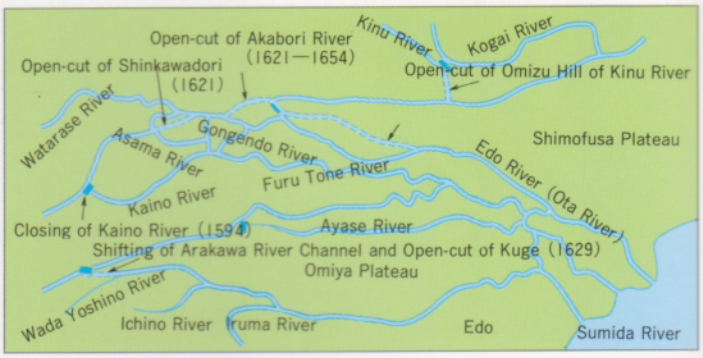
Overview of Edo River, Naka River and Ayase River

General Review of Edo River

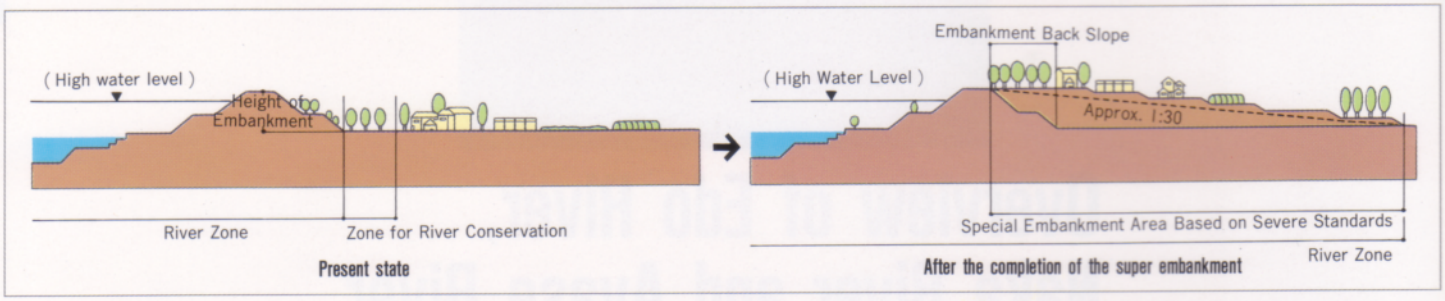
Edo River branches from Tone River at Sekiyado Town in Chiba Prefecture and flows along the prefectural border between Chiba and Saitama/Tokyo. It is a Class1river with a length of some 55 km and a catchment area of some 200 km^2 and travels through 2 wards, 7 cities, 5 towns and one village, emptying into Tokyo Bay. It was originally excavated by the Tokugawa Shogunate to protect Edo, the capital, from flooding and to facilitate the development of new farmland and physical distribution by means of inland water transportation.

Present channel of Edo River

Eastward shift of Tone River and excavation of Edo River

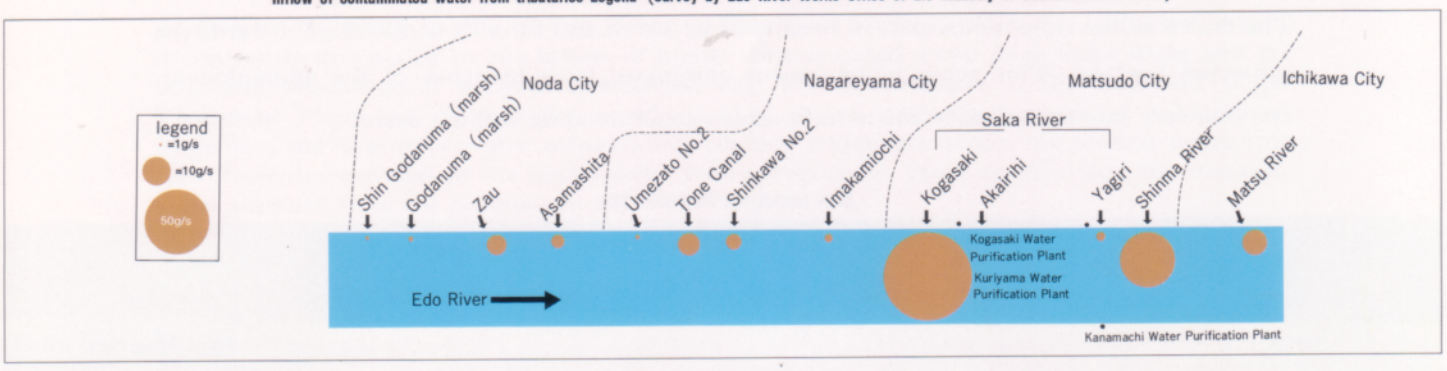


Due to the topographical characteristics of the catchment area of Edo River, any flooding takes the form of spread flooding. Once the embankments have been breached, devastating damage may be caused in the Tokyo Metropolitan Area, the heartland of Japan. In order to avoid such a calamity, super (high standard) embankments have been introduced and the work to construct super embankments is currently in progress in Myoten and Zau, etc.

