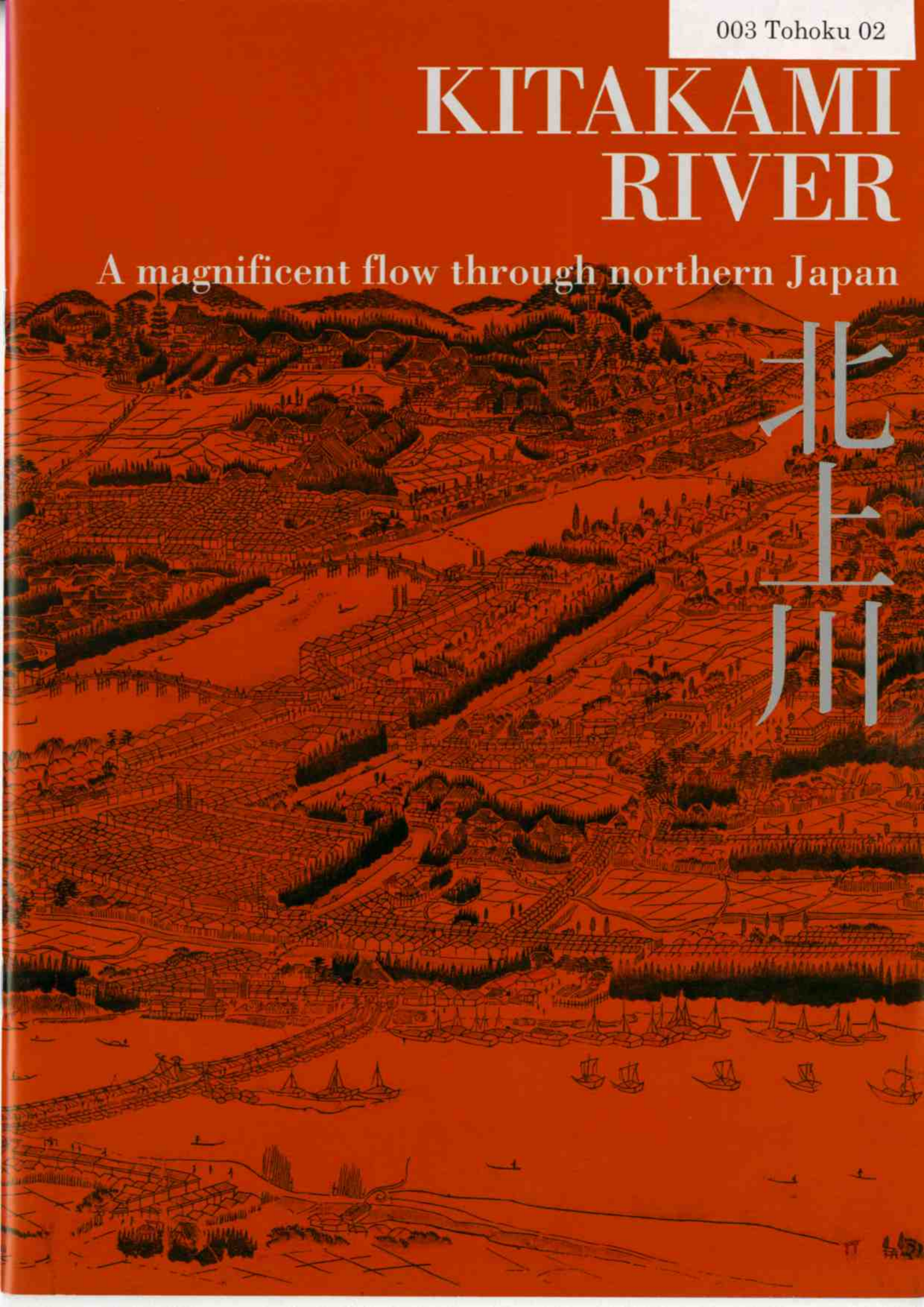
003 Tohoku 02

KITAKAMI RIVER

A magnificent flow through northern Japan

北上川



LANDSAT Image of Kitakami River basin
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D A T A

Length of the primary channel	249 kilometers
Area of the river basin	10,150 square kilometers
Number of tributaries	296
Number of communities in the basin	9cities,43towns,and 8villages
Basin population (approx.)	1.32 million people
Area of irrigated land (approx.)	2,209.2 square kilometers
Population density	130 people per square kilometer
Land composition	75%mountains areas, 22%flatland, and 3%river areas

KITAKAMI RIVER

The affluent flow of the Kitakami River

The Kitakami River is the largest river in the Tohoku region in the northern part of Honshu, the biggest of Japan's four main islands. The river begins its journey in Mido, which is located in Iwate Town in Iwate Prefecture. After some of its waters are diverted en route into the Old Kitakami River it pours into Oppa Bay in Miyagi Prefecture. Approximately 1.32 million people inhabit this river's basin.
Japan's central government began to exert full-fledged control over this part of the country during the Heian period (794 to 1191), as exemplified by the expedition that the military leader Tamuramaro Sakanoue led to this northern region. Before that expedition the basin of the Kitakami River was known as Hidakami-no-kuni (this place name was the origin of the Kitakami River's name). Many people were already living within the basin, and its land was quite extensively cultivated. The Tohoku Region's unique Oshu Fujiwara culture subsequently took shape through shipping activities that utilized the relatively stable flow of the Kitakami River as a means of transport. Chusonji Temple and Motsuji Temple are representative of the Oshu Fujiwara cultural sphere, which centered on Hiraizumi, a location that provided the most suitable base for transport by ship and was also a base for land routes extending further inland.
As this illustrates, the Kitakami River has had a long-standing heritage of being an integral part of the lives of the river basin's residents while linking areas within the basin and nurturing its culture and history.
The basin of the Kitakami River, a location known for its abundant water, was transformed into a farm belt in the Edo period (1603 to 1867). Waterways were built to serve as major aquatic transport arteries, and boats carried locally harvested rice downstream, transporting it to Edo (present-day Tokyo), the nation's capital.
Today, urban planning and civic activities focused on such themes as water, rivers, and the environment flourish along the Kitakami River. People from all walks of life are creating a new civil society as they interact and forge ties with each other. Through this pamphlet, the past and present of the entire basin of the Kitakami River are re-examined in a quest to identify a vision for the basin that will serve to create new ties between the river and the surrounding area.

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Topography and the river channel

Flowing gently between mountain districts and then through plains

The Kitakami River, a river flowing between two mountain districts

The basin of the Kitakami River is akin to a long, narrow, north-south rectangle with two mountain districts extending along its eastern and western edges. To the east lies the Kitakami mountain district, which slopes gently from the center to peripheral areas. To the west lies the Ohu mountain range, whose precipitous contours consist of towering peaks at altitudes ranging from 1,500 to 2,000 meters. Among them are such volcanic peaks as Mt. Iwate, Mt. Komagatake, Mt. Kurikomadake, and Mt. Yakeishidake and Hachimantai. As a result, volcanic residue lies scattered over a broad area, and the production of dirt and sand due to weathering and the desolation of this area's geologically fragile terrain is pronounced. Tributaries flowing out of the Kitakami mountain district and the Ohu mountain range merge at many junctures and have a great impact on the flow of the main Kitakami River.

The individually distinctive topography of the river basin's upstream, midstream, and downstream areas

Upstream, the river basin is characterized by the presence of Mt. Iwate and many other young volcanoes. Volcanic contours are still clearly visible at the crests of these peaks, while the landscape at the base of these mountains has become rugged due to deep erosion and is in the immature terms.

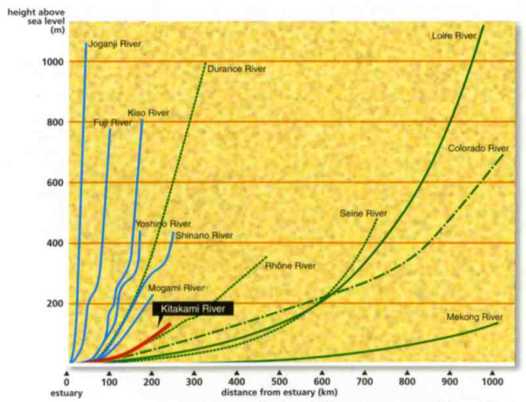
Midstream, the area between the Kitakami mountain district and the Ohu mountain range forms a basin. A large fan-shaped area extends from the Ohu mountain range to the Kitakami River. Although there are not any striking volcanoes visible in the vicinity, progressive valley weathering has produced a rugged landscape. Low peaks at altitudes of about 150 to 200 meters hang over both banks of the Kitakami River along a 28-kilometer segment stretching downstream from Kozenji in Ichinoseki City in the southern part of Iwate Prefecture. The river is narrow in this segment, where it is constricted to a width of about 100 meters. This bottleneck area is the primary cause of flood damage in Ichinoseki City.

Downstream, the river basin becomes a sweeping alluvial plain. The landscape, which was once a low, swampy zone is smooth, with virtually no difference in height. Two Old Kitakami River tributaries, the Hasama River and the Eai River, form a fan-shaped area on the western side of this plain.

A relatively gentle slope compared with other rivers in Japan

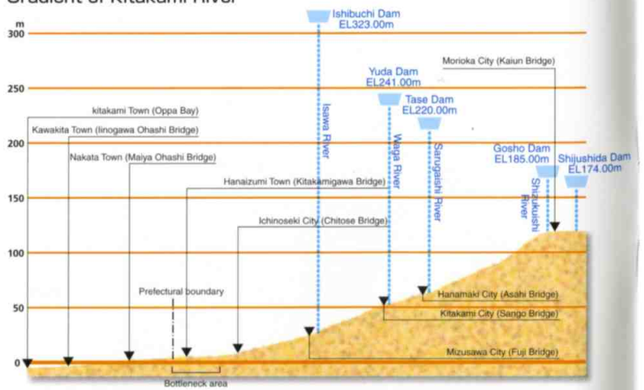
The Kitakami River is distinguished by the fact that it has a relatively gentle gradient compared with other rivers in Japan. There is a difference in the gradient of the riverbed in the river's upper and lower reaches, with the bottleneck section near Kozenji in Ichinoseki City as the boundary between the two. For the portion that is upstream from Shiwa Bridge in Shiwa Town, which is along the river's upper reaches in Iwate Prefecture, the gradient ranges from 1/600 to 1/800. The incline for the segment from Shiwa Bridge to Oomagari Bridge is approximately 1/1,000, and that in the vicinity of the bottleneck area is about 1/1,200 to 1/1,300. The length of the Kitakami River from this constricted area to the river's estuary is approximately 80 kilometers. The difference in height amounts to no more than a dozen or so meters along this stretch. The river's flow is gentle here, with a slope ranging from 1/8,000 to 1/10,000. Water damage has long plagued this area, since water is unable to drain away when the level of the Kitakami River rises at floodtime.

