from groundwater. One of the biggest tributaries to Japan's water is the tone river and flows from the northwest to the Pacific Ocean and is a major river for the Keihin industrial area. The river mainly provides power and water for the Keihin Industrial area. Another big tributary to Japan is the Shinano river which mainly just acts as a water way for transport and flows from 3 other connecting rivers to the Japan sea. And finally the Ishikari River, which supplies water to industries though they heavily pollute the river valley. The river is on the northwest coast and flows from the Kamikawa Basin to the sea of Japan.

12 The major bodies of water in Japan are the pacific oceans, the sea of japan (East sea), The sea of Okhotsk, And the east of china sea. These major bodies also surround Japan and somethings that are also related is that the pacific ocean was where the earthquake under it caused the flood or the tsunami that happened in 2011.

13 Japan's water populous. Japan has 124 million people, most are on the west coast of Japan. These populations need and use a lot of water. The cities obviously use the most amount of water and require complex water systems. The biggest water-using cities are Tokyo, Osaka, Yokohama, Kanagawa, Chiba, Nagoya, Kyoto, Kawasaki, Sapporo, and finally Hirishima. With all this water usage and complexity can come daisies. Here are some of the water borne diseases found in Japan's water from 1983 through 2012. E. coli is the most common with 58 total cases, campylobacter is second with 25 cases, shigella is third with 8 cases, yersinia is fourth with 5 cases, salmonella in fifth with 4 cases, aeromonas in sixth with 4 cases, and a few others with very few cases. There haven't been many cases but these diseases have been found in Japan's water.

1 The world's supply of fresh water is running low. Water scarcity is very important and is affecting nearly ⅔ of the world population currently. First, fresh water sources come from several different areas such as rain water, some rivers, springs, icecaps and glaciers, and deep groundwater. Majority comes from Ice Caps/glaciers and groundwater. Though what we use comes from lakes and rivers, but it mostly depends on where you live. Globally we use a lot of water in things such as agriculture and industry, we use about 4.7 trillion tonnes of water each year and replenish too little to counteract our usage. 70 percent of water usage is in agriculture alone and 20 percent to industry and another 12 to domestic. As well as adding pollution, like putting waste in lakes and rivers, or burning coal and affecting the water cycle through Co2 output, and plastic waste. Mass plastic production releases mass chemicals long term from plastic slowly breaking down and polluting water and rainwater, while more immediate pollution

includes mass greenhouse gasses being released into the atmosphere from oil drilling and refining. All this polluting and water usage is affecting the environment heavily and causing areas like wetlands to be destroyed. We both are destroying environments and polluting the little clean water available.

4 Climate change is a problem for water availability as extreme weather events like droughts, floods, and rising sea levels are affecting the freshwater sources. An example are sea salts reaching into some freshwater areas from rising water levels. Droughts are becoming a problem as water is evaporating then normal making water availability decrease. However Japan is significantly being impacted from climate change as snowfall has been shown to be decreasing which is a problem as many regions require or is crucial as the snowfall helps it replenish. This problem creates a risk of droughts mainly in areas that are reliant on snowfall for the water supply. Examples in southern and central like Tonegawa River are being affected by droughts due to decreasing snow as well as rainfall being at low which lead it to depleted reservoirs levels. Another problem is sea level rising as well as rainfall are often been concentrated in a single place which is causing floods to Rivers like Kamo rivers in kyoto and the Meguro rivers in Tokyo as they have been flooding from heavy amounts of rain and has even hit some city like Wajima, Ishikawa.

The water quality standards for japan for it to be drinkable should be a range of pH range of 5.8-8.6, it must be considered “soft” or with a low hardness level, the TDS level must be considered low, the nitrate level is not exceeding 10 Mg/l as a nitrate, Nitrites must not exceed 1

mg/L as nitrogen as they are very toxic to the human body, Escherichia coli (E.coli) their must be no presence of it per every 100 mL of water as they can contain diseases, PFAS as if right now don't have a specific limit as they are currently monitoring and regulate the framework as its being developed, Dissolved Oxygen (DO) also is usually measured for drinking water as its being used for water treatment and are generally above 5 mg/L, Chloramine must not be exceeding past o.1 mg/L for drinking as it can affect its taste and the health, and lastly Turbidity most not exceed 0.1 NTU as if it's more that means it has suspended particle and generally any other chemicals that may be in the water must be lower than 0.1. Japan's water quality standards for drinking water are designed to ensure that its clean and safe for the public and its alignment with the SDG 6, which ensures availability and sustainable management of water and sanitation for all. Japan's regulatory framework prioritizes water safety, clean water access, and aswell as protecting the public safety that consumes the water.