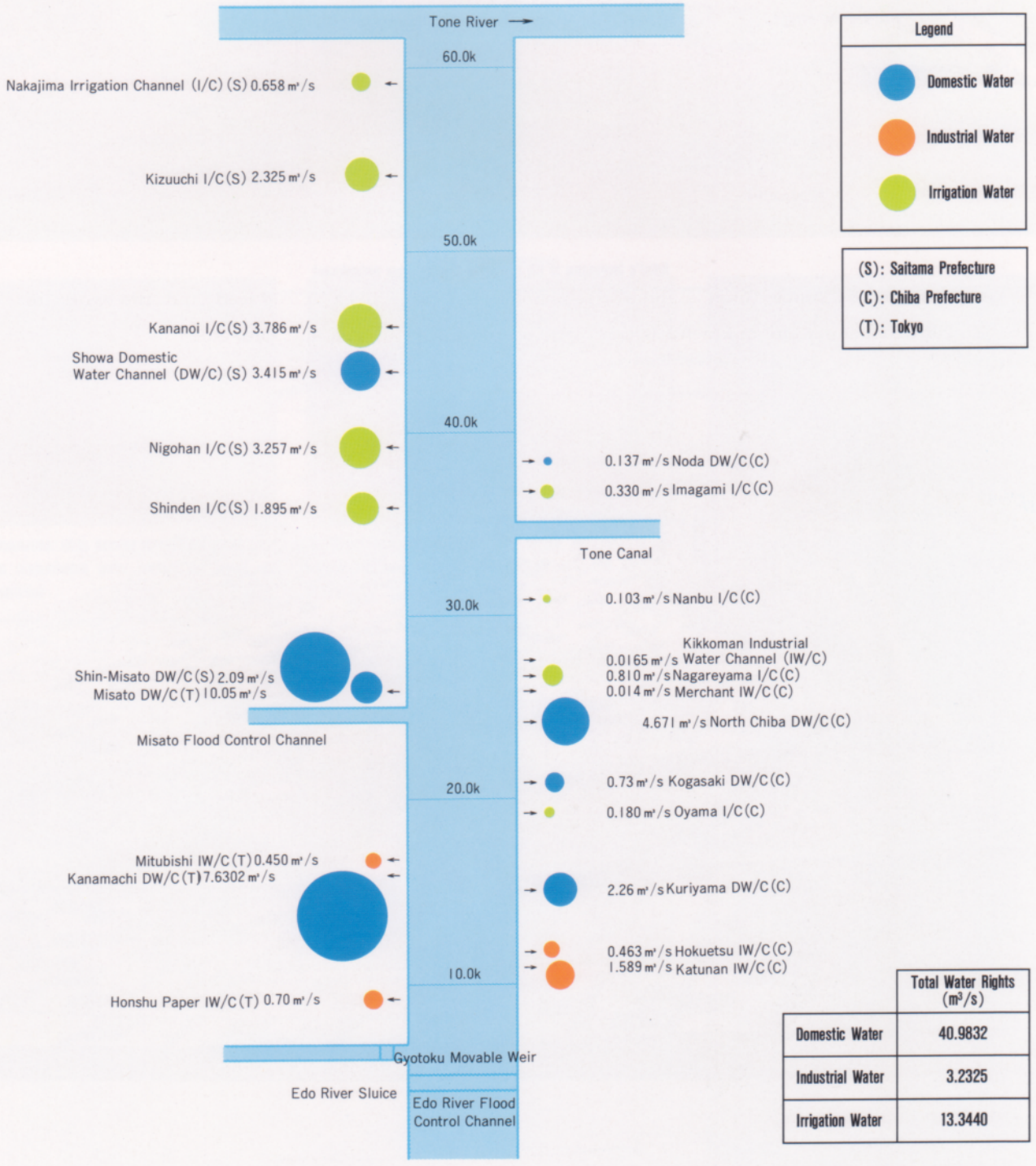


Edo River is an important water supply source, providing domestic water for some 7 million people as well as irrigation and industrial water. Its supply of domestic water accounts for more than one-third of the total supply for Tokyo, Chiba and Saitama, underlining its particular importance. With the coordinated operation of the Gyotoku Movable Weir and the Edo River Sluice, the upward flow of seawater is prevented and fresh river water is stored in the channel for stable supply. In addition, the water of Saka River, accounting for some 40% of the water inflow to Edo River, is treated by the Kogasaki Water Treatment Plant and a new channel to discharge the treated water downstream of the Kanamachi Purification Plant has been constructed to ensure the appropriate water quality of Edo River.

Inflow of contaminated water from tributaries Legend (survey by Edo River Works Office of the Ministry of Construction in 1990)



