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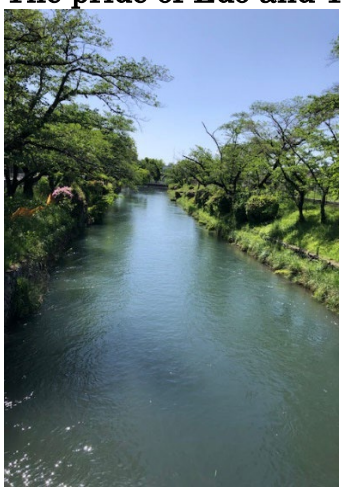
Tamagawa Josui: Edo's Precious Waterworks ---Basic artery for a city of one million people---

Water is an eternal problem for humankind. Culturally too, the Japanese have a deep relationship with water. Good-quality water is essential for making Japanese food, such as rice, tofu, and Japanese confectionery, as well as sake. And water displays its power in purification and ablutions at shrines too.

It was about four centuries ago when Tokugawa Ieyasu (1543–1616) stepped onto land that was swampy as far as the eye could see and began building Edo (present-day Tokyo) as the center of Japan's new politics. There was one big problem, however: The land was not blessed with fresh water. Crucial for Edo's development, the securing of water supplies turned into an enormous project.

The pride of Edo and Tokyo



Tamagawa Josui in Hamura

Edoites used to boast that "I was born in the shogun's neighborhood and used piped water for my first bath!" Records show that foreigners visiting Japan toward the end of the Tokugawa shogunate were impressed by two things: the giant statue of Buddha in Nara and Edo's waterworks. These waterworks, which at the beginning of the eighteenth century supported the world's largest city with a population of one million people, had a total pipe length of 150 km. At that time, both the population and the area served by this water-supply system were the largest in the world.

Water was delivered to people regardless of their status and gave rise to such customs as housewives' gossiping around the wells in row houses (*nagaya*) and enjoyable visits to public baths by townspeople. Water supplies were also essential for maintaining hygienic daily life in Edo. Statistics show that compared with European cities in the same period, Edo had a low mortality rate. Furthermore, Edo's waterworks continued to operate for four centuries. Among them, even today the Tamagawa Josui waterway continues to quench the thirst of Tokyo residents, and the nature remaining in its vicinity offers a soothing environment.

Construction of Tamagawa Josui

Since much of Edo stood on reclaimed land close to the sea, even if wells were dug, the water obtained would be salty. After setting up its government, therefore, the Tokugawa shogunate immediately set about ensuring fresh water supplies. At the beginning of the seventeenth century it built the Kanda Josui waterway, which had its source in the present-day Inokashira Pond in Inokashira Park, Kichijoji. The water of Tameike Pond in Akasaka was used as well. In 1609 the population of Edo was still only about 150,000. After that, however, at the time of the third shogun, Tokugawa Iemitsu (1604–51), the obligation of provincial daimyo to reside in alternate years in Edo to serve the shogun became an established rule, and the population of Edo began to swell as the retainers and families of daimyo came to live in the city from around the country. By 1733, it is thought, the population of Edo had reached one million.

To cater for this growing population, in 1652 the shogunate devised a plan to channel water to Edo from the Tama River. The shogunate consigned the project to two brothers, Shoemon and Seiemon, and handed them 6,000 *ryo* for the task. (Calculated at 1 *ryo* = 150,000 yen, this is the equivalent of 900 million yen in today's money.) Work began on April 4, 1653. Deciding the point of intake from the Tama River proved to be difficult, and the brothers erred twice. But eventually, just eight months later, the 43-km waterway from the intake weir in Hamura to Yotsuya-Okido in Edo was completed on November 15, 1653. (That year was a leap year, and the month of June was repeated.) In recognition of their meritorious deed, the shogunate bestowed the surname Tamagawa on the two brothers.

Waterpipes eventually reached Edo Castle in June 1654. As a result, water was supplied to the entire southwestern part of the city, including Yotsuya, Kojimachi, Akasaka, Shiba, and Kyobashi.

Statue of the Tamagawa brothers

The Hamura weir in *Tamagawa Josui sekimoto mizuyuki no zu* (Diagrams of Tamagawa Josui Weirs and Waterway) (Property of the Tokyo Waterworks Historical Museum)

Top level technology in the world

Hamura, which was finally decided as the place of intake from the Tama River, was 126 meters above sea level, and the difference in altitude to Yotsuya-Okido, the destination, was just 92 meters. So a drop of only 21 cm could be made every 100 meters. In other words, just 2 cm every 10 meters. If water were drawn from the river's downstream, the waterway could be shortened. But then there would be insufficient height difference, and it would not be possible to deliver the water into Edo with the natural incline. In the vicinity of Hamura, the intake site, the river veered sharply to the right. So even if the amount of water declined, it would be possible to draw off enough water. No doubt the brothers were indebted also to the enthusiasm of the outstanding civil engineering workers who they gathered from the neighborhood for the project.