River gradient in the world



(Source: Kitakami River Downstream Work Office)

Gradient of Kitakami River



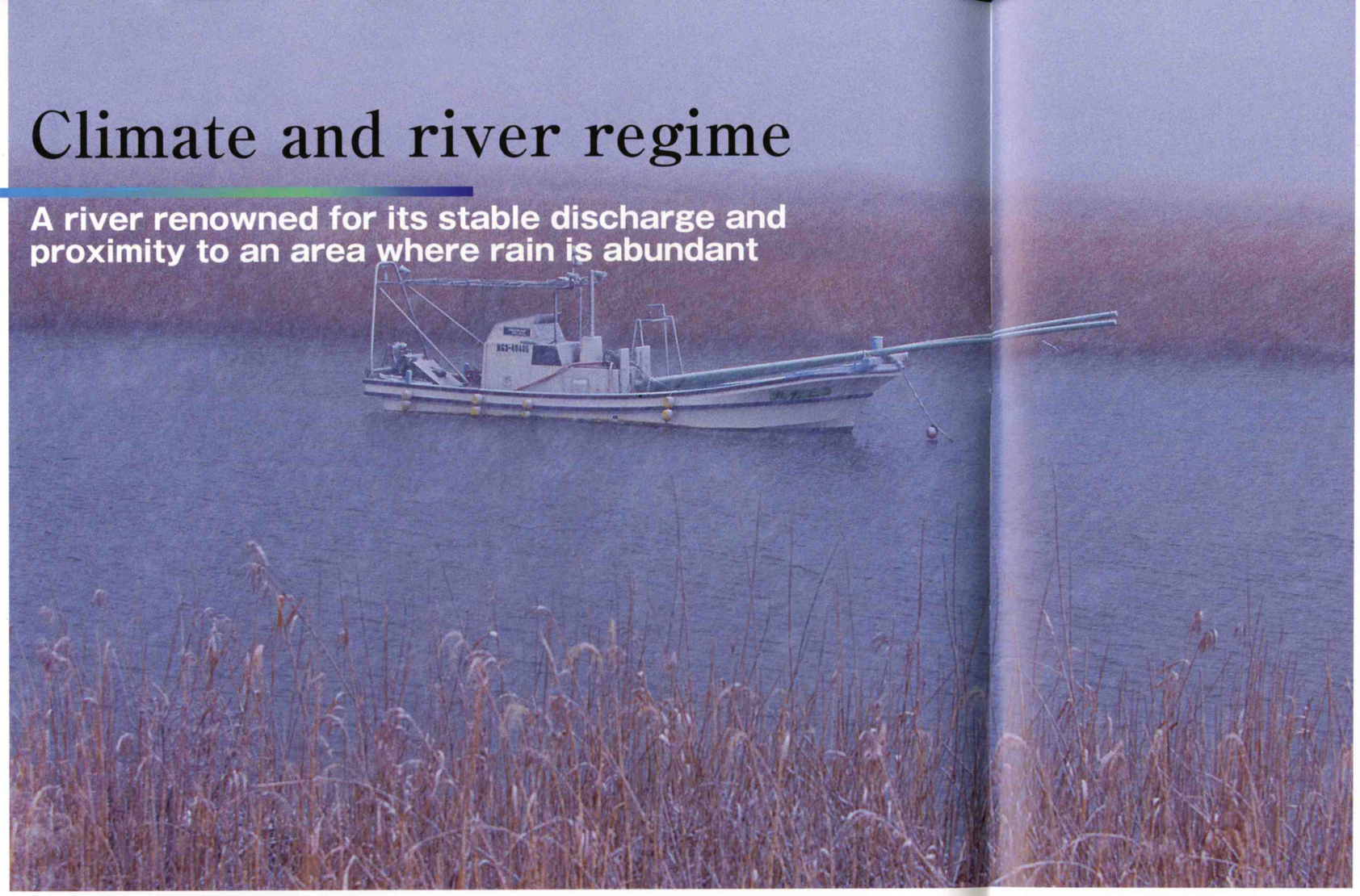
(Source: Kitakami River Integrated Dam Management Office)

River basin

Image of bottleneck area from the upper stream (H:V=1:3)

Climate and river regime

A river renowned for its stable discharge and proximity to an area where rain is abundant



Snowy Day (Kitakami River), photo by Tsuyoshi Kajiwara

Two climates: inland and Pacific Coast

The upstream and midstream areas, where the Kitakami River is surrounded by the Kitakami mountain district and the Ohu mountain range, has a basin-type or inland climate that is characterized by significant temperature variations, both on a daily basis and during the year. A Pacific Coast climate, which is mild compared with the climate upstream and midstream, prevails downstream (in Miyagi Prefecture).

The Ohu mountain range, an area with an abundant rainfall

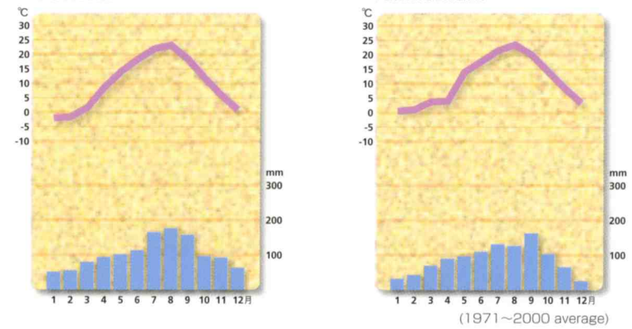
The annual rainfall of the basin of the Kitakami River is about 1,500 millimeters, an amount that is slightly less than the nationwide average of 1,718 millimeters. But the area at the base of the Ohu mountain range receives abundant precipitation (including snow), and there are parts of it where the average annual amount exceeds 2,000 millimeters. The basin's flatlands and the Kitakami mountain district receive average annual precipitation of about 1,000 to 1,300 millimeters. On a monthly basis, the amount of rain increases in July, August, and September. Moreover, the area bordering the Ohu mountain range in Iwate Prefecture is a heavy snowfall district where snow accumulates to a depth of 2 meters or more.

Stable river regime

The discharge of both the main Kitakami River and the Eai River, one of its tributaries, decreases in January and February as snow accumulates. It then increases as this snow starts to melt in late March and on into April. The discharge remains roughly the same moving into July through September, though precipitation from typhoons and so forth in September tends to produce an increase in the average discharge. The average annual discharge at Toyoma in the river's lower reaches in Miyagi Prefecture (a basin area of 7,868.4km^2) is 317.61m^3/s.

Due to various factors, the flow conditions of Japanese rivers are unstable compared with those of rivers in Europe and North America. One reason for this is the large volume of rain that Japan receives during the rainy season and the typhoon season. Another is the fact that steep riverbed slopes cause Japanese rivers to flow swiftly. However, the Kitakami River's river regime coefficient (the ratio of its maximum to minimum discharge) is less than those of other rivers in the country, and its river regime can be described as relatively stable.

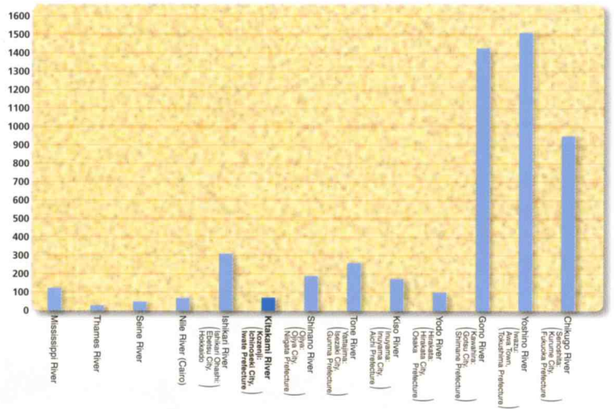
Monthly average temperature and precipitation



(1971~2000 average)

(Source: Association for Conservation of Kitakami River)

Comparison of river regime in the world

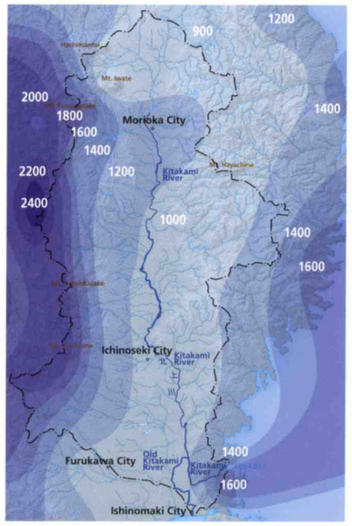


(Source: Association for Conservation of Kitakami River)

Annual average discharges at principal points along Kitakami River

observation spot	annual average water discharge (m^3/sec.)
Meiji Bridge (Morioka City, Iwate Prefecture)	88.83
Kozenji (Ichinoseki City, Iwate Prefecture)	300.57
Tome (Toyoma Town, Miyagi Prefecture)	317.61

(Source: Kitakami River Downstream Work Office)



(1979~2000 average)

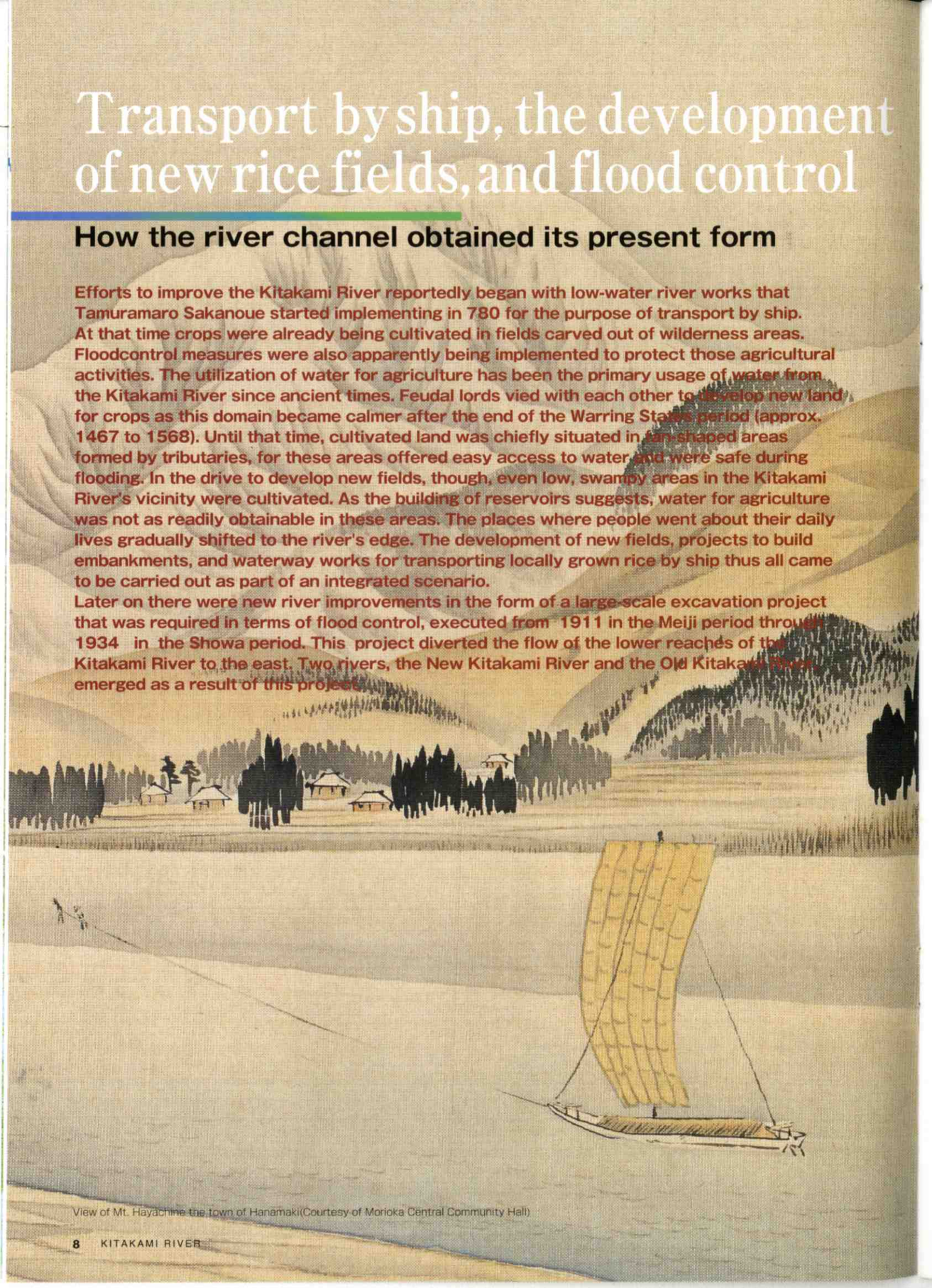
(Source: K Weather Data Limited company)

Distribution of annual precipitation in Kitakami River basin(mm/year)

Transport by ship, the development of new rice fields, and flood control

How the river channel obtained its present form

Efforts to improve the Kitakami River reportedly began with low-water river works that Tamuramaro Sakanoue started implementing in 780 for the purpose of transport by ship. At that time crops were already being cultivated in fields carved out of wilderness areas. Floodcontrol measures were also apparently being implemented to protect those agricultural activities. The utilization of water for agriculture has been the primary usage of water from the Kitakami River since ancient times. Feudal lords vied with each other to develop new land for crops as this domain became calmer after the end of the Warring States period (approx. 1467 to 1568). Until that time, cultivated land was chiefly situated in fan-shaped areas formed by tributaries, for these areas offered easy access to water and were safe during flooding. In the drive to develop new fields, though, even low, swampy areas in the Kitakami River's vicinity were cultivated. As the building of reservoirs suggests, water for agriculture was not as readily obtainable in these areas. The places where people went about their daily lives gradually shifted to the river's edge. The development of new fields, projects to build embankments, and waterway works for transporting locally grown rice by ship thus all came to be carried out as part of an integrated scenario.
Later on there were new river improvements in the form of a large-scale excavation project that was required in terms of flood control, executed from 1911 in the Meiji period through 1934 in the Showa period. This project diverted the flow of the lower reaches of the Kitakami River to the east. Two rivers, the New Kitakami River and the Old Kitakami River, emerged as a result of this project.