Schematic chart of water rights relating to Edo River

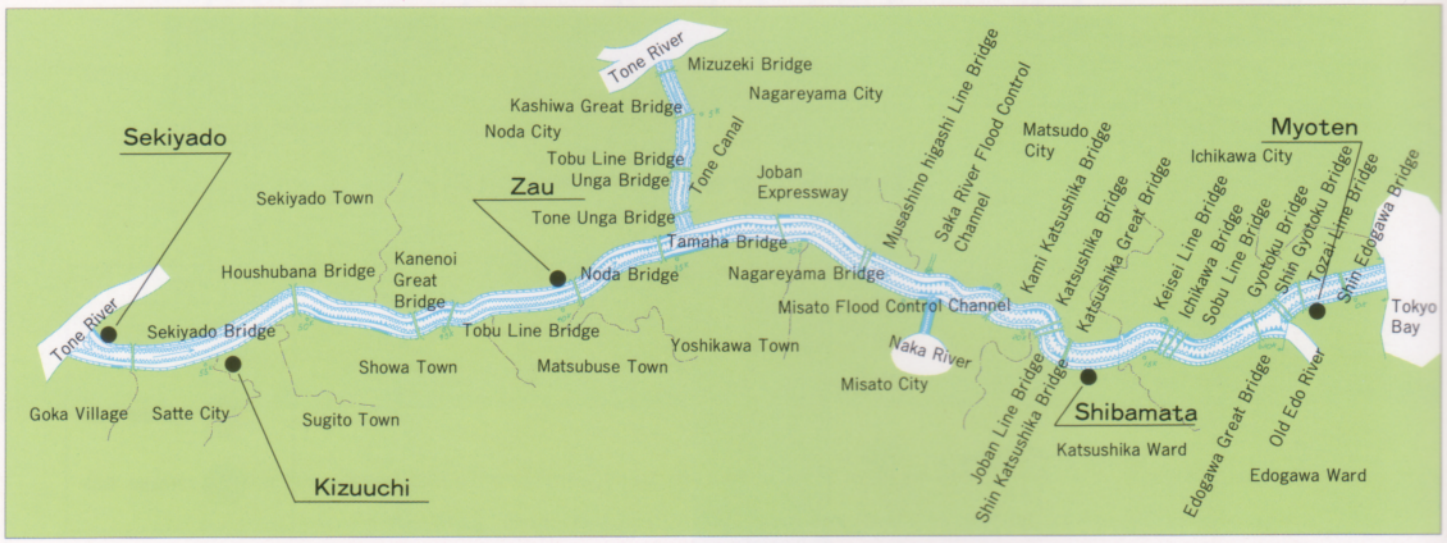


	Total Water Rights (m^3/s)
Domestic Water	40.9832
Industrial Water	3.2325
Irrigation Water	13.3440

Super Embankment

The crown of the super embankment is as wide as 300 m and forms a gentle slope towards the protected lowland. This super embankment eliminates local breaches of the embankment, creating very safe urban space where large-scale spread flooding will not occur.

Super Embankment Construction Sites



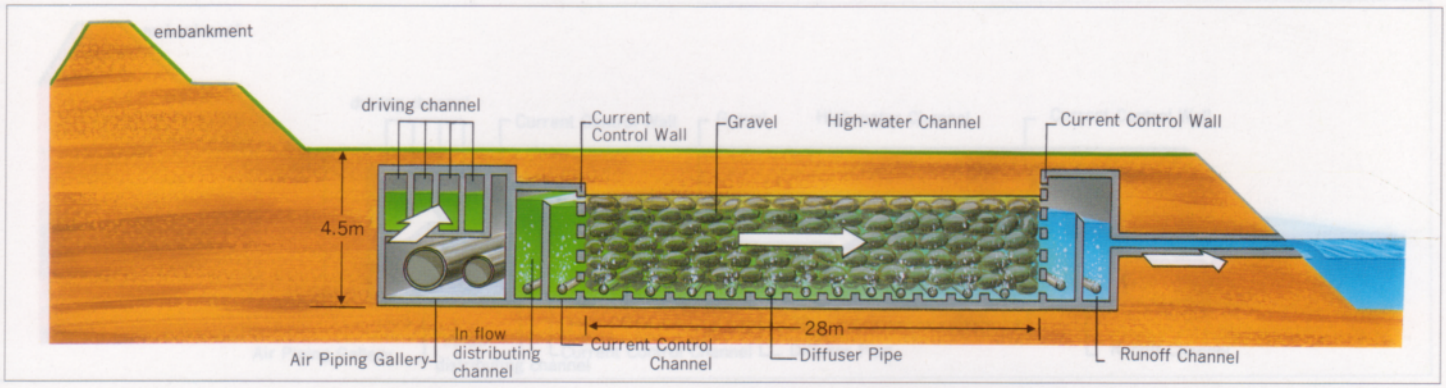
Artist's impression of the completed Myoten super embankment

River Water Conservation Channel/Kogasaki Water Treatment Plant

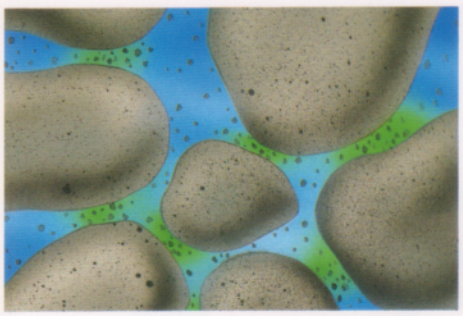
At present, the water quality of Edo River, an important source of domestic (drinking) water, is constantly threatened by the inflow of highly contaminated water from Saka River and the accidental discharge of harmful substances, etc. The construction of the Kogasaki Water Treatment Plant has assisted the purification of the contaminated water of Saka River. Moreover, the new river water conservation channel which discharges the treated water into Edo River downstream of the Kanamachi Water Treatment Plant ensures that the domestic water supplied from the Kanamachi Plant is of high quality.

Kogasaki Water Treatment Plant

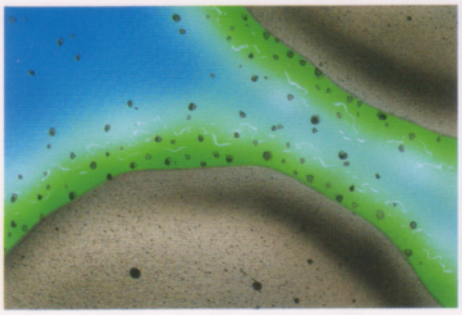
Cross-section of Kogasaki Water Treatment Plant (Operational since July, 1994 with a capacity of 1.0 m^3/s out of the planned total treatment capacity of 2.5 m^3/s)



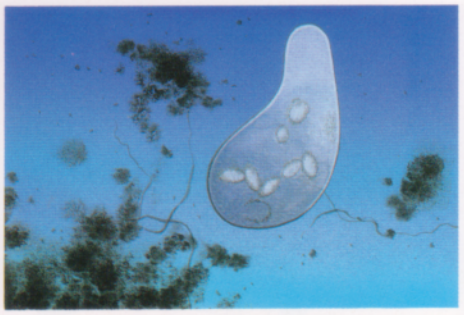
Water treatment system



(1) Contact sedimentation: while passing through the gravel layer, pollutants in the contaminated water contact the gravel and commence sedimentation