Human Impact on Water

6 Human activists have been impacting japan mainly industrial wastewater discharge and plastic pollution and are significantly impacting their water sources causing high level of microplastic in their waters, harming marine life or organisms that live in the water, and even contributing to the environmental degradation. The japanese rivers have presence of microplastic or plastic waste from their activity but Industrial waste water is also an another problem as their activity have been discharged or an action of discharging a liquid, gas ,other substance something I learned but the industrial wastewater making the rivers populated from having heavy metal or dangerous chemical in them affecting their water quality. The rivers of japan were found to have outbreak

mercury and cadmium poisoning due to a factory that got released in the river mainly Agano River.. Japan still has a problem as an incident in 2019 had a flood that led to an oil spill that affected the rivers.

5 Ambient water. Ambient water is natural water stores in an environment mostly untouched by man, which comes in many forms. Such as ground water, rivers, lakes, and wetlands. Ambient water usually has good qualities in things like minerals and waste. Ambient water is rather naturally pure and has what the environment around it needs. Good ambient water is not so often anymore due to pollution, over use, and damaging surrounding environments that give the water its clean properties.

Water Management & Conservation

14 Japan is a highly developed civil engineering infrastructure for water treat as they have robust of network of dams for the rivers as they are heavily depend on them to catch rainwater and a source for freshwater as a treatment and distribution, Sophisticated filtration system which is an advanced filtration systems that helps them remove wide ranges of contaminants from the water even specific ones which allows them to have high level of purity and is the primary water treatment method, and also minimizing water loss through the use of high-quality pipes, primarily made of ductile iron and stainless steel, which lets them have one of the world lowest

water loss rates also ensuring the water quality. The civil engineer infrastructure allows them to have the lowest water loss rates globally and have made them a better design to try to make them resistant to the earthquake to prevent it from happening, however these are financially expensive for the country to manage them.

15 Japan’s water management system. Japan's water management is rather advanced due to their flood prevention laws. They have to have these due to all the rivers in Japan and the slim nature of the island. Japan has been working on their water management since the end of WWII building flood prevention reservoirs and flood tunnels and building dams. Japan has 793 flood control dams as of 2019. Japan is still in danger of floods but with all of these the risks are heavily migrated.

8 The Japan Water Agency (JWA) manages the water resources across several major river systems for japan which ensure their water supply is stable to populated areas. The Japan water Agency has created laws to make water conservation which are the water pollution prevention act which is a law that regulates the emission of air pollutants like smoke and sets the emission standard for facilities and any business will be responsible for any air pollution damage. This is a way for the JWA to prevent more pollution of the water and affects its water quality and prevent as well as discharge to the water and manage water quality.

9 Water conservation treaties signed by Japan. Japan adopted the IAEA's policies in 2021 and requested help to safely release previously radioactive water from the Fukashimia nuclear plant that melted down in 2011. They also signed the EPA agreement in 1975. The EPA deals with some clean water acts and supports the clean water act of 1972 and the clean drinking water act of 1974. Japan also has an act of their own that regulates water use and makes pollution illegal, called the water prevention act. The US and Japan also made an initiative for development goal 6 called clean water for people initiative which came out in 2002.

10 One of the big disasters that japan had which affected rivers, human life, and environment was the 2011 Tohoku earthquake and tsunami which caused widespread destruction to the infrastructure of japan. The disaster also affected the water treatment plants and sewage system which lead them to contaminate water supplies and lead severe disruption to human life in japan. It also destroyed ecosystems and rivers as there was saltwater intrusions to rivers affecting the freshwater sources. These problems may still be visible in rivers like Kitakami rivers, Naruse rivers, Tone river and more as a lot of them had floods. Sediment deposition like salt damages the water quality mainly in Kitakami river. There was also a lot of waste in the water from the earthquake that got in some freshwater sources that got pollution in some of them.This disaster also has affected many people's lives as many peoples homes were destroyed and the towns were damaged.

Personal research

In the lab we have been doing our own research and testing on Japanese water from the Tone River and the Yodo River. We have tested PH, TDS, nitrite, and nitrate. The results were rather mixed with TDS, and the nitrate and nitrite tests, disclaimer: for TDS we used two different testers; one consistently gave a PPM-500 level of 60 but the second test with a different pen got a level of 186-221+. This could be due to the difference of equipment, lack of calibration (first pen comes calibrated), or a different type of test since the second pen didn't exactly tell what PPM it used to test TDS. As for the nitrate and nitrite tests the errors could be waiting too long for the nitrogen strips, the color being difficult to see, or defective strips.