View of Mt. Hayachine the town of Hanamaki(Courtesy of Morioka Central Community Hall)

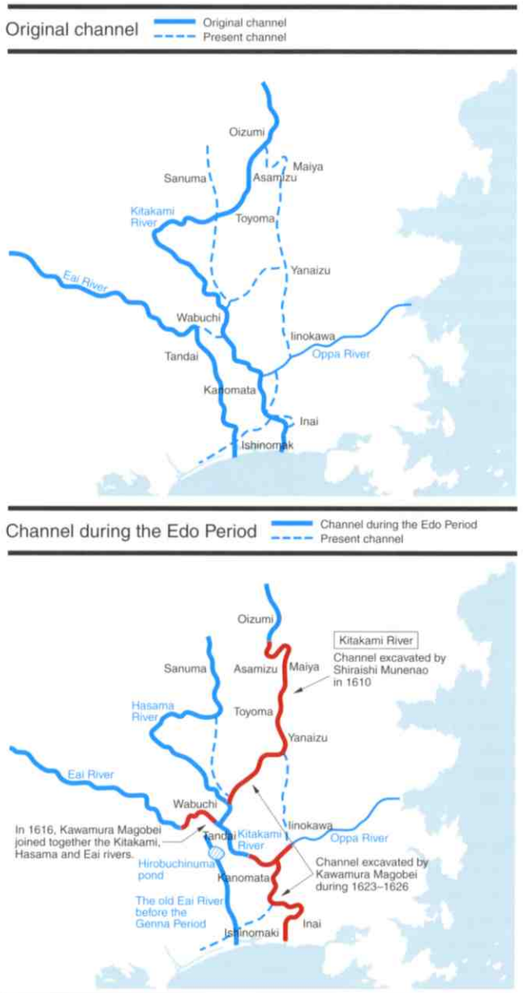
Edo period (1603 to 1867)

Masamune Date's development of new fields and provision of a waterway for transport by ship

Work to improve the lower reaches of the Kitakami River was carried out during the Edo period. These river improvements were primarily for the purpose of the provision of a waterway for transport by ship and the development of new fields. They were implemented on the basis of a concept that daimyo (Japanese feudal lord) Masamune Date had formulated for the management of his domain.

First, Munenao Date, Masamune's vassal, set out to create a castle town and develop new fields after he became lord of Toyoma Castle. He therefore directed the water of Kitakami River into the channel of the Futamata River, with Mizukoshi Nakada Town as the cut-off point, in 1610. Masamune then took steps to establish a base for clan finances through the collection of rice in Ishinomaki and its transport to Edo. He did this by ordering Magobei Kawamura to undertake the provision of an inland waterway network centering on Ishinomaki at the river's estuary. Magobei orchestrated a major project that combined three rivers: the Eai, Hasama, and Kitakami rivers. He first excavated the isthmus at Tandai and joined the Eai River, which flowed along the course of the present-day Joh River, with the Hasama River in 1616. He then cut through the isthmus at Mt. Kandori and diverted the Kitakami River in 1626.

Relocation process of the downstream channel of Kitakami River



(Source: Kitakami River Downstream Work Office)

River improvements by the Nanbu clan

The Nanbu clan began to construct a castle town after relocating the residence of the clan's lord to Morioka. The site for building the castle was the point where three rivers, the Kitakami, Nakatsu, and Shizukuishi, converged. Construction at the site, a granite plateau, was presumably extraordinarily difficult. Even after the completion of Morioka Castle, the Kitakami River flowed in a way that vigorously washed against the castle's southwest corner. This pounding caused the castle walls and stone barriers to collapse a little more each year. The Nanbu clan therefore embarked on a new river excavation project in 1673 to replace the channel of the Kitakami River. Over a span of two years the clan made improvements that gave the river channel its present form. The clan also carried out another project: replacing the channel of the Kitakami River at the base of Hanamaki Castle.

A flurry of activity upon the completion of a ship transport waterway

A ship transport waterway from Ishinomaki to Morioka was completed in accordance with Masamune Date's concept. Riverbank facilities were then erected at key points as bases for ship transport. Many of these riverbank facilities were bases for shipping nobosemai, rice that was collected as a land tax and sent to Edo, the capital. Storehouses called okura were erected near these riverbanks. Boats known as hiratabune, each capable of carrying a load of 350 to 450 straw bags of rice, traveled the 148 kilometers between Ishinomaki and Kurosawajiri (present-day Kitakami City). The upstream journey took 10 days, while the downstream trip required 3. Other vessels, oguribune, which were capable of carrying 100 to 120 straw bags of rice, plied between Kurosawajiri and Morioka. They covered this 52-kilometer stretch in 4 days when traveling upstream and in half a day when moving downstream. Rice that was sent to Edo in this way reportedly accounted for two-thirds of the capital's rice when this supply route was at its peak.

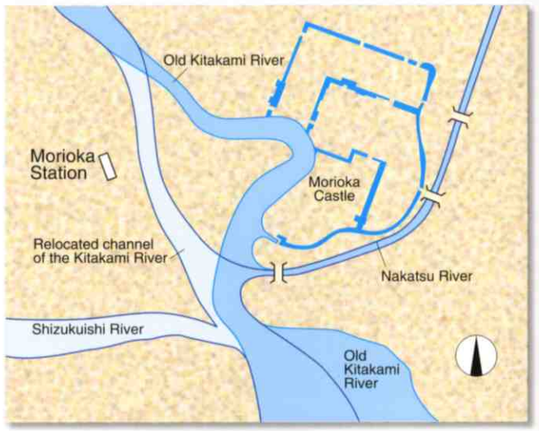
The development of new fields and Juan Canal

The creation of a ship transport waterway and the development of new fields were carried out in parallel in the early Edo period. The development of new fields prompted the construction of canals to provide water for agriculture. Juan Canal is one example of the many canals that were erected in tributaries flowing through the basin of the Kitakami River.

Juan Goto, the lord of a small castle in Fukuhara Mizusawa City, built Juan Canal in the early Edo period. He did this by cutting through Isawa Plain in 1618. It is said that Juan, who was a Christian, accomplished this undertaking by making full use of all information that he obtained. Employing methods learned from foreign missionaries, he utilized large stone materials and invented a new type of apparatus, a machine for piling up boulders. He reportedly used this machine to erect sturdy stone walls along both sides of the canal. Unfortunately, structures that would serve as evidence of his endeavor can no longer be found today.

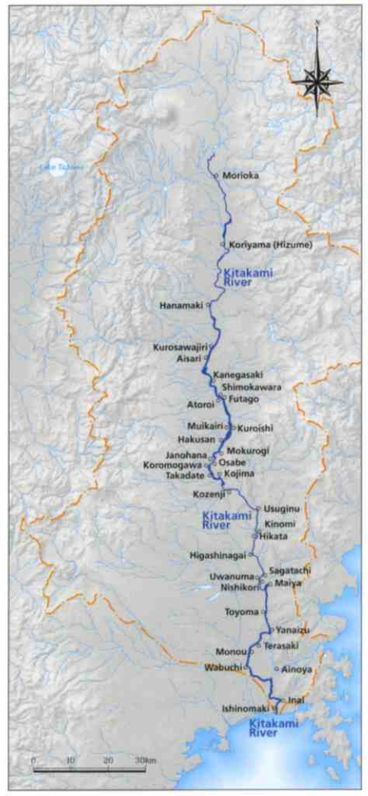
Cylindrical water distribution facility built in 1957 to resolve water disputes involving the Juan and Shigeira weirs. The water is distributed equally by this facility.

The history of channel relocation in the Morioka area



Illustrated by Yoshiaki Yoshida

River ports along Kitakami River



(Source: Iwate Work Office)

Meiji period (1868 to 1911)

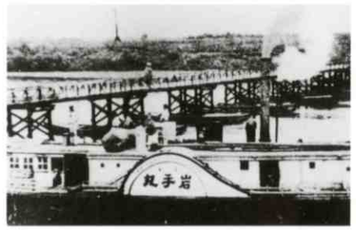
The emergence of the Old Kitakami River and the New Kitakami River

The modernization of the nation of Japan began in the Meiji period. Rivers were utilized as the preferred transport route until railway service became available. Kitakami River works under the direct control of the government began in 1880. This initial construction, which continued until 1902, involved low-water river works, with an emphasis on waterway improvement for the segment between Morioka and the Kitakami River's estuary at Ishinomaki.

Phase I of the Kitakami River Improvement Works, which covered the lower reaches of the river (in Miyagi Prefecture), was begun in 1911 as a full-fledged river improvement initiative aimed at fortification against floods. Prompted by flooding in 1910, Phase I of the Kitakami River Improvement Works set the design flood discharge at Yanaizu at 5,570 m^3/s. A new channel was to be excavated between Yanaizu and Iinogawa. With this new channel serving as the main river, a river discharge of 4,730 m^3/s would then be routed downstream through the Oppa River and into Oppa Bay. The plan entailed erecting Iinogawa Weir, a movable weir, in the New Kitakami River to divert normal flow, and constructing Tokinami Weir and Wakiya Weir, both overflow weirs, in the Old Kitakami River to divert 840m^3/s of water at times of flooding. Construction work based on this plan began in 1911 and continued until 1934. This 24-year endeavor led to the emergence of two flows, the New Kitakami River and the Old Kitakami River, and resulted in the creation of the present-day form of the river channel.

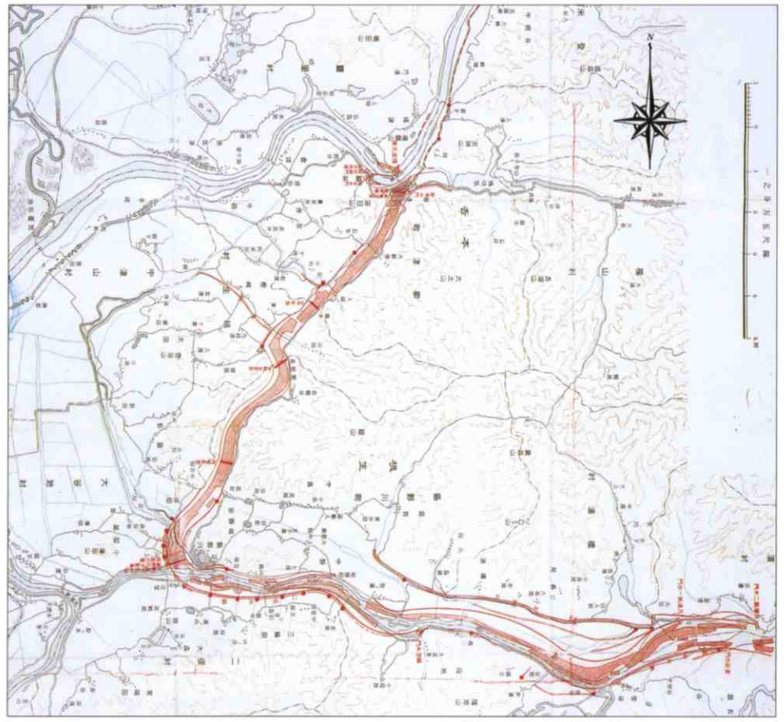
Improvements initially aimed at transport by ship

Transport by ship was the objective of initial endeavors to improve the Kitakami River. At that time transport along the river was shifting away from the practice of using traditional Japanese vessels, which were small boats. Newly built Western-style steamships were starting to be used to navigate the river between its estuary at Ishinomaki and Kozenji. Shipping companies were established, and they competed for both passengers and cargo. There was consequently an additional need to boost the transport capacity along the upper reaches of the river in Iwate Prefecture by widening the waterway from Kozenji upstream to Morioka. Although these river improvements were effective, transport by ship along the Kitakami River gradually declined with the opening of railway service in 1890.