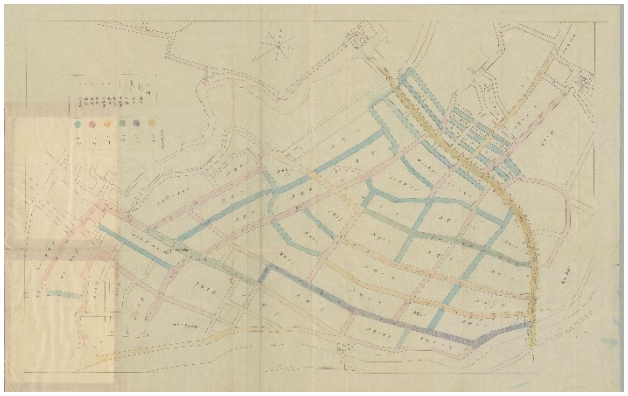
At one point water was taken from the river at Fussa, but that plan had to be revised because it turned out that part of the Musashino Plateau was composed of a thick layer of gravel, and this "water-guzzling" stratum absorbed the water. (Even today, there is a park in Fussa called Mizukuraido, or "Water-Guzzling," Park.)

In addition, much initiative went into the construction of the intake weir at Hamura. In particular, one of the dams there, called the Nagewatashi Weir, consisted of a combination of cedar logs, fascines (bundles of tree branches), and gravel that could be easily removed. So in the event of a typhoon or heavy rainfall, the dam could be broken down so that the muddy water flowed into the main river and not into the Tamagawa Josui. Since they were natural materials, they did not impact the environment, and the dam could be easily rebuilt. Indeed, this technique, known as *nagiharai* and unique to Japan, is still used even today.

The present-day Nagewatashi Weir at Hamura draws water from the Tama River.

Sluice Gate No. 1 adjusts the amount of water flowing into Tamagawa Josui.

From Yotsuya-Okido pipes were buried underground to deliver water to the city. These also made use of the natural incline, and meticulous design and resilient pipes were necessary. Since procurement was easy, wood was used for the waterpipes, which were called *mokuhi*. Fine technology was required to ensure no leakage of water, and this was where ship carpenters and underground-storage carpenters displayed their skills. (Edo had many fires, so to store their valuables, people would make large wooden boxes and bury them underground.) Pipes went to daimyo and samurai residences and to the row houses where the townspeople lived in half of Edo's numerous districts. And wells were installed in the row houses, so people never had to go far to collect water.



Kojimachi kunai josui tosen no zu (Diagram of the Water-Supply Conduit Network in Kojimachi) (Property of the Tokyo Waterworks Historical Museum)

A wooden waterpipe (Cooperation: Tokyo Waterworks Historical Museum)

Waterpipes were replaced regularly, with construction work taking place just as it does today. For the management of water quality, measuring cups were put in place to enable the testing of water quality from above ground. Maintenance of the open-cut waterway from Hamura to Yotsuya-Okido was administered by each village along the route, and water quality management was conducted by water watchmen. In another initiative, cherry trees were planted on both sides of the waterway along the stretch from present-day Koganei to Sakurazutsumi in Musashino. The idea was that the cherry tree roots would spread and protect the banks, and people flocking to admire the blossoms would solidify the ground by treading on it. This section became a popular place for cherry-blossom viewing in Edo, and today it is designated as a national scenic spot.

Drawing water from a row-house well
(Cooperation: Tokyo Waterworks Historical Museum)

A row-house well, laundry washtub,
and dish-washing utensils
(Cooperation: Tokyo Waterworks Historical Museum)

The underground side of a well, wooden waterpipe, and parts
(Cooperation: Tokyo Waterworks Historical Museum)

Water and daily life in Edo

In this way, Edo, a city with a population of one million people, came to be blessed with an excellent waterworks. From their childhood, however, Edoites were taught that even more than money, water must not be wasted. Water used for rinsing rice was used again for cleaning and then again for watering plants. Piped water also contributed a lot toward making life enjoyable for Edoites. At home, they could use safe water, and in the town, many restaurants appeared where they could eat out.

In a row house, water would be drawn and stored in the wooden tubs in the foreground.
(Cooperation: Tokyo Waterworks Historical Museum)

water pot in a row house
(Cooperation: Tokyo Waterworks Historical Museum)

People paid water utility rates. These consisted of fees for the use of water, which were calculated for daimyo according to the value of their land and for townspeople according to the size of the owner's house, and maintenance fees, because the wooden pipes had to be replaced every 20 years. In addition, every July 7 on the old calendar was designated as well-cleaning day, when each community would clear away fallen leaves and clean the inside of wells. In the middle of the Edo period (1603–1868) there were wells just about every 20–30 square meters. Water supplies did not reach places like Honjo or Fukagawa, however, so piped water would be carried there by water vendors.