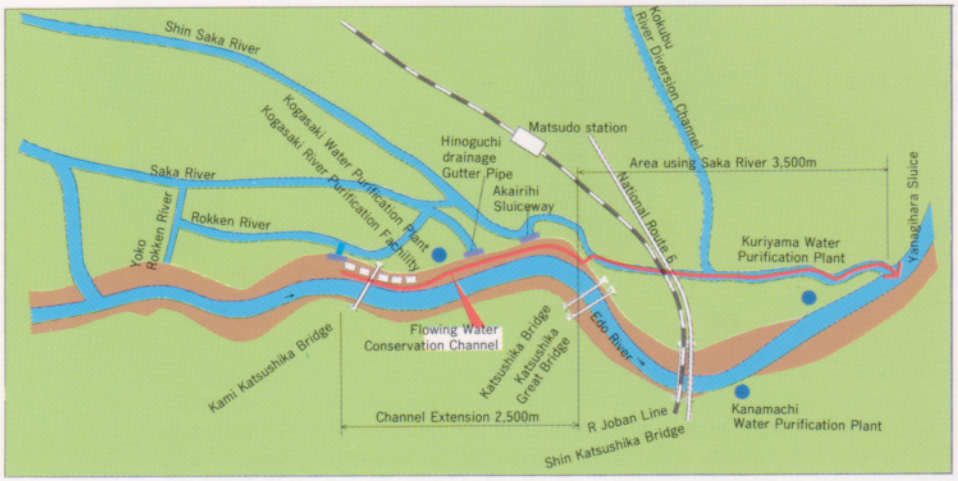


(2) Absorption: the pollutants are further absorbed by the contaminated gravel or cling to the sticky surface of the gravel in the water



(3) Oxidation and resolution: the microbes living on the surface of the gravel eat the accumulated pollutants which will finally be resolved into water and CO_2

River Water Conservation Channel Construction Project

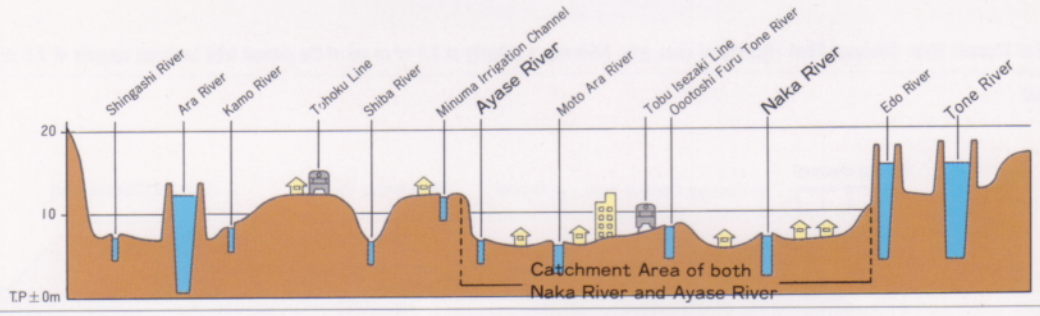


General Review of Naka River and Ayase River

Naka River originates in Hanyu City, Saitama Prefecture and is a Class 1 river with a length of some 82 km and a catchment area of approximately 1,000 km^2. It has such tributaries as Moto Ara River and Ayase River and runs through 2 wards, 18 cities, 11 towns and 2 villages, emptying into Tokyo Bay.

The Naka River Depression where the main part of the Naka River system is located has the lowest land area in the Kanto Plain. Both Naka River and Ayase River are characterised by the facts that they do not have a distinctive headwater area as such and that they only flow in the lowland.

Plate-like topographical cross-section of the catchment area being vulnerable to water accumulation



The catchment area of Naka River was subject to the process of early urbanisation in the region and the recent trend of industrial and population concentration in the Metropolitan Area has been making this catchment area even more congested.

State of Development in Catchment Area: Past, Present and Future

Ayase River is a primary tributary of Naka River. It originates in Okegawa City, Saitama Prefecture and some 80% of this 47 km long plain river flows through Saitama Prefecture. The river has a catchment area of approximately 178 km^2. It joins Old Ayase River in Soka City, Den-u River and Kenaga River at the border between Tokyo and Saitama Prefecture and finally Naka River in Katsushika Ward in Tokyo. The areas along its route in Tokyo are extremely congested with factories and housing, etc. while urbanisation is rapidly taking place in areas along its route in Saitama Prefecture due to the geographical proximity to the