Western-style steamboat (Iwate-maru)
(Source: Kitakami River Downstream Work Office)

Plan of the improvement of Kitakami River



(Source: Kitakami River Downstream Work Office)

The history of flood damage

Numerous instances of flood damage that caused people to suffer

A river basin characterized by frequent flooding

The availability of records dating back to the start of the Edo period in 1603 is relatively good. These records show that the basin of the Kitakami River has experienced flooding on 334 occasions during the approximately 400 years between then and now. In other words, the frequency of flood damage has been once every 1.2 years. There were 213 instances of flooding during the approximately 270 years of the Edo period. Records also indicate flooding occurred 116 times during the 93 years between the start of the Meiji period (in 1868) and 1960. Since then, though, there has been an abrupt decline, partially because of the fact that efforts to reduce damage caused by floods have progressed.

Most of the places where flooding occurs are situated along the midstream portion of the Kitakami River, that is, the segment upstream from the area where the river's flow is constricted. Locations in the Isawa River's fan-shaped area and the Esashi region, as well as other areas in the basin of the main Kitakami River and in the basins of the Isawa and Hitokabe rivers, come next. They are followed by places along the lower reaches of the Kitakami River in Miyagi Prefecture. Various sayings can be heard along this downstream segment. For instance, Monou Town's residents say, "Here in May, gone in September," while people in Kahoku Town say, "One good harvest every three years." In the first case, although rice is planted in the spring, there is not any rice to harvest in September because of flood damage. In the second instance, people are content if there is one decent harvest every three years. As the existence of these sayings suggests, these places are locations that have been beset by chronic flood damage.

Three points can be made with respect to the nature of damage caused by flooding in the basin of the Kitakami River. First, this flooding causes extensive damage when embankments collapse. Second, the flooding of the main Kitakami River causes water to back up into its tributaries, or the water in the tributaries cannot drain away. Third, swollen rivers take a long-time to drain, and this greatly impact crops.

Damage caused by Typhoon Kathleen (1947) and Ion (1948) at city of Ichinoseki

Major flooding that has caused extensive damage in the river basin

(1) August and September of 1910

Two typhoons approached in August as a stationary front hovered. This resulted in powerful storms and heavy rain that continued for days in the basin of the Kitakami River. Damage was particularly severe in Miyagi Prefecture, where 320 people died and 357 dwellings were washed away. The Eai, Kitakami, and Yoshida rivers experienced extensive flooding again in September because of a typhoon and a front. On top of that, in the northwestern part of Iwate Prefecture, which was at the center of the rain-struck area, Morioka City incurred heavy losses when the Nakatsu River overflowed. This flooding prompted the Meiji government to launch the Kitakami River Improvement Works.

(2) Typhoon Catherine, September 1947

Due to the impact of low atmospheric pressure extending from the sea off the coast of Akita Prefecture to the central part of the island of Hokkaido, a typhoon headed northward at a time when rain had been falling continuously since June or so. A warm front subsequently grew stronger, and this caused a heavy downpour starting on Sept. 15. The deluge resulted in precipitation levels of 200 millimeters or more from Sept. 12 to 15 in locations throughout the area, with the greatest amount, 429.6 millimeters, falling on Mt. Iwate. There was massive overflowing of river water, primarily in Ichinoseki City, where the water level recorded at Kozenji reached 16.89 meters (an alert is issued when the water level hits 7.0 meters) as unprecedented flooding occurred. In Miyagi Prefecture, three towns and five villages were inundated by muddy water and sustained major damage when 250 meters of the Oizumi Embankment collapsed in Nakada Town. The number of people who were killed or injured along the main Kitakami River and its tributaries totaled 109, and 293 dwellings were washed away.

(3) Typhoon Ion, September 1948

In September of the following year, Typhoon Ion, which was even larger than Typhoon Catherine, struck when efforts to recover from Catherine had still not been adequately completed. Heavy rain from Typhoon Ion fell in a swath extending from Miyagi Prefecture into Iwate Prefecture, where Ichinoseki City suffered exceptionally severe damage. The level of the water in the Iwai River, a tributary of the Kitakami River, rose six meters in two hours. More than 500 human lives and 1,000 dwellings were lost when the Iwai River sent a torrent of rocks and mud into Ichinoseki's streets. The muddy flow reached a height of 2.5 meters above floor level, and the water that had accumulated did not recede until 28 hours later. Meanwhile, along the Hasama River, another tributary of the Kitakami River, the Kurikoma reservoir area recorded rainfall totaling 460 millimeters. The overflowing of the Hasama River and other tributaries and the collapse of embankments along them caused major losses.

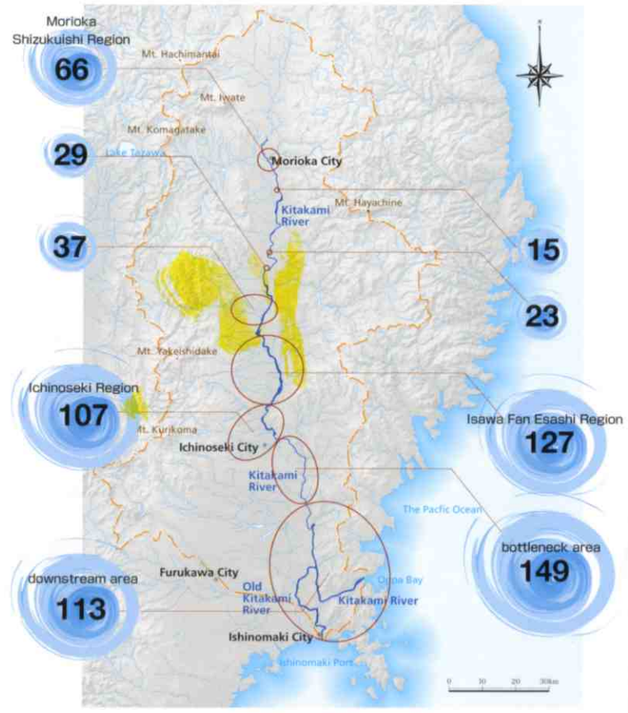
(4) August 1998

A stationary front in the Tohoku region produced continuous heavy rain and resulted in large-scale flooding. Major flood damage occurred, chiefly in Kawasaki Village and Ichinoseki City in the southern part of Iwate Prefecture. Flooding caused disasters in various locations as 345 dwellings had flooding under their floors, 176 people were evacuated, and 2,722 hectares of farmland were submerged.

(5) July 2002

As Typhoon No. 6 approached Iwate Prefecture it activated a rainy season front that had become stationary in the Tohoku region. This caused heavy rain throughout virtually all of Iwate Prefecture. Kozenji in Ichinoseki City recorded a high water level of 13.51 meters, the third-highest level in the post-war era (the levels during Typhoon Catherine and Typhoon Ion were 16.89 and 14.89 meters, respectively), as flooding occurred. Losses were severe in Iwate Prefecture, where 2 people died, 9 were injured, 14 buildings were either entirely or partially destroyed, 1,122 houses were flooded above floor level, and 2,648 houses were inundated below floor level. Damage was also heavy in Miyagi Prefecture, where 1 person died, 3 were injured, 3 houses were either entirely or partially destroyed, 541 houses were flooded above floor level, and 2,874 houses were inundated below floor level.

Frequency of floods in Kitakami River basin



(1600-1995) (Source: Iwate Work Office)

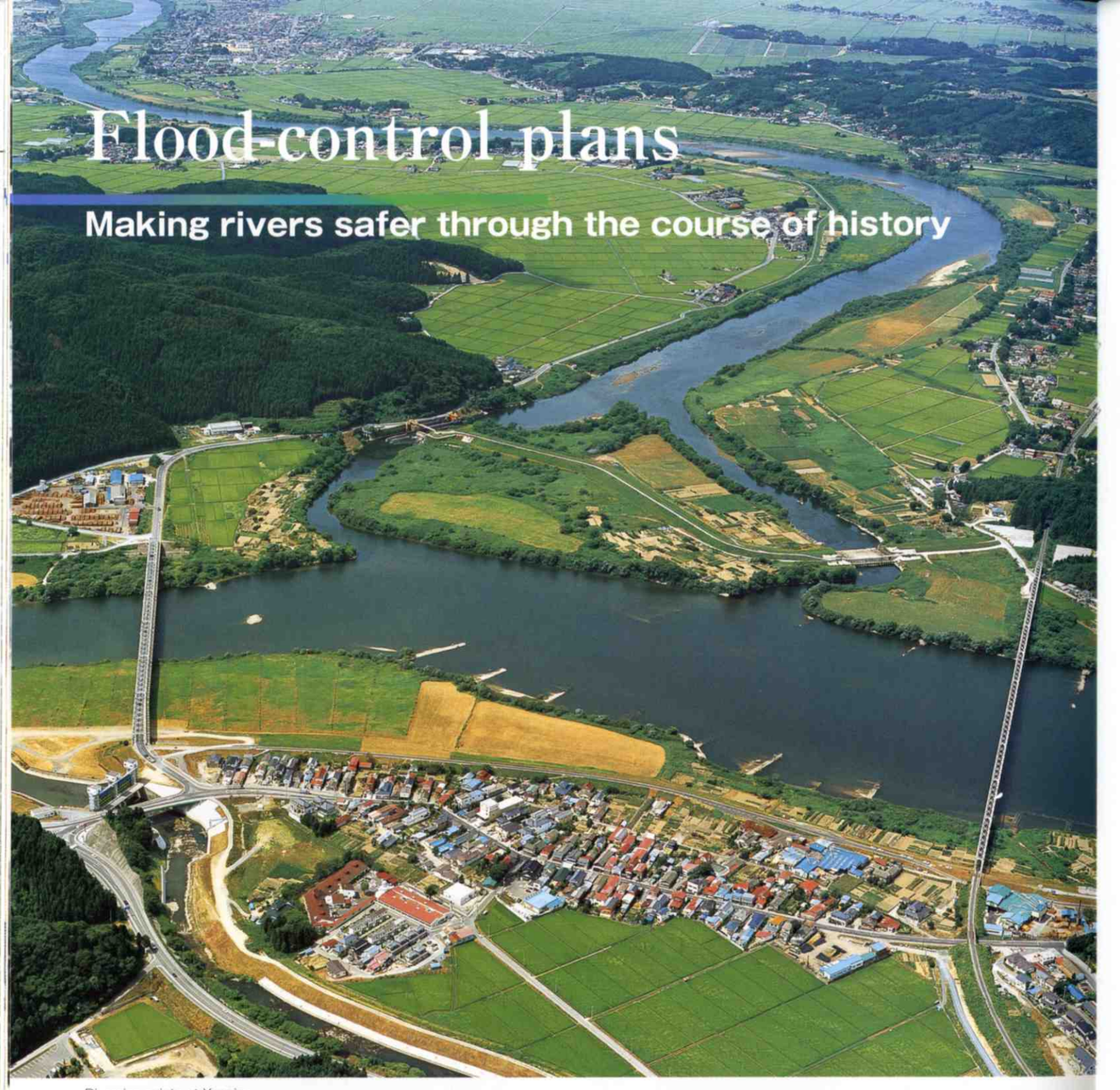
Flooding at the confluence of the Satetsu and Kitakami rivers (August 1998)

Flooding of Mizusawa Industrial Estate (July 2002)

Flooding at the confluence of the Old Kitakami and Eai rivers (July 2002)

Flood-control plans

Making rivers safer through the course of history



Diversion points at Yanaizu

The philosophy of flood-control measures

The primary point of flood control is to protect the lives and assets of people in river basins. In order to shield the various regions along the Kitakami River, which has a long north-to-south flow, there must be balanced flood-control planning that takes into account the differences between natural conditions upstream and downstream.

Flood-control projects from the Edo period, which started in 1603, through the years prior to World War II concentrated primarily on river channel replacement and embankment construction. One of these projects split the Kitakami River into two flows, the Old Kitakami River and the New Kitakami River, through the construction of a floodway. Designed for the improvement of flood safety in northern Miyagi Prefecture's low-lying flatlands, this project marked the start of the Kitakami River's modern improvements.