Nitrate and nitrite tests. For the nitrate and nitrite tests we had a pretty consistent number of 0 for nitrite and nitrates, this could possibly indicate a problem with the nitrogen cycle such as too much denitrification (where nitrate in converted back to nitrogen gas) causing mass loss of nitrogen, leaching (Nitrogen being lost to mass irrigation or mass rainfall), or volatilization (this is when ammonium is turned into ammonia gas causing a loss of nitrogen from the ammonium having nitrogen in it), or it could indicate an error in are testing.

PH tests. For the PH tests for the Tone River we got around 6.86 for the low and 7.48 for the high. This came from a freshly calibrated PH testing pen. The range for safe drinking water is 6.5 to 8.5 Overall these are pretty good numbers and are rather neutral, not much acidic or basic.

This was expected since Japan's water quality is some of the best in the world, at least their PH levels are some of the best.

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Tone river

Tokyo

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Date	1 Jan	1 Feb	1 Mar	18 Apr	30 May	21 Jun	25 Jul	24 Aug	5 Sep	11 Oct	7 Nov	7 Dec
pH	7.6	7.6	7.5	7.3	7.2	7.4	7.5	7.3	7.4	7.5	7.5	7.5
BOD [mg/l]	2.6	2.4	2.7	1.4	0.6	1.6	1.4	2.5	1.1	0.9	1.1	3.1
DO [mg/l]	11.8	12.5	12.2	10.7	9.6	8.0	7.7	6.6	7.6	8.2	8.1	11.0
SS [mg/l]	5	9	7	10	17	17	27	100	21	9	15	8
Coliform group[2] [$x10^3$MPN/100ml]	1.7	0.2	0.5	0.2	0.5	3.3	2.8	23.0	4.9	13.0	0.0	3.3
Discharge[3] [m^3/s]	90.40	86.07	82.11	125.82	245.53	121.58	161.1	229.29	132.5	223.5	212.6	109.5

Bod, Biochemical Oxygen Demand

Do, dissolved oxygen.

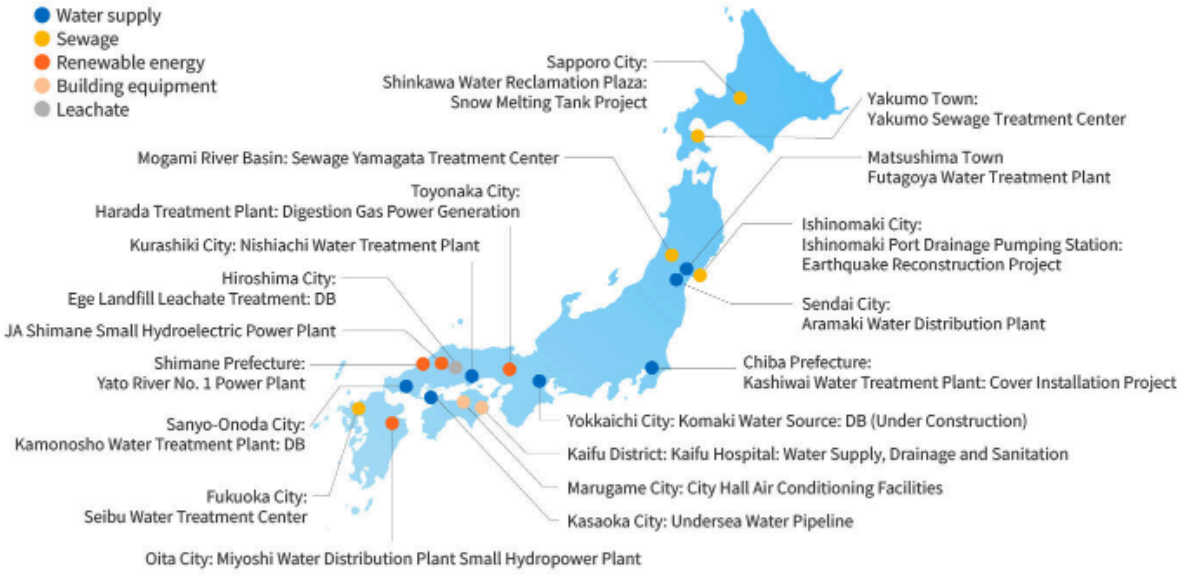
SS. suspended solids.

Coliform groups is a group of bacteria adn the count of them. x10'mpn/100ml, mpn means most probable number.

Discharge is like water waste from factories dumping water in the river.

