

Kokai River-Hakojima Retarding Basin



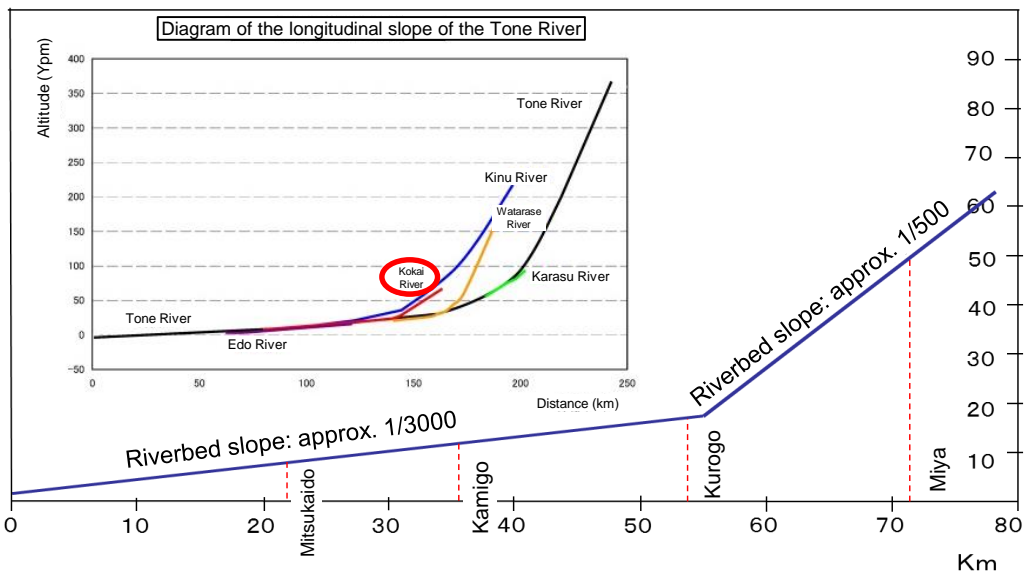
Daiya River→

←Kokai River

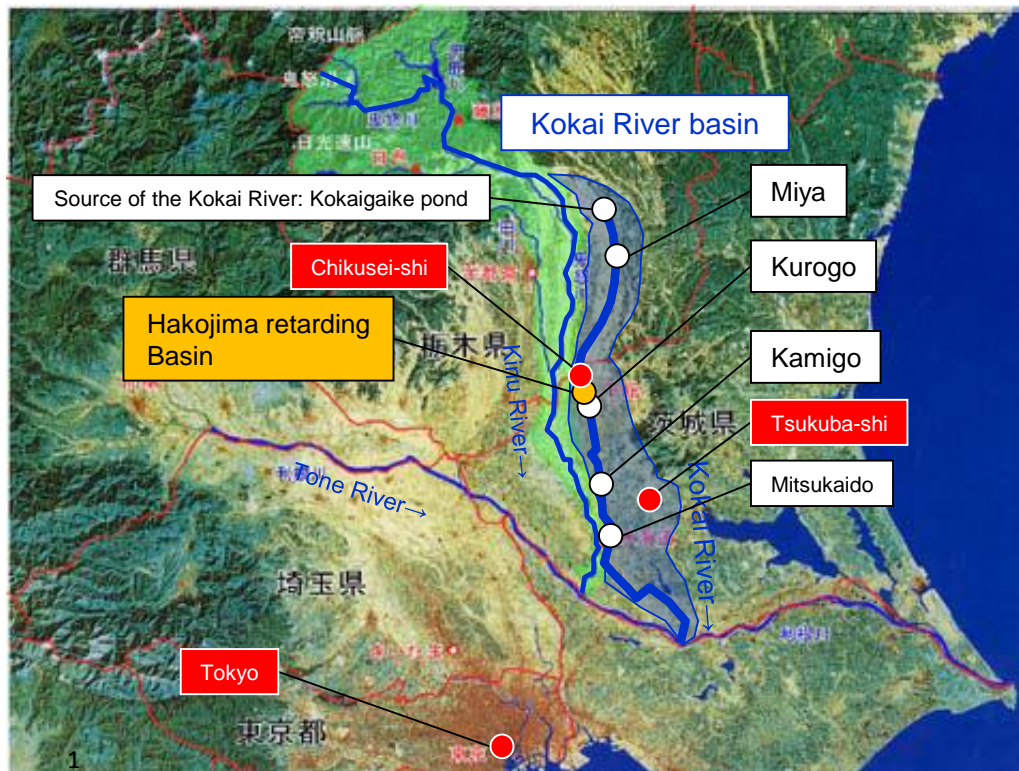
Shimodate River Office, Ministry of Land, Infrastructure,
Transport and Tourism