The excavation of the New Kitakami River

Existing plans for flood control were radically revised after Typhoon Catherine and Typhoon Ion caused massive damage in the basin of the Kitakami River. A new plan was formulated for the comprehensive improvement of the degree of the safety of flood control in northern Miyagi Prefecture's low-lying flatlands. This plan was designed to boost the level of flood safety in the basins of both the New Kitakami River and the Old Kitakami River by not burdening the Old Kitakami River with the flood discharge of the main Kitakami River. This would be accomplished by implementing Kitakami River improvements on a priority basis and stopping the diversion of floodwater into the Old Kitakami River. The plan also aimed to facilitate the drainage of water from tributaries of the Old Kitakami River by eliminating the impact of prolonged flooding on the main Kitakami River .

The Main Kitakami River flood-control planning

Based on major floods in the past, a peak river discharge of 13,000 m³/s was set at the reference point, Kozenji in Ichinoseki City, for the main Kitakami River. They determined that a group of dams upstream and a retarding basin in Ichinoseki City would be used to control 4,500 m³/s of this discharge, and that the river channel's design flood discharge would be 8,500 m³/s. The Five Great Dams and Ichinoseki Retarding Basin were constructed on the basis of this plan. Adding in the Satetsu River and other tributaries, it was then determined that the river channel's discharge downstream at Toyoma would be 8,700 m³/s. They also specified the same discharge for the channel segment from that point to the river's estuary. Embankment heights were then determined in accordance with the amount of the discharge at these different points, and the construction of structures commenced.

The Old Kitakami River flood-control planning

The amount of discharge to be diverted into the Old Kitakami River at floodtime was set at zero. Taking major floods in the past as their basis, the peak flood-time discharge was set at the reference point, Wabuchi, at 4,100 m³/s. Of this amount, 1,600 m³/s would be regulated by two dams, Naganuma and Narugo, and three retarding basins, Kabukurinuma, Minamiyachi, and Monou or would be diverted into the New Eai River, a discharge canal. The river channel's design flood discharge would then be 2,500 m³/s. The dams, retarding basins, and discharge canal were constructed on the basis of this plan. Embankment heights were then determined in accordance with the amount of the discharge at these different points, and the construction of structures commenced.

Additional consideration was given to the area around the Old Kitakami River's estuary, where an urban center focused on the river had formed as an estuary port. Consequently, circumstances were such that this area did not have any embankments. Nor was it equipped with protection against floods, high tides, and tidal waves caused by earthquakes. Plans are therefore underway to build secure embankments to defend the area against such elements.

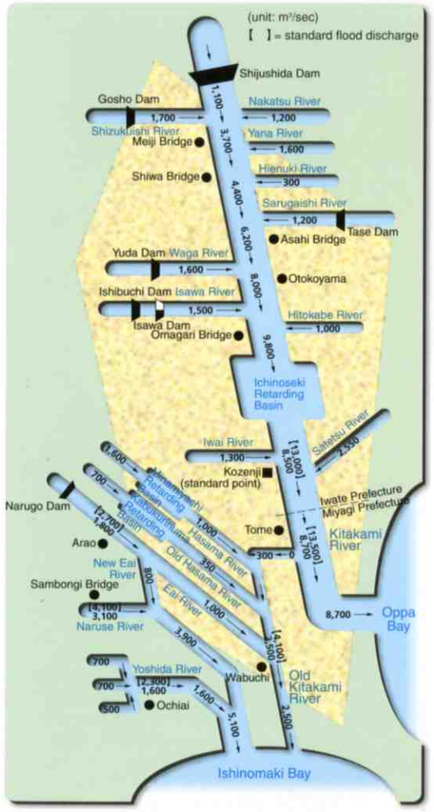
The Eai River flood-control planning

Damage due to the repeated overflowing of the Eai River in the post-war era prompted the construction of the Narugo Dam. This dam and Naruse River are to serve as receptacles for some of this river's peak flood-time discharge. There has been relatively good progress in terms of the construction of embankments along the Eai River. But the plan is premised on the diversion of water into the Naruse River, and diversion through the New Eai River is inadequate. Given this current situation, the Eai River is a river with a low degree of safety.

The present status of flood-control measures

Dams have been built in the upstream portion of the Kitakami River to control flooding, while retarding basins and floodways are used in response to flooding in the river's midstream and downstream segments. In this way there has been an effort to make balanced provisions for the river system that accommodate natural conditions at its different locations, and this approach is having an effect. The construction of Isawa Dam, emergency flood-control measures for the Satetsu River, and the renovation of diversion facilities for the New Kitakami River and the Old Kitakami River are presently in progress in order to further improve safety. However, the proportion of the required embankments that have been built thus far is about one-third of the total, and more time is needed before the plan can be accomplished.

Design flood discharge distribution of Kitakami River



(Source: Tohoku Regional Construction Bureau)

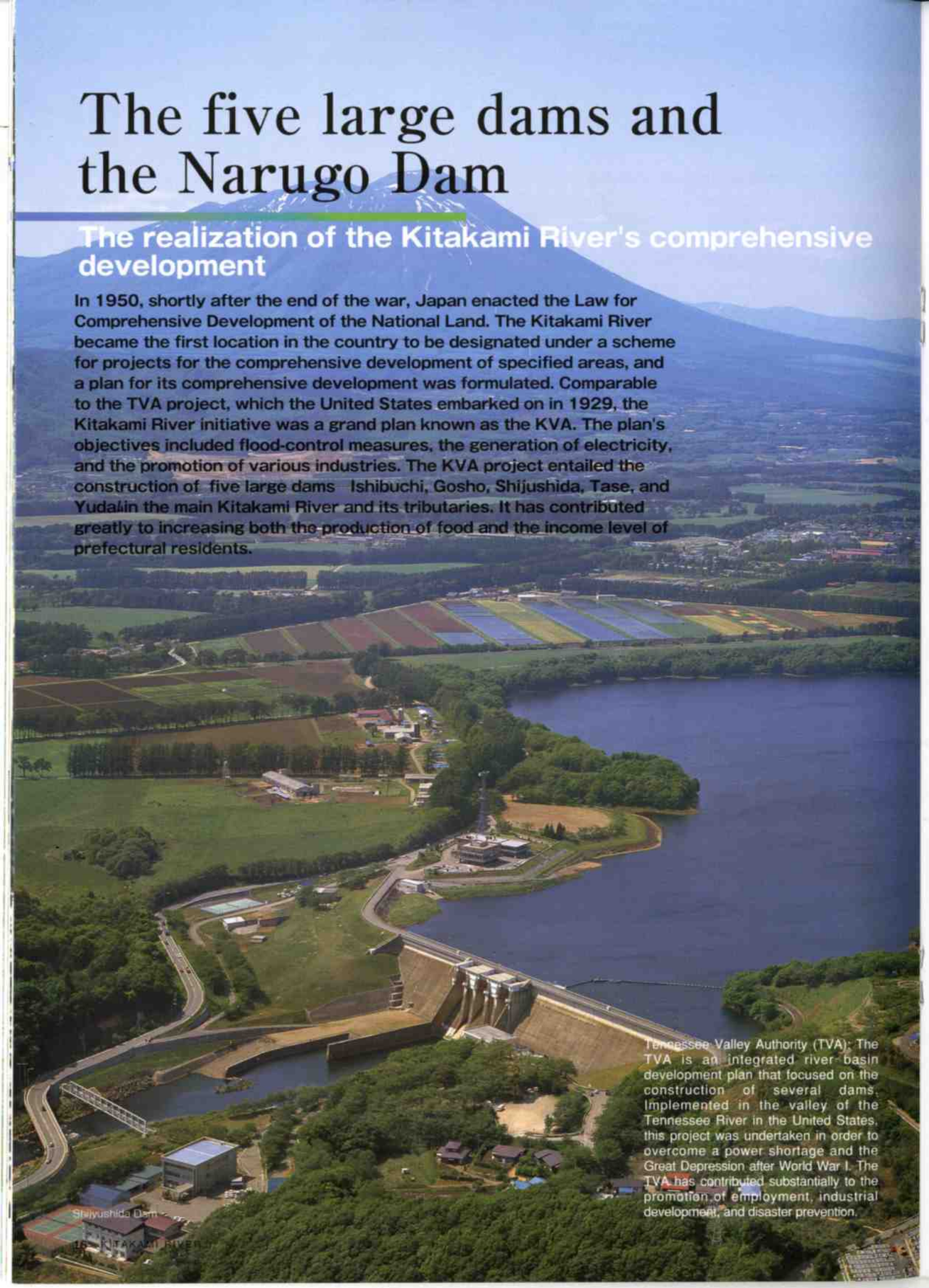
Confluence of three rivers at city of Morioka

New channel between Yanaizu and Iinokawa

The five large dams and the Narugo Dam

The realization of the Kitakami River's comprehensive development

In 1950, shortly after the end of the war, Japan enacted the Law for Comprehensive Development of the National Land. The Kitakami River became the first location in the country to be designated under a scheme for projects for the comprehensive development of specified areas, and a plan for its comprehensive development was formulated. Comparable to the TVA project, which the United States embarked on in 1929, the Kitakami River initiative was a grand plan known as the KVA. The plan's objectives included flood-control measures, the generation of electricity, and the promotion of various industries. The KVA project entailed the construction of five large dams Ishibuchi, Gosho, Shijushida, Tase, and Yudaiin the main Kitakami River and its tributaries. It has contributed greatly to increasing both the production of food and the income level of prefectural residents.



Shijyushida Dam

Tennessee Valley Authority (TVA): The TVA is an integrated river basin development plan that focused on the construction of several dams. Implemented in the valley of the Tennessee River in the United States, this project was undertaken in order to overcome a power shortage and the Great Depression after World War I. The TVA has contributed substantially to the promotion of employment, industrial development, and disaster prevention.

Ensuring the safety of the river basin through dams

The five large dams have flood-control functions that utilize their flood-control capacity. These dams are operated in such a way that floodwater upstream from them is retained temporarily by these structures. This enables the level of the water in the main Kitakami River to be controlled and minimizes damage due to flooding.

The utilization of water for production and daily life in the area

The water held by the five large dams is utilized for irrigation, public water works, and the generation of electricity.

Water for irrigation is available downstream, where water for agricultural use is supplied by all of the five dams except for Shijushida Dam. These four dams are equipped for a total water intake of 50.3 m^3/s. This water brings moisture to rice fields covering a total of 22,568 hectares in Iwate Prefecture, an area that is equivalent to about 22% of the prefecture. As for water for public water works, Morioka City takes in 23,000 m^3 a day downstream from Gosho Dam. This amount covers the water that is supplied through water works to approximately 154,000 people, or more than half the city's population. And for water for the generation of electricity, the five dams can together take in a maximum of 226.0 m^3/s (their total normal intake is 72.7 m^3/s). Altogether, the maximum amount of the power generated is 113,500 kilowatts, or about 18% of Iwate Prefecture's total output of electricity.

Dams as recreational sites for residents

The five large dams and their surrounding areas also attract interest as sites that are blessed by abundant nature and are suited for leisure activities. The areas around reservoirs in particular have been opened up to surrounding communities, and people use them as spaces for such pursuits as recreation and events. One of the five dams, Gosho, is used by approximately 1 million people each year. It has ranked at the top nationwide in the last four surveys on the utilization of dam reservoirs in Japan.