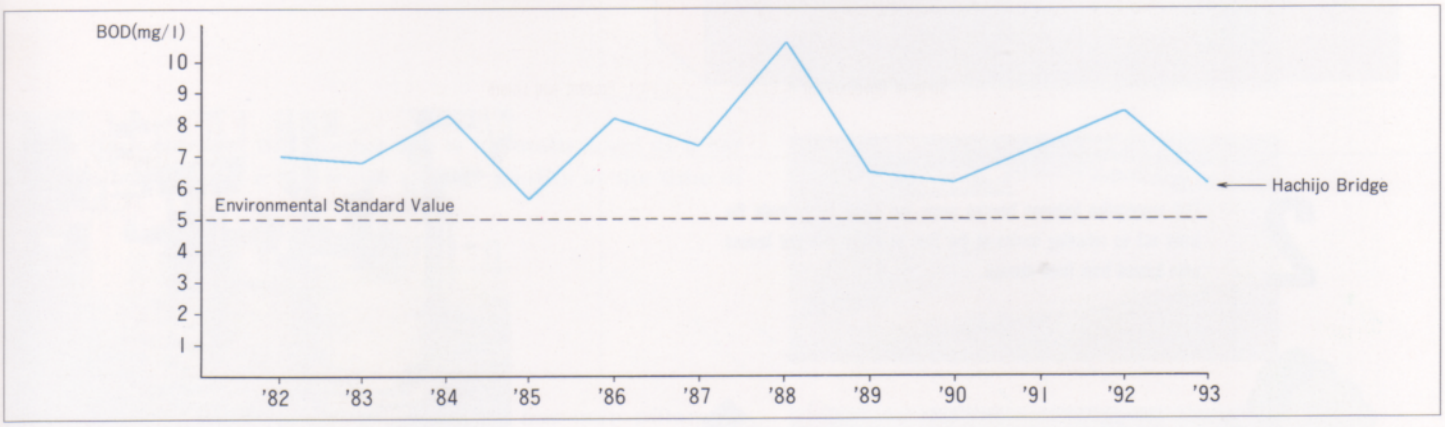
Metropolitan Area.

Because of the predominantly lowland nature of the catchment area of both Naka River and Ayase River, areas along the route have suffered from inundation inside the embankments several times in the past. The rapid urbanisation in more recent years has increased the vulnerability of these areas to flooding. In an attempt to improve the disaster prevention prospects, an integrated project is currently being implemented to combine conventional river channel improvement with the construction of river-side retarding basins and flood control channels. The implementation of river improvement work in harmony with urban development is the objective of this Integrated River Control Project in the Naka River and Ayase River Catchment Areas.

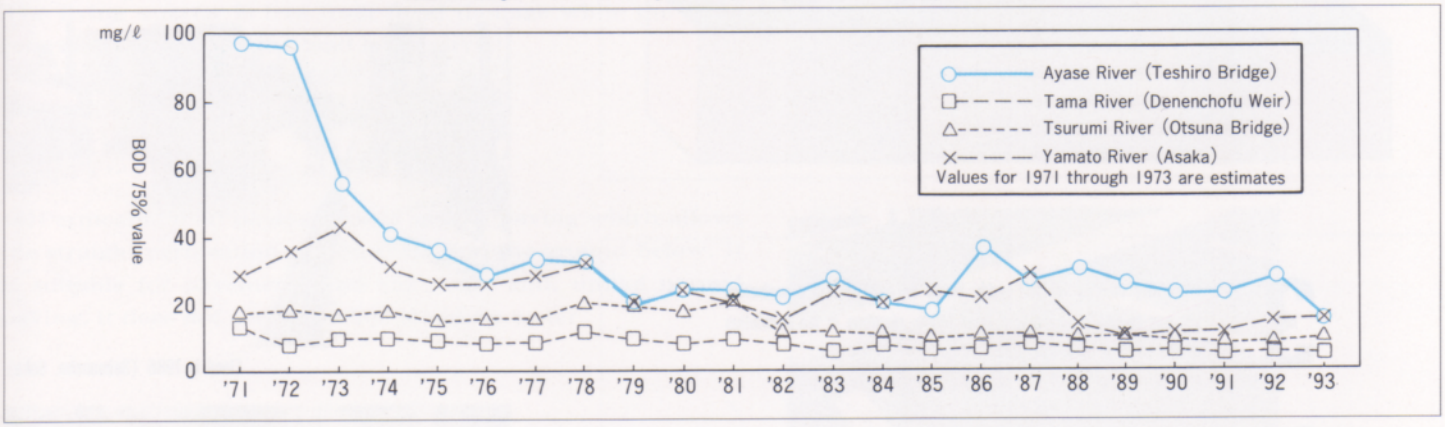
A fundamental measure to alleviate the almost chronic flood damage in areas along these two rivers is the construction of 2 large-scale flood control channels, i.e. the Ayase River Flood Control Channel designed to discharge some of the flood water from Ayase River to Naka River through an open channel and the Metropolitan Outer Ring Flood Control Channel designed to redirect some of the flood water from Tairaku Old Tone River, Kuramatsu River and Naka River to Edo River via a 10 m diameter underground channel constructed 50 m below the ground.

The water quality of Naka River, observed at its regular monitoring point at Hachijo Bridge, has been almost level since the commencement of monitoring in 1971. The highest BOD value ever of 10.6 mg/l was recorded in 1988 but which then declined to 6.1 mg/l in 1993 just above the environmental standard value (5.0 mg/l).

Historical changes of BOD value of Naka River (C type; 75% value)



Historical changes of BOD value of Ayase River and major urban rivers (C type; 75% value)

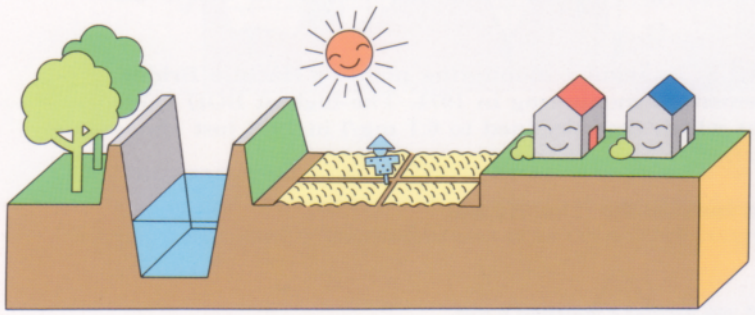


In the case of Ayase River, the construction of a sewer system in areas along its route could not keep pace with the rapid population increase and the resulting inflow of waste water pushed the BOD value up to almost 100 mg/l at Teshiro Bridge in 1971/72. The enforcement of the Water Pollution Prevention Law, extension of the sewer system and introduction of various measures to clean river water in subsequent years greatly reduced the pollution load and substantially improved the river water quality. In recent years, the BOD value has levelled at around 20 mg/l, one-fifth of the peak value. Despite such improvement, however, Ayase River has had the disgraceful record of being the worst river in terms of water quality among those directly controlled by the Ministry of Construction for 14 consecutive years since the introduction of the annual public announcement system for river water quality.