Kokai River and general description of the river

- General description
- River basin area: 1,043 km²
 - Length of the river: 112 km
 - Flatlands account for 71% of the basin.
 - Cultivated land accounts for 93% of the flatlands (658 km²).
 - The riverbed slope of the Kokai River is approx. 1/500 along the river's middle course in Chikusei city toward the upper course, and approx. 1/2,000 - 1/3,000 in the lower course.
 - The riverbed material mainly consists of sand and gravel in the upper course, and sand in the lower course.



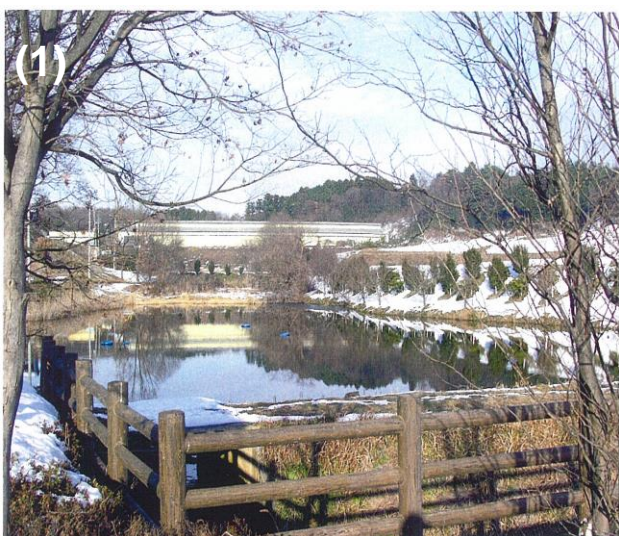
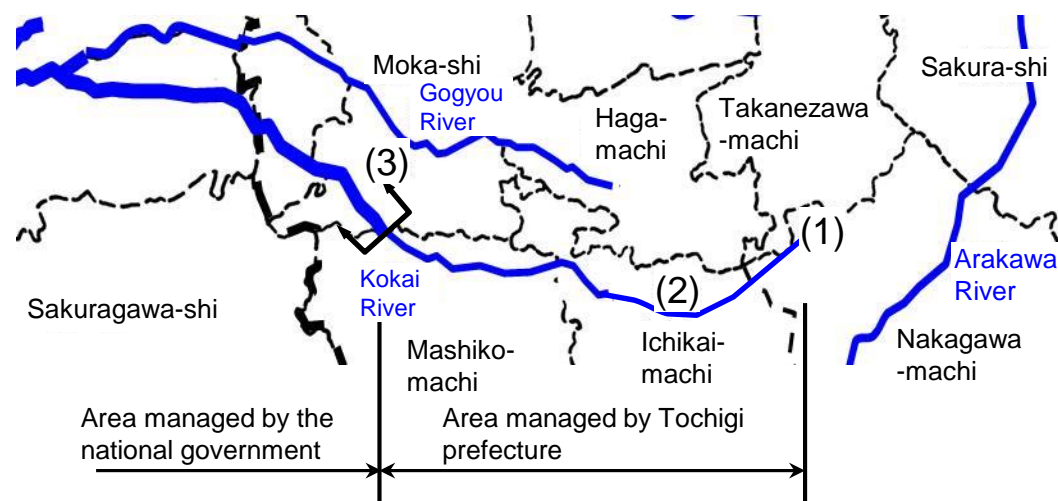
- Source of the Kokai River (Kokaigaike pond)
- The source of the Kokai River is Kokaigaike pond located in the Kitsuregawa hills (altitude: 187 m) in Oakane, Nasukarasuyama city, Tochigi prefecture.