Edo had a sewage system as well. Water used for washing without detergent, rainwater, and other wastewater, such as water for washing dishes, bathing, and washing hair, was discharged into communal wastewater gutters, from where it flowed into moats and rivers. Feces and urine were purchased as natural fertilizer by farmers in the neighborhood, so they did not flow into the rivers.

Furthermore, as well as delivering water to the city of Edo, Tamagawa Josui had branches leading to villages along the way. In the year after the waterway was completed, a branch was built to the Nobidome Yosui irrigation channel. This was followed by more than 30 other branches, including the Ogawa, Sunagawa, and Kokubunji distributaries. Water supplies, and hence cropland, thus spread around Musashino, which became a major area supplying agricultural produce to the one million residents of Edo.

The starting point of the Karasuyama Branch seen from upstream Tamagawa Josui (Property of the Tokyo Waterworks Historical Museum)

Present-day Tamagawa Josui

During and after the Meiji period (1868–1912) new waterways were built and used that headed toward the Yodobashi Purification Plant, which was located in the vicinity of the present Keio Plaza Hotel on the western side of Shinjuku. Some of them are still in use today.

In Yotsuya-Okido there is a large stone monument commemorating the Tamagawa Josui waterworks. Here there used to be a guardhouse administering the amount and quality of the water in Tamagawa Josui. The monument explains the reasons for its construction and the achievement of the Tamagawa brothers. The title inscription was written by Tokugawa Iesato (1863–1940), the sixteenth head of the Tokugawa family and first after the overthrow of the shogunate.

From Hamura to the city center, municipalities are carefully looking after Tamagawa Josui, which has become a relaxing tree-lined walking course for Tokyoites. Elementary schools near Tamagawa Josui offer lessons to learn about the waterway and nurture people who cherish and protect Tamagawa Josui just as in the Edo period, four centuries ago.

The Tama River Hamura Weir

Mizu (Water) Shrine near Hamura Weir

Tamagawa-Josui Station of Seibu Railway

Tamagawa Josui near the station

You can enjoy the scenery of Tamagawa Josui, which changes over the four seasons, or bird watching to spot the visiting wild birds. Or you can earnestly follow the long green pathway and think about the hardships entailed in digging the waterway during the Edo period. The numerous bridges over the canal are interesting too. And the walk from Hamura to Fussa, Haijima, Tachikawa, Kokubunji, Kodaira, Koganei, Musashi-Sakai, Mitaka, the vicinity of Inokashira Park, and onto the starting point of the Karasuyama Branch in Suginami-ku is fascinating, with many parks along the way.

Green pathway near Kugayama in Suginami-ku

Tokyo Waterworks Historical Museum

The Tokyo Waterworks Historical Museum, which is essential for learning about Tamagawa Josui, is about an eight-minute walk from JR Ochanomizu Station. When I visited, I spoke with Mr. Satoshi Kaneko, who is in charge of planning and research at the museum.

The Tokyo Waterworks Historical Museum preserves many valuable materials, including *Josuiki* (Water Records), an official record compiled by the shogunate in 1791, 137 years after the Tamagawa Josui aqueduct was built. Using videos and other exhibits, the display explains the water-supply systems of Edo and Tokyo in an easy-to-understand manner. Visitors can also see excavated wooden pipes and wells. Noting especially Tamagawa Josui's high level of technology, large scale, and advanced surveying techniques, Mr. Kaneko explained its importance as the foundation of later, more modern waterworks.

The second floor of the museum focuses on waterworks in Edo and the first floor on the history of waterworks in Tokyo during and after the Meiji period. Admission is free, and the pamphlet and audio guide are both available in English, Korean, and Chinese as well as Japanese. There is also a well-stocked library and digital archive.

Josuiki (Water Records)
(Property of the Tokyo Waterworks Historical Museum)

Mr. Satoshi Kaneko,
who is responsible for planning
and research at the museum

Tradition of quality continued in Tokyo water

The tradition of quality nurtured by the large-scale water-supply system of Edo, symbolized by the Tamagawa Josui waterway, continues to this day, as Tokyo water, to support the lives of the capital's residents. Indeed, the quality is so high that tap water is used for making sake. Tokyo water is safe and always close at hand. Once again, I would like to say a word of thanks to our ancestors who made such awesome efforts and to the people who protect our water today.

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Cooperation:

Tokyo Waterworks Historical Museum
2-7-1 Hongo, Bunkyo-ku, Tokyo
Tel.: 03-5802-9040 Fax: 03-5802-9041
Website: **https://www.suidorekishi.jp/en/**