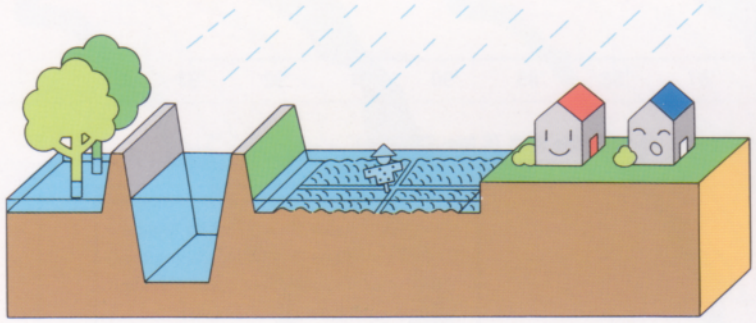
In the case of such urban rivers as Naka River and Ayase River of which the catchment area has been subject to intensive urban development, the construction of individual flood control facilities, including improved river courses, river-side retarding basins and flood control channels, etc., has been unable to accommodate the tremendously increased water inflow into the river system caused by rapid urbanisation in the catchment area, resulting in recurrent flooding in recent years. In order to to resolve this negative development in terms of flood control, the idea of a new measure was born to prevent or alleviate flood damage through a combination of implementing catchment basin improvement, including conservation of the water retaining and flood retarding functions to suppress the water outflow from the catchment area to the river system, and the construction of flood control facilities. This is called an integrated flood control measure.

Escalation of flood damage by banking

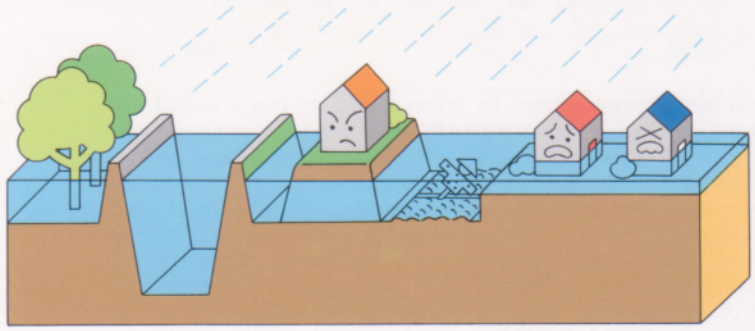
1 When the catchment area was not yet urbanised, houses were constructed on high land or natural embankments and lowland was used for paddy fields.



2 This segregation between housing areas and paddy fields made the latter act as retarding basins at the time of heavy rain and houses were spared from flood damage.



3 Disorderly banking on the paddy fields as part of the urbanisation process causes a rise of the flood stage, resulting in the inundation of the hitherto flood-free areas.



Flood in 1982 (Sakae-cho, Soka)

Flood in 1986 (Seimoncho, Soka)

Flood in September, 1991 (Matsue-cho, Soka)

Concrete examples of catchment area improvement measures

(1)School grounds storage: school grounds are designed to act as a storage to trap rainwater falling onto the ground

(2)Park storage: the grounds of a park are artificially lowered vis-a-vis the surrounding area to collect and store rainwater from the surrounding area at the time of heavy rain while serving as a park at other times

(3)Inter-building storage: the area between such high-rise public buildings as public apartment buildings is used to store rainwater

(4)Car park storage: the storage site is normally used as a car park while acting as a rainwater storage facility at the time of heavy rain

(5)Raised-floor building: the ground floor has only pillars as the first floor and subsequent floors are used as living space. The living quarter is free from flood damage while the flood retarding function of the land is preserved