Kokai River and general description of the river

Source and area of the upper course of the Kokai River

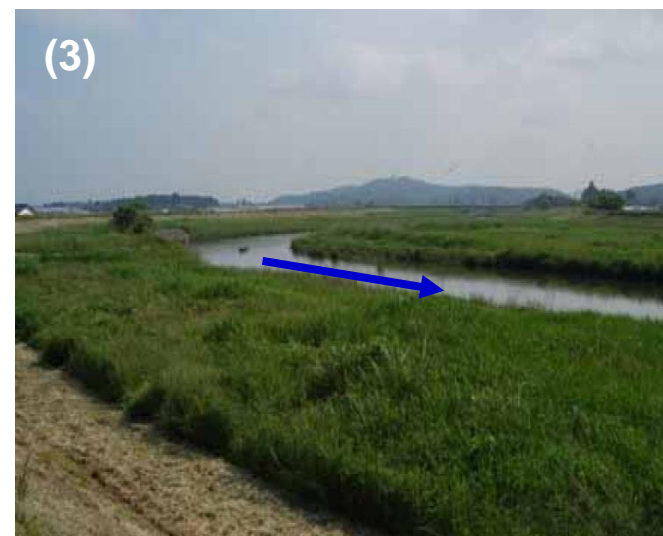
- In the area of the upper course managed by Tochigi prefecture, the river is lined with small hills and runs through the central area of the plain. Rice fields occupy almost the entire area (photo (2)).
- In the area of the upper course managed by the national government, the river widens to approx. 100 meters, and runs through a vast plain (photo (3)).



Source of the Kokai River
(Kokaigaike pond)



Area managed by Tochigi
prefecture (Ichikai-machi)



Area managed by the national
government (Moka-shi)

Kokai River and general description of the river

Area of the middle and lower courses of the Kokai River

- The Kokai River is wider along its middle and lower courses, and flows slowly through the plain. The grandeur of Mount Tsukuba characterizes the view from Chikusei city and Shimotsuma city (photo (1)).
- The riparian forest consists of *Quercus acutissima*, *Aphananthe aspera*, and *Celtis sinensis*, and forms a wet environment where various kinds of fauna and flora live and grow (photo (2)).
- Newly developed rice fields in the Kokai River basin require an irrigation water source. Consequently, such irrigation facilities as Fukuoka dam have been constructed (photo (3)).



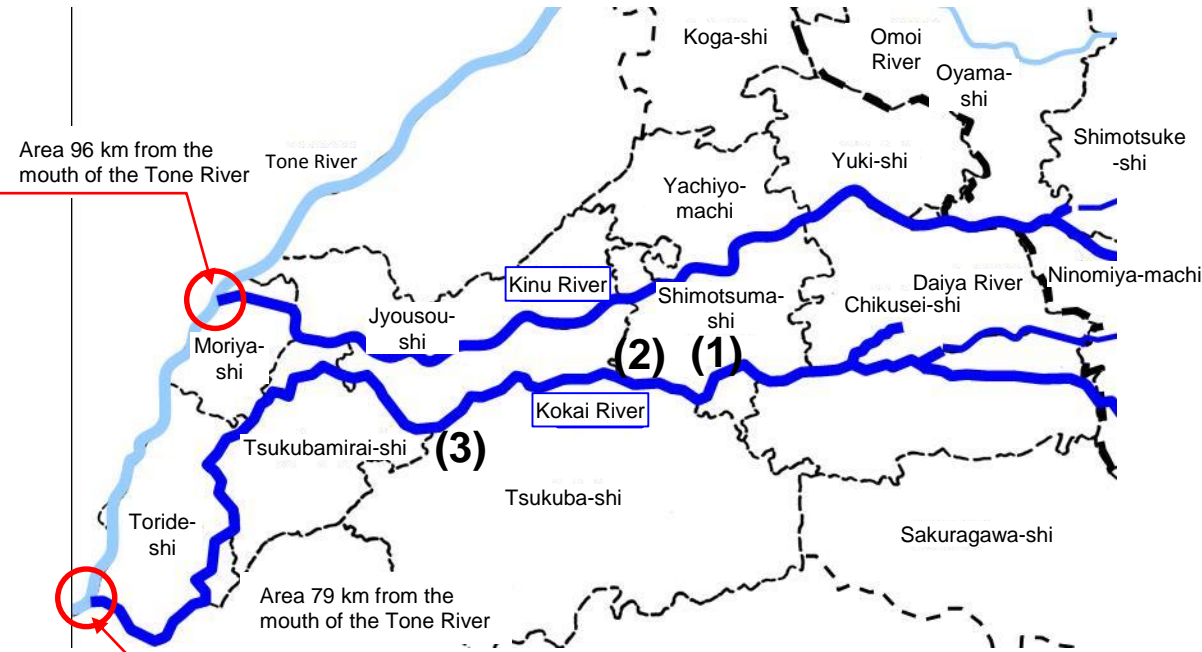
Area at 43 km along the middle course of the Kokai River
(with a view of Shimotsuma city and Mount Tsukuba)