Five large dams in Kitakami River

Name of dam		Shijushida Dam	Gosho Dam	Tase Dam	Yuda Dam	Ishibuchi Dam
Name of river system/name of river		Kitakami/Kitakami	Kitakami/Shizukuishi	Kitakami/Sarugaishi	Kitakami/Waga	Kitakami/Isawa
Catchment area (km^2)		1,196.0	635.0	740.0	583.0	154.0
Dam height (m)		50.0	52.5	81.5	89.5	53.0
Crest length (m)		480.0	327.0	320.0	264.9	345.0
Reservoir area (km^2)		3.9	6.4	6.0	6.3	1.1
Total storage capacity (m^3)		47,100,000	65,000,000	146,500,000	114,160,000	16,150,000
Flood control capacity (m^3)		33,900,000	40,000,000	84,500,000	77,810,000	5,600,000
Design flood discharge (m^3/s)		1,350	2,450	2,700	2,200	1,200
Design release discharge (m^3/s)		700	1,200	500	400	900
Start/completion of project		1962/1968	1967/1981	1941/1954	1953/1964	1947/1953
No. of compensated houses		60	448	181	565	13
Drinking water	Quantity (m^3/s)	-	0.75	-	-	-
	Target for supply(person)	-	154,000	-	-	-
Irrigation water	Quantity (m^3/s)	-	17.3	9.0	8.0	16.0
	Area (ha)	-	4,989	6,272	3,715	7,592
Water for hydropower generation	Quantity (m^3/s)	Maximum withdrawal rate 55 Normal withdrawal rate 17.4	60 17.9	35 17.0	42 14.83	16 5.57
	Maximum output (kw)	15,100	13,000	27,000	37,600	Power plant No. 1 14,600 Power plant No. 2 6,200

(Source: Kitakami River Integrated Dam Management Office)

Gosho Dam

Tase Dam

Yuda Dam

Ishibuchi Dam

The substantial impact of the Narugo Dam

The Narugo Dam is a multipurpose dam that was built in the Eai River, a tributary of the Old Kitakami River. This dam controls flooding along the Eai River, supplies water that is used to irrigate the Osaki Plain grain belt, and generates electricity. Completed in 1952, it is Japan's first arch dam and was built solely by Japanese engineers. Even though flooding has occurred at different times, such as when typhoons struck in 1974, 1981, and 1989, water from the Eai River caused hardly any flood damage in the basin downstream from Narugo Dam thanks to the regulation of water by this dam and to the progress of river improvement works. Additionally, during times of severe drought in 1973, 1978, 1984, and 1985, grain-belt harvests were abundant thanks to the release of water from this dam. In this way, Narugo Dam is proving to be effective as it serves to ensure that the area downstream from it is stable and productive.

Narugo Dam, the first arch dam designed and built entirely by Japanese engineers

Narugo Dam

Name of river system/name of river		Kitakami／Eai
Catchment area (km²)		210.1
Dam height (m)		94.5
Crest length (m)		215.0
Reservoir area (km²)		2.1
Total storage capacity (m³)		50,000,000
Flood control capacity (m³)		19,000,000
Design flood discharge (m³/s)		2,000
Design release discharge (m³/s)		400
Start/completion of project		1952/1957
No. of compensated houses		20
Drinking water	Quantity (m³/s)	-
	Target for supply(person)	-
Irrigation water	Quantity (m³/s)	22
	Area (ha)	-
Water for hydropower generation	Quantity(m³/s)	Maximum withdrawal rate 21 Normal withdrawal rate 8.19
	Maximum output (kw)	18,000

(Source: Tohoku Regional Construction Bureau)

Construction of the Isawa Dam

The transformation of one of the five large dams in the Kitakami River basin

One of Japan's largest rock-fill dams

The Isawa Dam will be constructed in the upper reaches of the Isawa River, a tributary of the Kitakami River that flows down from beautiful Mt. Yakeishidake (elevation 1,548 m). When completed, it will be one of the largest rock-fill dams in Japan. Work on excavating the foundation for the dam began in fiscal 2002, and the dam will appear around 2013 at a site approximately two kilometers downstream of the existing Ishibuchi Dam. The Isawa Dam is designed for flood control and to ensure an adequate river flow for preservation of the river environments and so on. It will also generate power and provide water for irrigation and the public water supply.

Designed to provide backup for the Ishibuchi Dam

The Isawa Dam is designed to reinforce the functions of the Ishibuchi Dam to enable it to be more effective in flood control and irrigation. The Ishibuchi Dam was constructed to use the abundant water from melting snows in the Ohu Mountains for irrigation and power generation. However, because of its small capacity for storing adequate water, water shortage for irrigation occurs once every two years. In terms of flood safety as well, it is possible floods exceeding the flow capacity of the downstream section may occur once every five years. The Isawa Dam is designed to solve these problems; its flood control capacity and water utilization capacity are 9 times and 13 times greater, respectively, than the Ishibuchi Dam.

Environmental harmony in the dam construction project

The Isawa Dam Project Office handling the dam construction has introduced an Environmental Management System (EMS) compliant with the ISO 14001 standard to ensure the implementation of environmental measures of the highest reliability. The office has also organized study sessions concerning environmental conservation and heritage surveys in order to encourage the participation of specialists and local residents. In cooperation with active NPOs in the region, the office also conducts activities to protect the natural environment of the region and operates the Isawa Dam Learning Center to support general education regarding the dam project.

Image of Isawa Dam

Comparison of Isawa Dam and Ishibuchi Dam

Name of dam	Isawa Dam (New Ishibuchi)	Ishibuchi Dam	Comparison
Type	Central core Rockfill dam	Concrete facing Rockfill dam	—
Dam height (m)	132.0	53.2	2.5:1
Crest length (m)	745.0	345.0	2.2:1
Dam volume (m³)	15,000,000	442,500	34:1
Reservoir area (km²)	4.4	1.1	4:1
Total storage capacity (m³)	143,000,000	16,150,000	9:1
Effective storage capacity (m³)	132,000,000	11,960,000	11:1
Flood control capacity (m³)	51,000,000	5,600,000	9:1
Water utilization capacity (m³)	81,000,000	6,360,000	13:1

(Source: Isawa Dam Work Office)

Nature conservation activity with local inhabtants

Integrated Dam Management

The Combined Power of Five Dams

Collecting all hydrological data and river information in the Kitakami River Basin

At the Integrated Management Office for the Kitakami River dams, information on the movement of typhoons and weather fronts is provided by the Himawari meteorological satellite. In addition, 52 telemetric rainfall monitoring stations set up in the upper reaches of the Kitakami River basin (in Iwate Prefecture) and 43 telemetric water level monitoring stations provide hourly data on rainfall and water levels, and the Monomiyama and Nishidake radar installations provide information on rain and snow patterns. The office also collects data on reservoir levels, inflow levels, discharge quantities and so on from the five dams, and this information is managed in an integrated manner.

Water data is used to control the river flow during a flood or drought

In the event of a flood or drought, the water information that has been collected is analyzed in an integrated manner and becomes basic data for managing the water flow in the Kitakami River. For example, if there is the danger of a flood, the amount of water that will flow into the dam reservoir prior to the flood is predicted, based on the collected rainfall and water level data, and instructions are issued regarding the discharge operation. This enables the five dams to operate with maximum effectiveness and reduces the damage caused by flooding in the Kitakami River.

Effectiveness of dam flood control: Typhoon No. 6, 2002

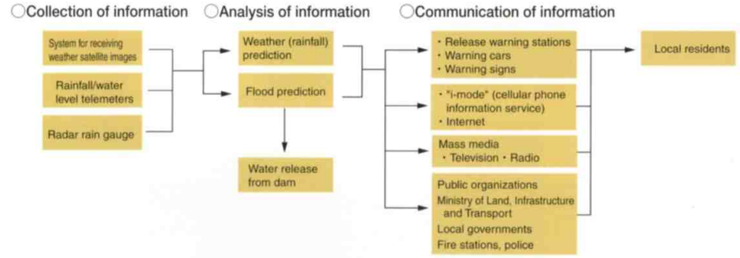
In July 2002, an extremely powerful typhoon approached the seasonal rain front that was stationary in the Tohoku region at that time. Between July 9 and 11, heavy rains fell throughout the entire Kitakami River basin, causing enormous damage in various parts of the river basin.

In order to minimize the flood damage caused by these torrential downpours, flood control measures were implemented to reduce the flow at four of the five dams in the Kitakami River basin (Shijushida Dam, Gosho Dam, Tase Dam and Yuda Dam - in other words, all of the dams except the Ishibuchi Dam). At the Ishibuchi Dam, the inflow had not reached the level at which regulation should begin, so discharge of approximately the same quantity as the inflow was conducted.

Of these dams, the Shijushida Dam recorded the greatest inflow since the dam's completion in 1968 (908 m^3/s) at 1:10 p.m. on the 11th; however, the discharge from the dam at this time was regulated to reduce the flow to 503 m^3/s. Judging from the status of damage in the rivers downstream, the discharge from the Tase Dam and Yuda Dam was reduced largely after the peak inflow to the reservoir, while taking subsequent rainfall and inflow levels into consideration. At the Yuda Dam in particular, the discharge was reduced to 383 m^3/s at the time of the peak inflow of 975 m^3/s, and subsequently the discharge was reduced to below 200 m^3/s.

These measures enabled the water level at Kozenji in Ichinoseki, the reference point for flood control at the Kitakami River, to be reduced by approximately 70 cm from the level it would have reached had there been no dams.

Collection, analysis and communication of flood information




Monomiyama radar site


Telemetry rainfall observation spot

Providing river disaster prevention information

The Ministry of Land, Infrastructure and Transport provides rainfall, flow and other disaster prevention information via the Internet and the i-Mode mobile telephone network. See the following sites:

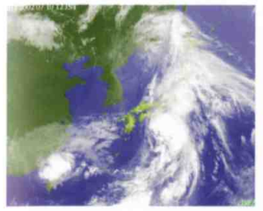
River Disaster Prevention Information (i-Mode)
http://i.river.go.jp

River Disaster Prevention Information (Internet)
http://www.river.go.jp

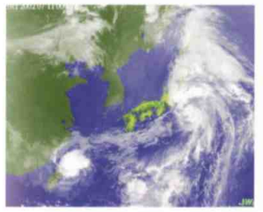
Flood control effect of dam-operation during typhoon No.6 in 2002

Picture of Weather satellite

12 : 00,10th of July



24 : 00,11th of July



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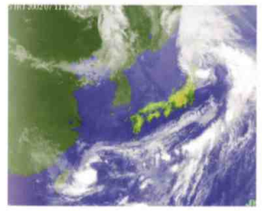


Picture of Radar Rain gauge

12 : 00,10th of July

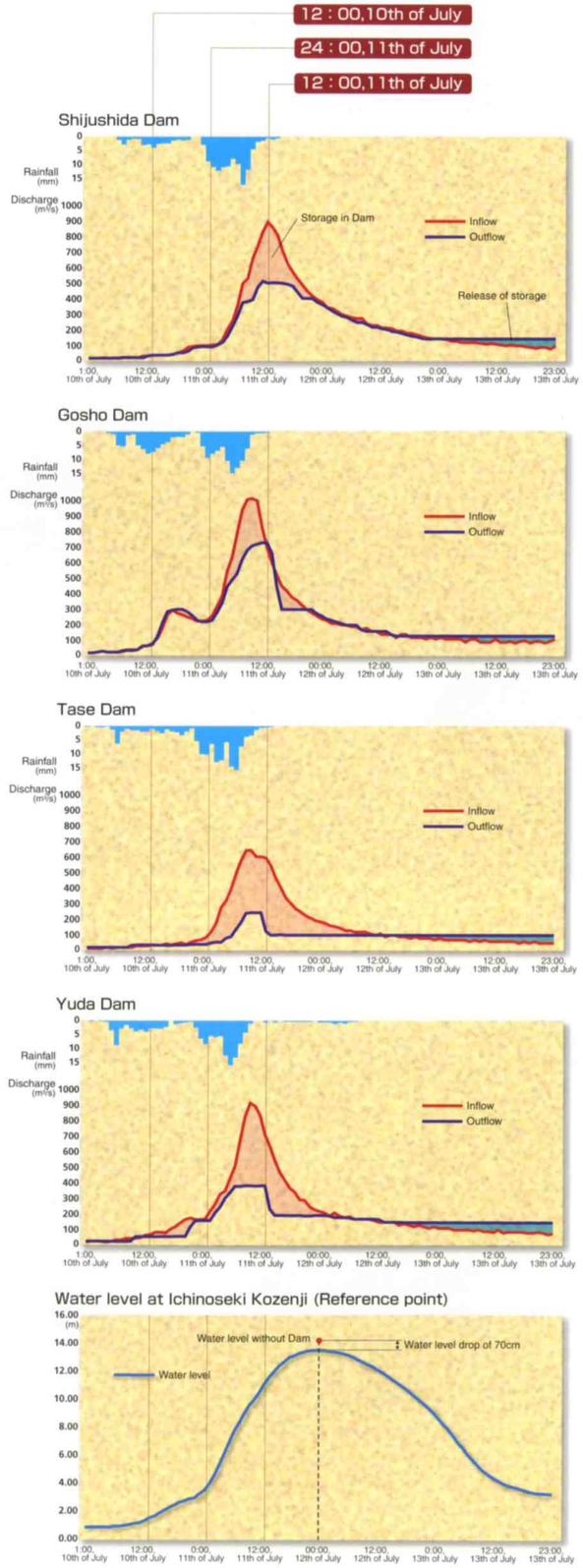
24 : 00,11th of July

12 : 00,11th of July

(Source: Japan Weather Association)

Practice of dam operation

The image from the "Himawari" meteorological satellite shows the movement of the typhoon, while the radar rain gauge image shows the movement of the rain at that time. These images show the inflow to the reservoirs beginning to increase along the path of the torrential rains, as well as the manner in which flood control operations were begun from the Yuda Dam located in the most southern area in the path of the typhoon. When the typhoon passed by, the quantity of inflow into the four reservoirs was at its peaks; the dams were at maximum effectiveness at this point. Twelve hours later, the water level at Kozenji in Ichinoseki reached its highest level, after which it gradually decreased.