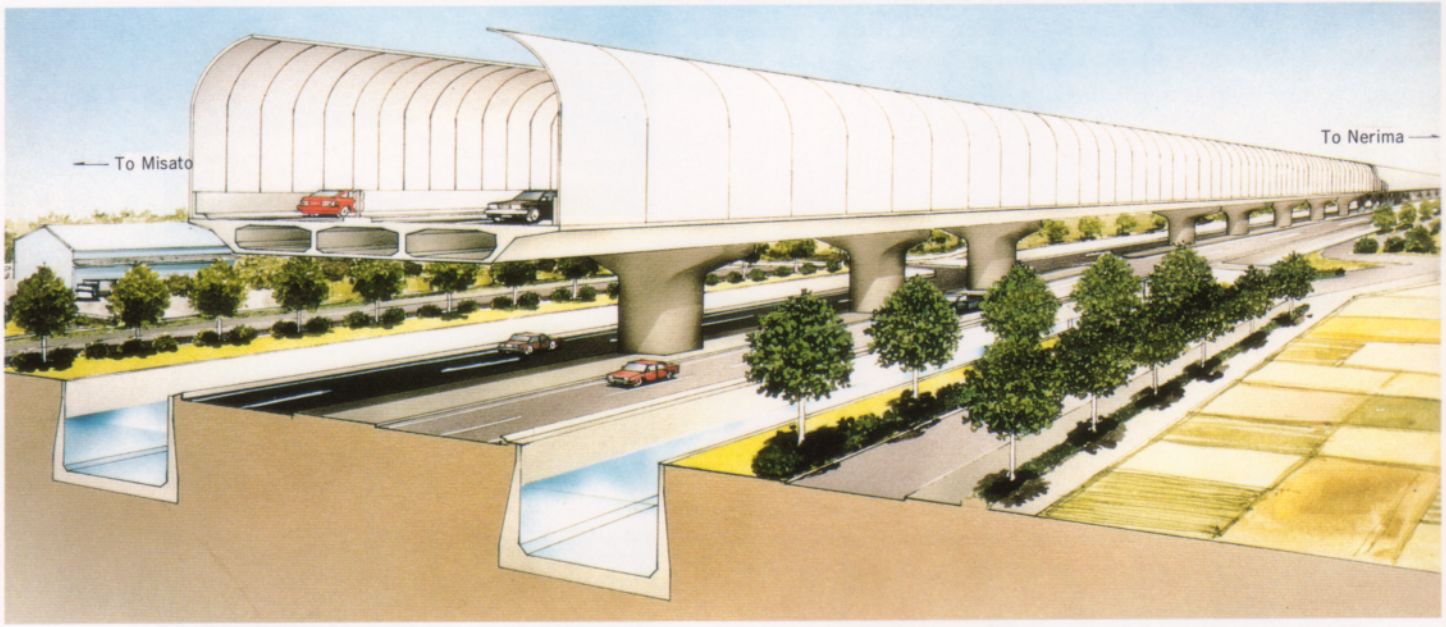
(6)Permeable road paving: this is special paving which allows the straight permeation of rainwater into the ground below. It is suitable for pavements and car parks and, unlike normal paving, it does not accommodate standing water

(7)Multi-purpose rainwater storage facility: a regulating basin is constructed as part of a development to serve multiple purposes, including the suppression of water outflow at the time of flooding. Here, the regulating basin is normally used as a tennis court

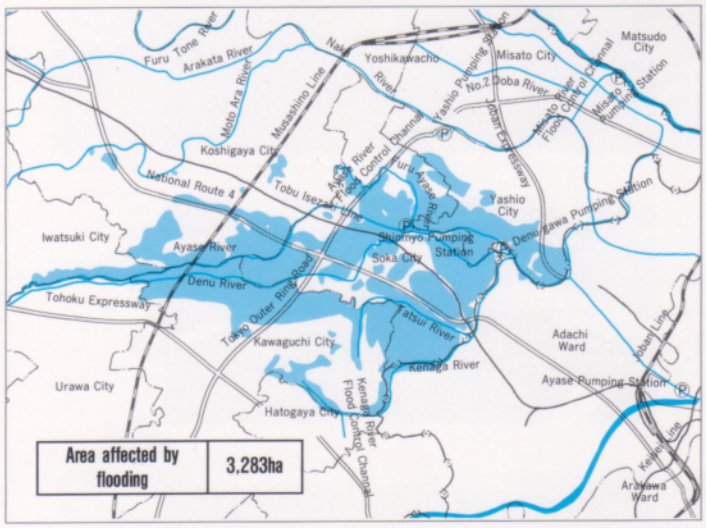
Ayase River Flood Control Channel

As the lower reaches of Ayase River are densely populated, it is extremely difficult to widen the embankments or to improve the river course. The construction of the Ayase River Flood Control Channel linking Ayase River and Naka River will enable the pumping of flood water from the middle reaches of Ayase River for its discharge to Naka River, improving the flood control prospect of the catchment area of Ayase River. In order to minimise the unwanted compartmentation of populated areas by this channel to ensure the maximum use of land and to create a pleasant environment, the route of the channel is mainly overlapping with the Tokyo Outer Ring Road.

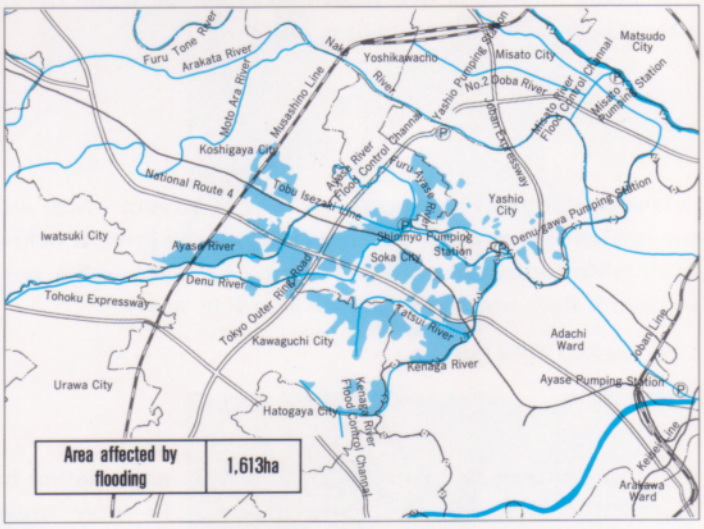
Artist's impression of the completed Ayase River Flood Control Channel