Forest of Yokone at 47 km

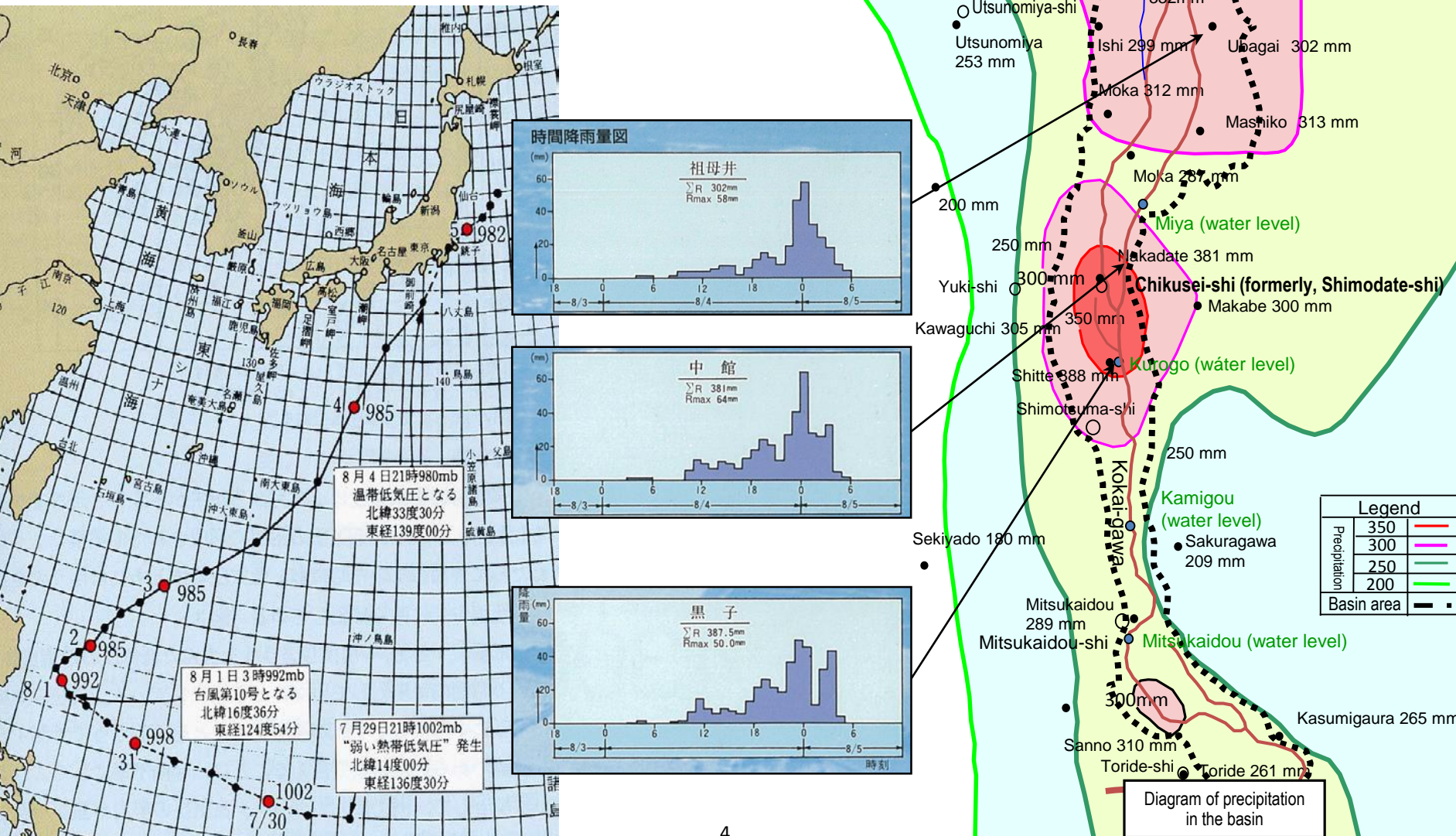


Fukuoka bridge at 27 km



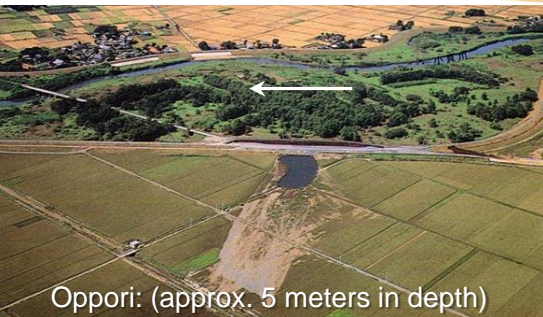
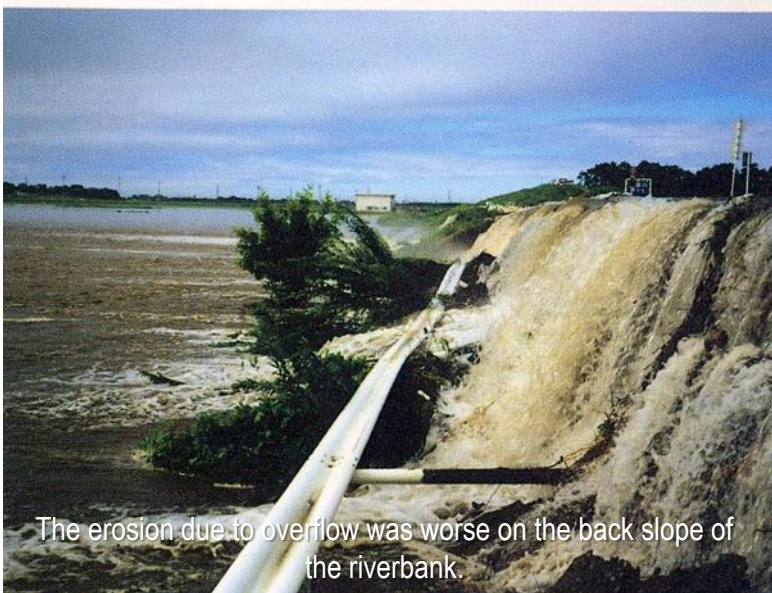
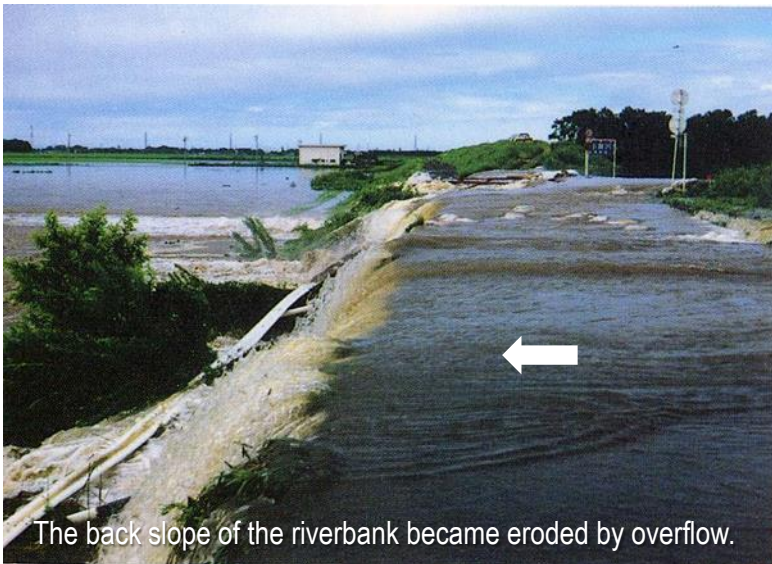