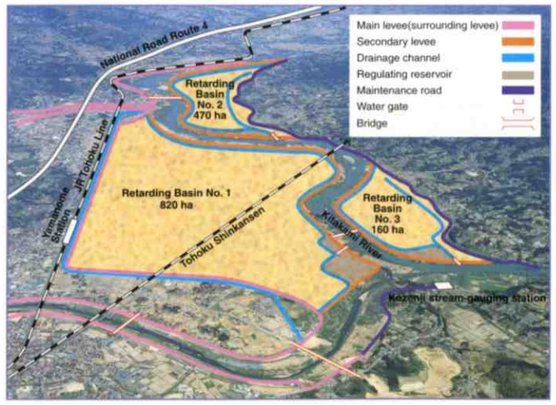


Water level at Ichinoseki Kozenji (Reference point)

Flood Control

Construction of the Ichinoseki Retarding Basin and renovation of the old Kitakami River diversion facilities

Bird's eye view of the Ichinoseki Retarding Basin



Ichinoseki Retarding Basin: Protecting chronic flood-ravaged regions

The Ichinoseki - Hiraizumi area suffers frequent flood damage due to the bottleneck in the downstream section of the area. Following major damage by Typhoon Catherine in 1947 and Typhoon Ion in 1948, construction of the Maikawa Retarding Basin (the current No. 2 and No. 3 retarding basins) was planned in February 1949 to protect the region and increase safety in downstream areas. In 1973, the plan was revised and the scope of the Maikawa Retarding Basin was enlarged to create the Ichinoseki Retarding Basin Plan. Regulating the peak flow in the event of a flood would help increase the degree of safety in the areas downstream of the retarding basin.

The Ichinoseki Retarding Basin is made up of three retarding basins. The No. 1 retarding basin (820 ha) uses a double-line embankment system made up of an encircling embankment that protects downtown Ichinoseki and Hiraizumi from flooding from the main river and small embankments right in front of the river. The No. 2 retarding basin (470 ha) and No. 3 retarding basin (160 ha) are enclosed by the mountains in the rear and have small embankments in front of the river. Farmlands have been preserved in the interior of the retarding basin to enable them to be used as producing areas, and the retarding basin has been planned to enable small embankments to prevent inundation from flooding that occurs approximately once every ten years.

The encircling embankment for the No. 1 retarding basin is almost complete, and it demonstrated its effectiveness in the flood that occurred in July 2002. If it had not been nearly complete, it is estimated that the area submerged would have increased by approximately 550 ha and approximately 620 more houses would have been damaged by inundation.

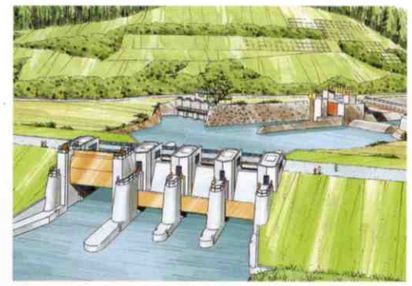
Emergency flood control measures for the Satetsu River

Flooding both above and below floor level and other major damage occurred along the Satetsu River in August 1998 as a result of torrential rains caused by a front and Typhoon No. 4, and in July 2002 due to torrential rains caused by a front and Typhoon No. 6. To prevent such damage from ever happening again, the national and local governments have joined to promote intensive river channel excavation, embankment work, revetment construction and so on;. The area covering approximately six kilometers from the Kitakami River junction is directly administered by the Ministry of Land, Infrastructure and Transport (MLIT), and the area covering approximately six kilometers directly upstream from this area is implemented by local government.The work began in 2002 and scheduled to continue throuth 2006.

Renovation of the strategic points for flood control in the Kitakami River system

The Tokinami and Wakiya overflow weirs located at the juncture between the Kitakami River and the Old Kitakami River were constructed nearly 70 years ago. In addition, due to the strengthening of the embankments on the main Kitakami River at the juncture point and the near completion of a river cross-sectional area able to accommodate flooding, it was decided to renovate the diversion facilities on the Old Kitakami River in order to improve overall flood control safety in the low-lying areas in the northern part of the prefecture. Halting diversion from the Kitakami River to the Old Kitakami River in the event of a flood would increase the safety of the Old Kitakami River and enable the water level in the Eai River, Hasama River and other tributaries to be reduced, helping to reduce flooding of inland water areas as well.

River improvement works for the Satetsu River



Perspective of the new facilities (new Wakiya gate)
(Source: Kitakami River Downstream Work Office)

Erosion control projects in the Hachimantai Mountains

The Hachimantai Mountains are a major resort area with many hot springs and ski slopes and the ruggedly beautiful scenery of a volcanic region that changes throughout the four seasons. However, the mountain streams fed by these mountains flow down at a steep angle, and the unique geologic conditions of the volcanic region and other factors result in frequent landslides and sediment problems. For this reason, erosion control projects have been implemented in Iwate Prefecture since 1932. Due to the enormous size of the project area, however, major progress in erosion control projects is needed, and in 1990 the Iwate Work Office began directly administering erosion control projects. Since 1998, primarily volcano disaster control measures have been conducted for Mt. Iwate, which has been active in recent years.

Nishine No.2 Groundsel

Genbu check dam

River Environments

Ensuring a rich ecosystem

The rich ecosystem of the Kitakami River

The plant communities seen throughout the river basin include willow (Salix), walnut (Juglans sieboldiana), yoshi reeds (Phragmites communis), ogi reeds (Miscanthus sacchariflorus) and so on. The poet Takuboku Ishikawa wrote "I weep / for the banks of the Kitakami River / with the soft green leaves / of the willow trees / reflected in the waters." As this poem shows, the Kitakami River has an abundance of willow trees. Moreover, the estuary has one of the largest river reed beds in Japan, stretching for several kilometers. The reed cutting ceremony held each winter is a traditional seasonal event.
55 species of fish have been confirmed in the river (as of the 1995 National Census of the River Environment. The river is a favorite fishing spot for ayu (sweetfish), salmon and trout, and at one time the salmon from the Kitakami River were presented to the Edo shogunate. Currently, cleanup measures have succeeded in restoring the river to one in which salmon and trout swim upstream to spawn, and inland water fisheries have resumed operations.
133 species of birds have also been confirmed (as of the 1997 National Census of the River Environment). Of these, the presence of 44 species of stork (ciconiiformes), duck (anseriformes) and plover (charadriiformes) that inhabit areas by rivers has been confirmed. The Kitakami River whose basin stretches to the north and south also plays an important role as a route for migratory birds. Lake Izunuma and Lake Uchinuma, located in Miyagi Prefecture, have been registered under the Ramsar Convention (Convention on Wetlands of International Importance), and these areas are visited by many migratory birds.

Conducting a National Census of the River Environment

Studies are conducted of the fish and shellfish, plants and other living things that inhabit the Kitakami River and the status of river use. The results of these studies are used as basic references for river environment conservation and river works construction. The study results are also used to prepare and distribute pamphlets and so on for use at elementary and junior high schools and the like.

Ensuring that the rich ecosystem is preserved for future generations

Kitakami City / Hanamaki City

At Tenshochi Park (Kitakami City) and Igirisu Kaigan ("English Coast") (Hanamaki City) along the Kitakami River, embankment work projects using natural tree planting have been conducted to create shoreline environments that can be readily inhabited by animals.

Minowada revetments (Kahoku Town)

Spur dikes have been constructed using stones with consideration for restoration of the native reed beds, ensuring habitats for living organisms, and securing habitat environments for aquatic life.

1

2

3

4

5

1 Yoshigari (annual reed cutting) carried out in reed fields (Kitakami-machi), photo by Michihisa Kawamura
2 Nature Watching note, a pamphlet for aimed at elementary school children
3 Minowada revetments designed for the restoration of vegetation and the creation of living space for aquatic life (Kahoku-cho)
4 Revetment works built with cuttings of woody plants at Kitakami Tenshochi (Kitakami-machi)
5 A Frigid Winter Morning, photo by Noboru Kitaizaki

Salmon-fishing Day in Kitakami River, photo by Zenji Sato

Preserving the Historical Environment

Protecting and carrying on the traditions of our ancestors

Present Tokinami weir

Historical remains in the river basin

The Kitakami River basin has been the setting for numerous events in history, and valuable historical remains have been discovered along the river. In order to preserve those that are particularly valuable, the planned sites of river structures have been moved on occasion. Of the flood control facilities constructed from the Meiji period (1868 - 1911 through the Showa period (1926 - 1988), using state-of-the-art technologies of the time, some are still in existence. These facilities are important historical remains of the region, and measures will be promoted to ensure that they are preserved for future generations.

Preserving the "Yanaginogosho" by moving the embankment

The remains of the "Yanaginogosho" (Yanagi Palace) were discovered at the site where the initial embankment was to be constructed. These remains have been determined to date back to the time of the Hiraizumi Fujiwaras in the latter half of the 12th century, and were designated a national historical site in 1997. For this reason, the Ministry of Construction (now the Ministry of Land, Infrastructure and Transport) moved the planned location of the embankment to a site closer to the river so as to avoid the remains. Currently Hiraizumi Town and the Iwate Work Office have constructed a provisional historical museum at the site. In the future, Iwate Prefecture plans to restore the remains and construct an exhibition and management facility there. Plans also call for a riverside plaza, "Michi no Eki" roadside rest stop and other facilities to be constructed primarily by Hiraizumi Town in the future, as a place of rest and recreation and river access for the general public.

Preserving the lock gates and overflow weirs

The Wakiya overflow weir and ship lock gate were completed in 1932 and are designed to divert a portion of the flow of the Kitakami River to the Old Kitakami River and to permit navigation by vessels.

The Tokinami overflow weir, constructed in the same year, is located at the point at which the Kitakami River and Old Kitakami River divide. At the time, the plan called for the Wakiya and Tokinami overflow weirs to be constructed side by side, but since the ground was weak, they were constructed in separate locations. Currently, with the aging of the facilities, work is progressing on the construction of a new diversion facility in front of the Wakiya overflow weir / lock gate and the Tokinami overflow weir. The existing facilities will be preserved.

The Ishii lock gate located at the point where the Old Kitakami River and the Kitakami Canal meet was constructed in 1880 and is the oldest Western-style brick lock gate. Currently a Canal Museum, boat landing and water park have been constructed in the area around the Ishii lock gate, forming a place of rest and relaxation for the general public.

Yanaginogosho Museum and Michi-no-Eki (roadway station)

Ishii ship lock

Water Quality and Cleanup Measures

Formerly a "dead river," now a salmon spawning ground

On a Full Moon's Eve (Kitakami River), photo by Toshiharu Suenaga

Restoring the clear waters of the river

The basin of the Matsukawa River, an upstream tributary of the Kitakami River, has some of the most abundant sulfur deposits in Japan. The deposits were discovered in the Meiji period, and the mines here were the largest in Asia and once accounted for one-third of all of the sulfur produced in Japan. However, as production increased, highly acidic water flowed out from inside the mine, causing damage that extended throughout the downstream areas of Miyagi Prefecture.

Starting around 1919 or 1920, the problem of mining pollution had already begun to be a problem among the farmers who used the Aka River as a source of irrigation water. In 1931, a reduced harvest due to cold weather damage fueled farming residents' concerns regarding the mining pollution, and when it was reported in the newspaper the following year (1932, it instantly became an issue of society-wide concern. Study by the government of measures to correct the situation is said to have begun around 1944.