Area flooded by Typhoon No.18 in September, 1991



Area flooded by Typhoon No.11 in August, 1993



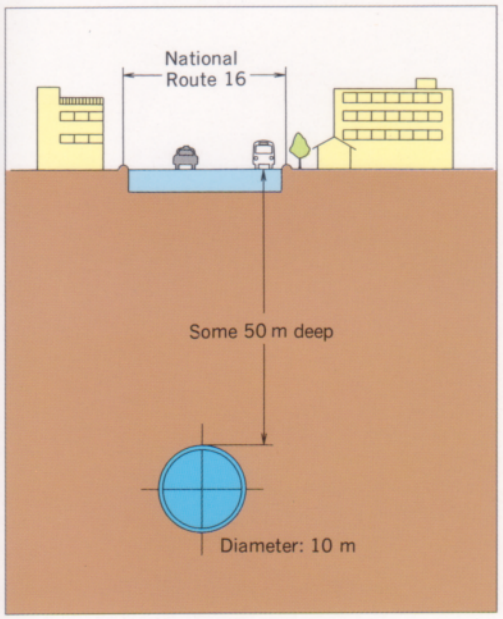
At the end of fiscal 1993, the pumping capacity of the Yashio Pumping Station was increased to 50 m^3/s. The current plan envisages the diversion of 100 m^3/s from the design flood discharge of Ayase River of 190 m^3/s to the channel with a total discharge to Naka River of 150 m^3/s, including the discharge of 50 m^3/s from Old Ayase River and the Hachijo Basin to the channel.

In the catchment area of Naka River, a rapid build up of population and assets is taking place in the flood-prone middle and upper reaches, following a similar build up in the lower reaches, as part of the sprawling process of the Metropolitan Area. As the ratio of urbanisation of 36% is still low in the belt-like zone between the 20 km and 40 km radii of central Tokyo, rapid development in this zone, to which the middle reaches of Naka River belong, is likely to occur in the near future with the improvement of the transport network and the implementation of an urban development plan.

The prospect of the further progress of urbanisation in the middles reaches of Naka River which suffer from frequent flooding makes improvement of the flood control system for Naka River extremely urgent. The Metropolitan Outer Ring Flood Control Channel is now planned as a fundamental answer to this pressing need together with conventional improvement involving phased river work commencing in the lower reaches. The construction of this channel is a major project referred to in the Mega City Law which is designed to provide high quality housing land and which is expected to have positive results as a matter of urgency.

In general, a flood control channel is constructed as an open channel like the Ayase River Flood Control Channel or as a subterranean channel like the Tokyo Underground Channel. Due to the strong urgency to achieve positive results, the Outer Ring Flood Control Channel Project should be implemented as soon as possible as a subterranean channel. This decision also takes the hydraulics and topographical conditions of the project areas into consideration. The channel will have a diameter of 10 m and will be constructed some 50 m below the ground while its 8.3 km section will have 5 vertical shafts.

Standard cross-section



Overall structure of pressurised flood control channel complex operation system

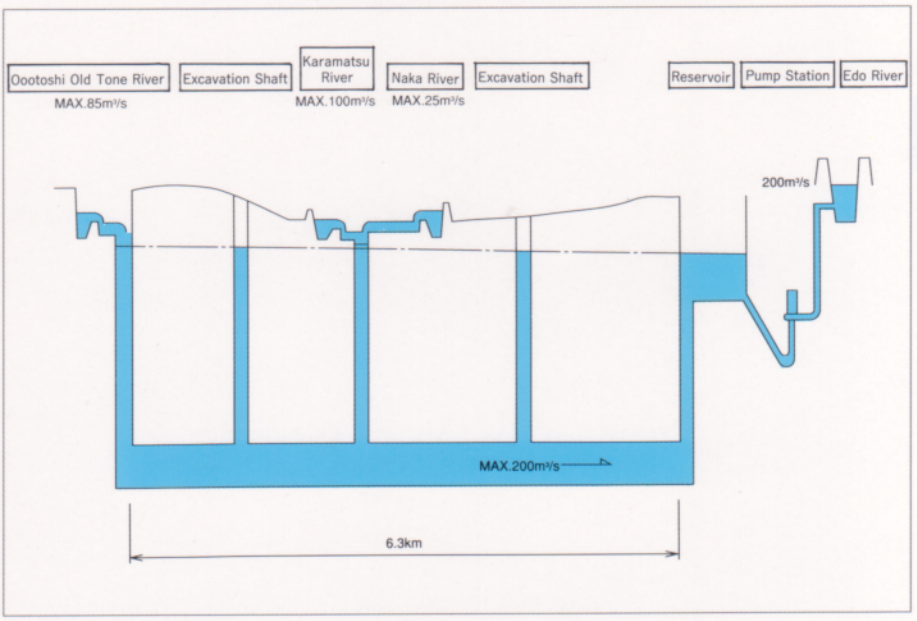
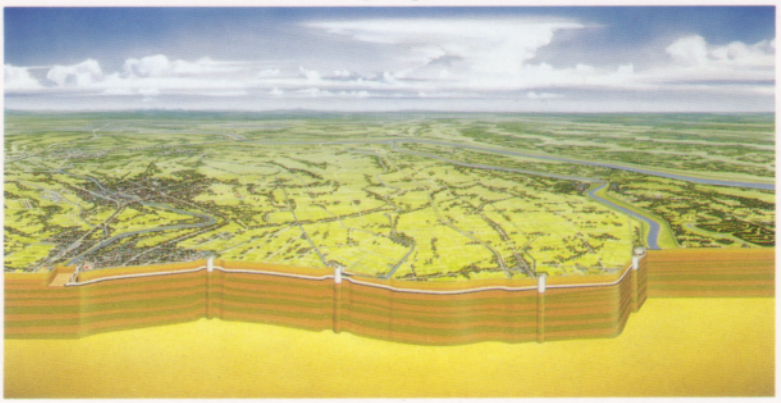


Image diagram



Edo River Construction Office of Kanto Local Construction Bureau
of the Ministry of Construction

Address: No.134, Miyazaki, Noda City, Chiba Prefecture, Japan 278
Phone Number: 0471-25-7317

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