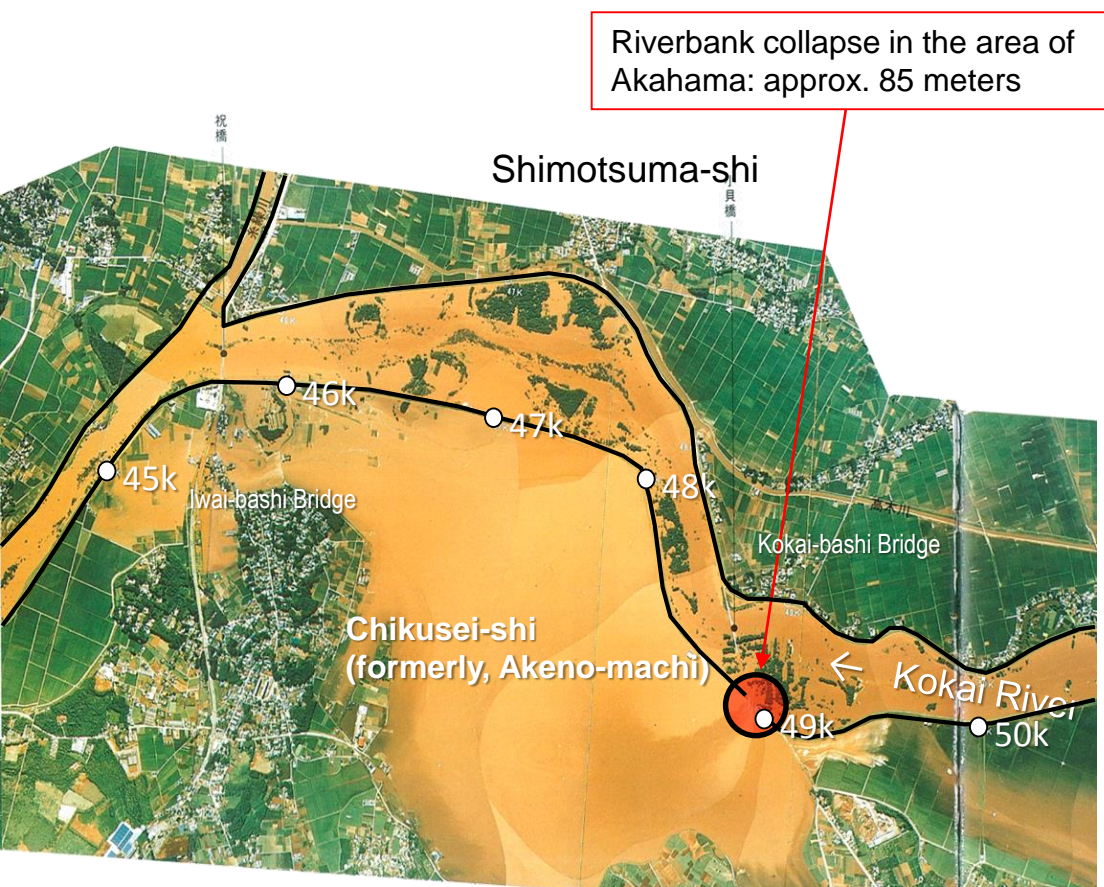
General description of rainfall that caused flooding in August 1986

Rain began to fall at around noon on August 4th due to Typhoon No. 10. Heavy rain continued until dawn the next day. The amount of rainfall accumulated in 24 hours exceeded 200 mm throughout the entire basin. In particular, record heavy rainfall with 24-hour precipitation exceeding 350 mm was observed in Chikusei city.