Due to financial woes, the mine was closed in 1972. However, for a period of around 20 years from the early 1950s through the early 1970s, the highly acidic water produced from the old mine caused the Kitakami River to be turned temporarily into a "dead river" uninhabitable by fish for most of its length. Large quantities of quicklime were dumped into the river in an effort to improve the water quality, but the products of neutralization in the river channel included highly concentrated arsenic, which flowed downstream and collected in the Shijushida Dam reservoir.

Beginning in 1971, relevant government agencies and researchers began studying the problem, and a new neutralization processing facility was constructed to employ a revolutionary technology known as the iron oxide　bacteria / calcium carbonate neutralization method. The facility, which began operating in 1982, is capable of processing polluted mining water at up to 28 cubic meters per minute. The result was that the clear waters of the Kitakami River have been restored, and now salmon once again travel upstream 200 kilometers from the mouth of the river to lay their eggs in the river in downtown Morioka City.

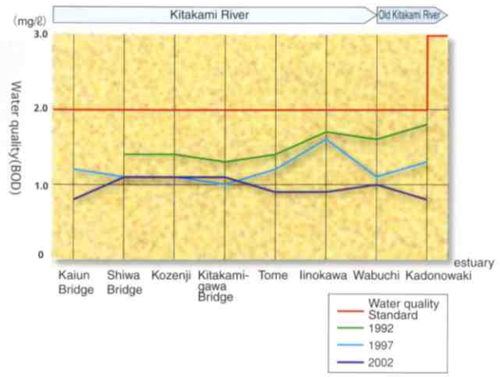
Present water quality in the Kitakami River

When biological oxygen demand (BOD), one of the indicators of water quality, is used as the standard, the Kitakami River satisfies environmental standards throughout its entire length, and changes in water quality have almost completely leveled off in recent years. However, once the river is polluted, it is not easily restored and will once again require enormous sums of money. From now on, care must be paid to preserving and improving water quality throughout the entire river basin.

The confluence of the highly polluted Matsu River and the Kitakami River in 1974

The Kitakami-Matsu confluence today

Changes in water quality



A Center for Community Interchange

Providing abundant opportunities for contact with the river

River basin provides numerous places for rest and relaxation

In fiscal 2000, the number of users of the river environment was estimated at 3.57 million over the entire river basin. Residents of cities and towns bordering the river estimated that each of them used the river about three times per year. In terms of the type of use, around 79% of the total or 2.85 million persons select the "Strolling, etc." category which includes strolling, attending fireworks exhibitions, kite flying and so on. Next most popular were sports (320,000 persons / 9%) and fishing (160,000 persons / 5%). Facilities constructed in the area of the dams include a park and yacht harbor (at the Tase Dam), the Ayame (Iris) Park and a baseball field (Yuda Dam), and a prefectural park (Gosho Dam), and these are visited by many persons.

The unique river scenery along the banks of the Kitakami River includes such beloved sightseeing destinations as Igirisu Kaigan, Geibikei Valley, Genbikei Valley, Narugokyo Valley and so on. The area is also dotted with hot springs, mainly in the foothills of the Ohu Mountains, and it is also rich in historical treasures such as Chusonji Temple. Many sightseers are attracted by the tourist resources and facilities located along the river and the beautiful river scenery.

Creation of a center for community interchange via the river

Currently, the government and citizens groups have joined to create a network for community interchange, with the river playing a pivotal role. The center of this network is the Riverside Plaza constructed on the banks of the Kitakami River by the Ministry of Land, Infrastructure and Transport. The Riverside Plaza has wide-ranging functions that include providing river access, nature education, rest and relaxation, and interchange and community-building. It also serves as a symbol of the area and provides information on the region and the river basin.

(1) Riverside Plaza Ichinoseki ("Ai-Port" - Kitakami River Information Center)

The Ichinoseki Retarding Basin Memorial Park and the Kitakami River Information Center in Ichinoseki are core facilities located at riverside . The " Ai-Port" is devoted to disseminating a wide range of information on the history, culture, customs, folklore and natural environment of the Kitakami River, as well as providing the opportunity for "hands-on" learning regarding the relationship between flood control measure and regional development in the Kitakami River region and so on. NPOs and citizen volunteers are involved in the Center's operations.

"Ai-Port" web site: http://www.iport.jp/

(2) Kitakami River and Canal Museum - "Water Cavern"

The Ishii ship lock gate in the area of the Kitakami River and Kitakami Canal has been preserved, and facilities that include the Canal Pavilion (with a main building for interchange and a separate building for education) and a boat landing have been constructed. The Interchange building introduces the Kitakami Canal and provides space for interchange, rest and relaxation and so on.

Kitakami River and Canal Museum - web site : http://www.thr.mlit.go.jp/karyuu/unga/index.html

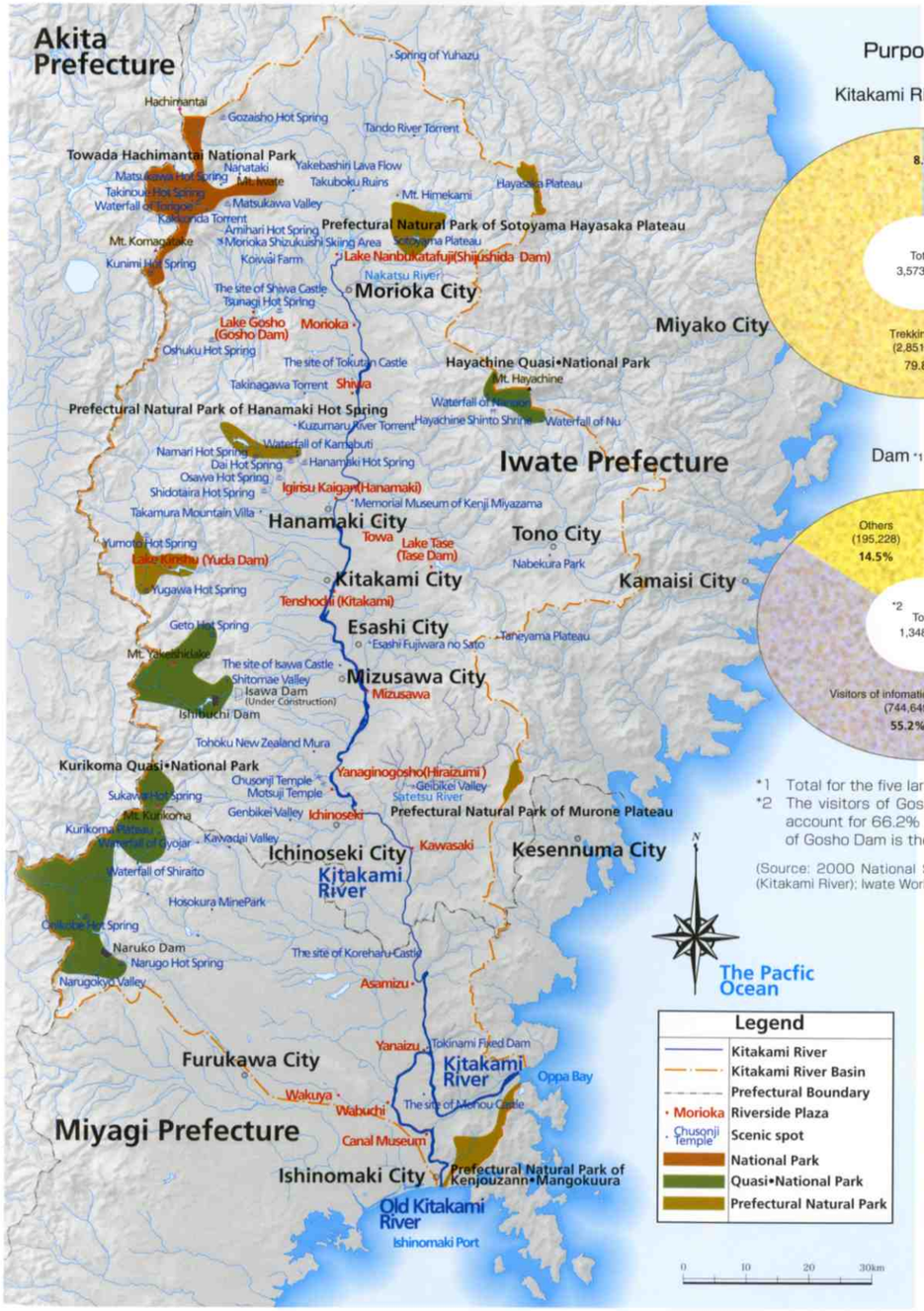
Kitakami River and Canal Museum

Ai-Port(Kitakami River Information Center)

Tase Dam Monoshiri-kan (Tase Dam Information Center)

Isawa Dam Gakushuu-kan (Isawa Dam Information Center)

The scenic spot of Kitakami River Basin and Human activities at riverside



*1 Total for the five large dams and Narugo Dam
*2 The visitors of Gosho Dam (892,435 persons) account for 66.2% of all. The number of visitors of Gosho Dam is the top in Japan

(Source: 2000 National Survey on River Environments (Kitakami River); Iwate Work Office)

The Future of the Kitakami River

Ensuring the future of the river and its people

A spring scene of the Kitakami River photo by Toshiyuki Narusawa

Nurturing the river

In the future, the Kitakami River should be a river that ensures the protection of our lifestyles. Its rich natural environment and abundant water should provide both enrichment and peace of mind to our lifestyles and the community. To achieve this vision of the river, the government, private citizens and companies and other organizations must cooperate in this effort.

At the Kitakami River, many private citizens have been active in efforts to regulate and preserve the natural environment. They have studied and learned about the history and culture of the region and participated in efforts to revitalize the river basin and the regional community. By 2002, two organizations active in river efforts had acquired NPO status: the Kitakami River Basin Association and the Hitakami Mizu-no-Sato.

Solidarity among local governments in the river basin

In April 1997, the Council of Kitakami River Basin Municipalities, made up of 36 local governments in the Kitakami River basin, was established to promote community-building through interchange and alliances using the special character of the region. The association has organized various events, such as the "Kitakami River Health Checkup" in which 580 elementary school students in the river basin surveyed water quality and aquatic life in the Kitakami River, and cleanup events in which people gather at the mouth of the river to pick up trash. Such activities are designed to promote interchange between upstream and downstream regions.

Envisioning a bright future reflected in the abundant river flow

As we have seen, the Kitakami River has an abundant flow of water and is surrounded by a rich natural environment. The riverbanks and river basin have been the setting for the Hiraizumi culture, the period of the Date lords and many other historical events, and its rich culture and history have produced many cultural figures, among them the poet Takuboku Ishikawa and poet and author Kenji Miyazawa. Once the river was the center of both transport and shipping, and not only goods but culture also traveled by way of the river. Now the perspective of such ties with the river has become a new current with the residents of communities along the river playing a central role.

In 1996, the government, local residents, scholars, the Chambers of Commerce in communities along the river and so on gathered together to put together the basic principles listed below regarding river development at the Kitakami River, entitled "The Kitakami River of Tomorrow." This marks the beginning of a new effort by the government and private citizens to build a new relationship between the river and the community, and to ensure that river development and community-building efforts create a Kitakami River and river basin that we can offer proudly to future generations.

- ○ Ensure that this everlasting flow that connects regions is the indispensable basis for river development and community-building
- ○ Treasure the river that has nurtured both history and culture and use it as a place for cultivating a rich sense of humanity
- ○ Provide shoreline environments and a river flow that allow a true appreciation of nature
- ○ Make sure the river is one that makes the lives of people in the river basin both safe and pleasant

1 Landscape and environmental study: A citizens' group is conducting an environmental study from the standpoints of ecology and landscapes.
2 River master school: The river master school has been held since 1996 with the aim of producing instructors for citizens participating in river recreations or other river-related activities.
3 Navigability study: The Kitakami River used to be a major traffick waterway. Currently, a study is underway on the benefits of the restoration of navigation to community building.
4 Kitakami River Kids Club: Since 1997, this club has organized various river-related hands-on activities for one hundred children from Iwate and Miyagi prefectures.
5 Coastal cleanup activities.

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Illustration: Bird's eye view of the town around Morioka Castle(Courtesy of Morioka Central Community Hall)

Photo: Kitakami River flowing in the city of Morioka