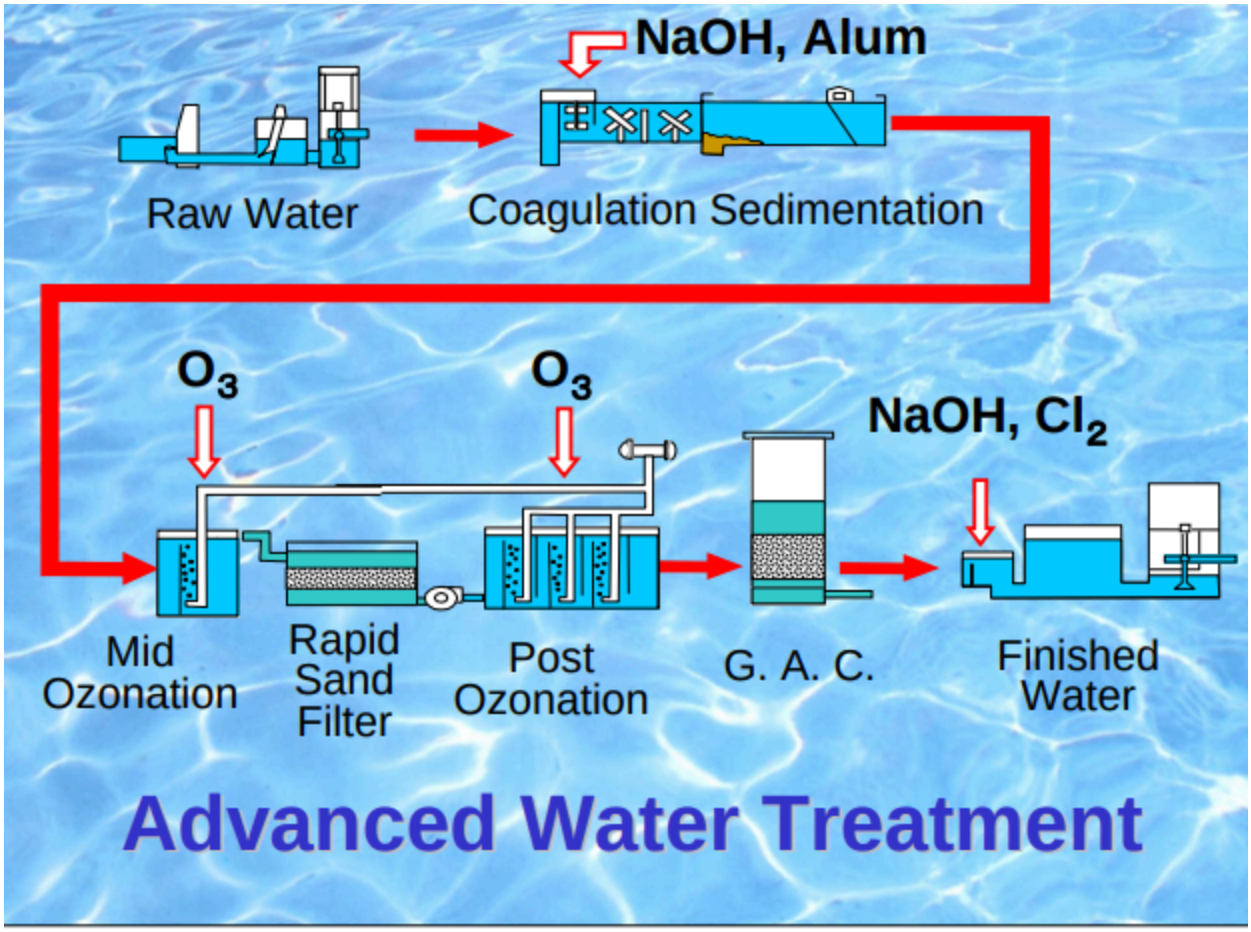
https://www.niph.go.jp/soshiki/suido/pdf/h21JPUS/abstract/r7-3.pdf

Japans water treatment plants and a map of them and their water regulations like government



Water Utilities of YRWQCC

Name	Water Supply Capacity (m^3/D)
Osaka Municipal Waterworks	2,430,000
Osaka Prefectural Waterworks	2,330,000
Hanshin Water Supply Authority	1,128,000
Moriguchi City Waterworks	103,500
Hirakata City Waterworks	191,317
Neyagawa City Waterworks	129,000
Amagasaki City Waterworks	351,486
Suita City Waterworks	208,000
Nishinomiya City Waterworks	275,691
Itami City Waterworks	94,600



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