Flood damage in August 1986; collapse in the area of Akahama

At around 13:30 on August 5th, about 85 meters of the left bank of the Kokai River collapsed due to overflow at around 49 km (the area of Akahama in Shimouma city).



Flood damage in August 1986; collapse in the area of Hontoyoda

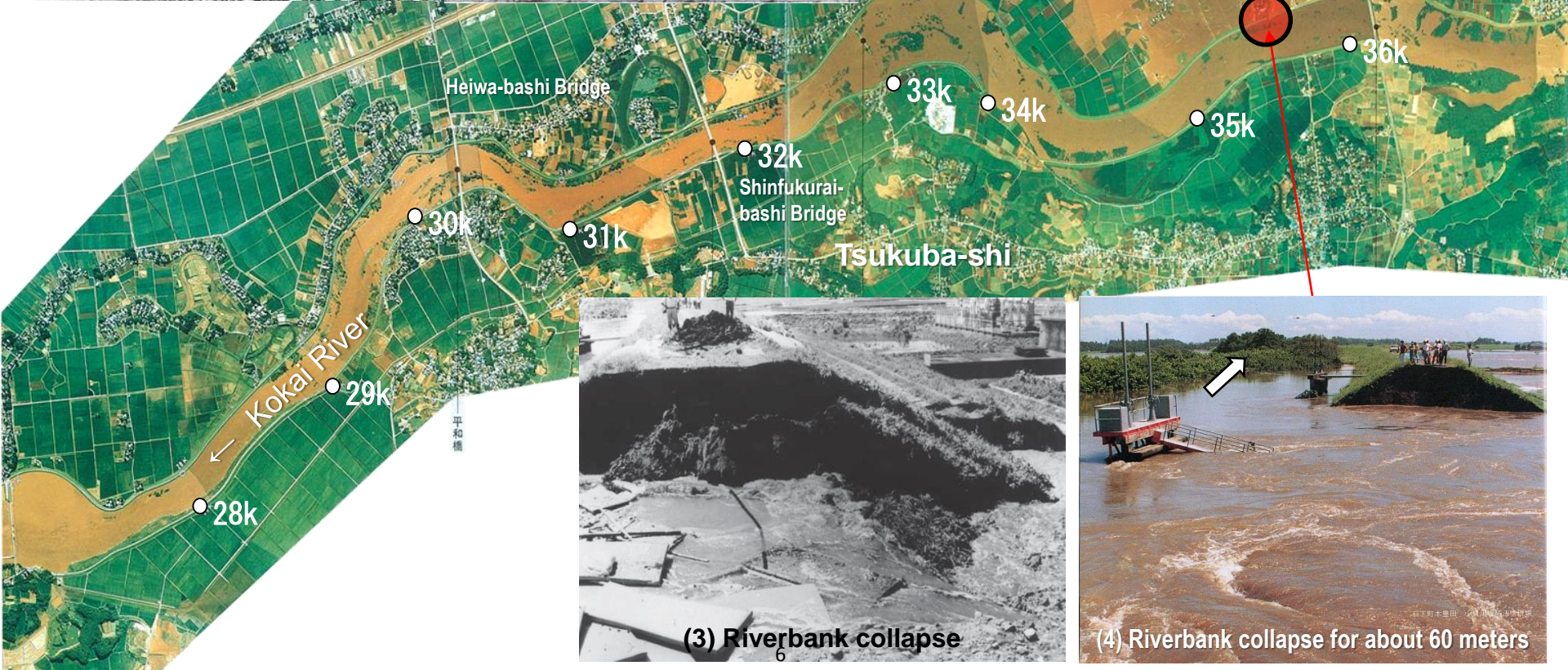
On August 5th, about 60 meters of the right bank of the Kokai River collapsed at around 35.5 km (the area of Hontoyoda in Joso city, formerly Ishige-machi).



(1) Riverside slope depressed



(2) The depression on the riverside slope became bigger.



(3) Riverbank collapse



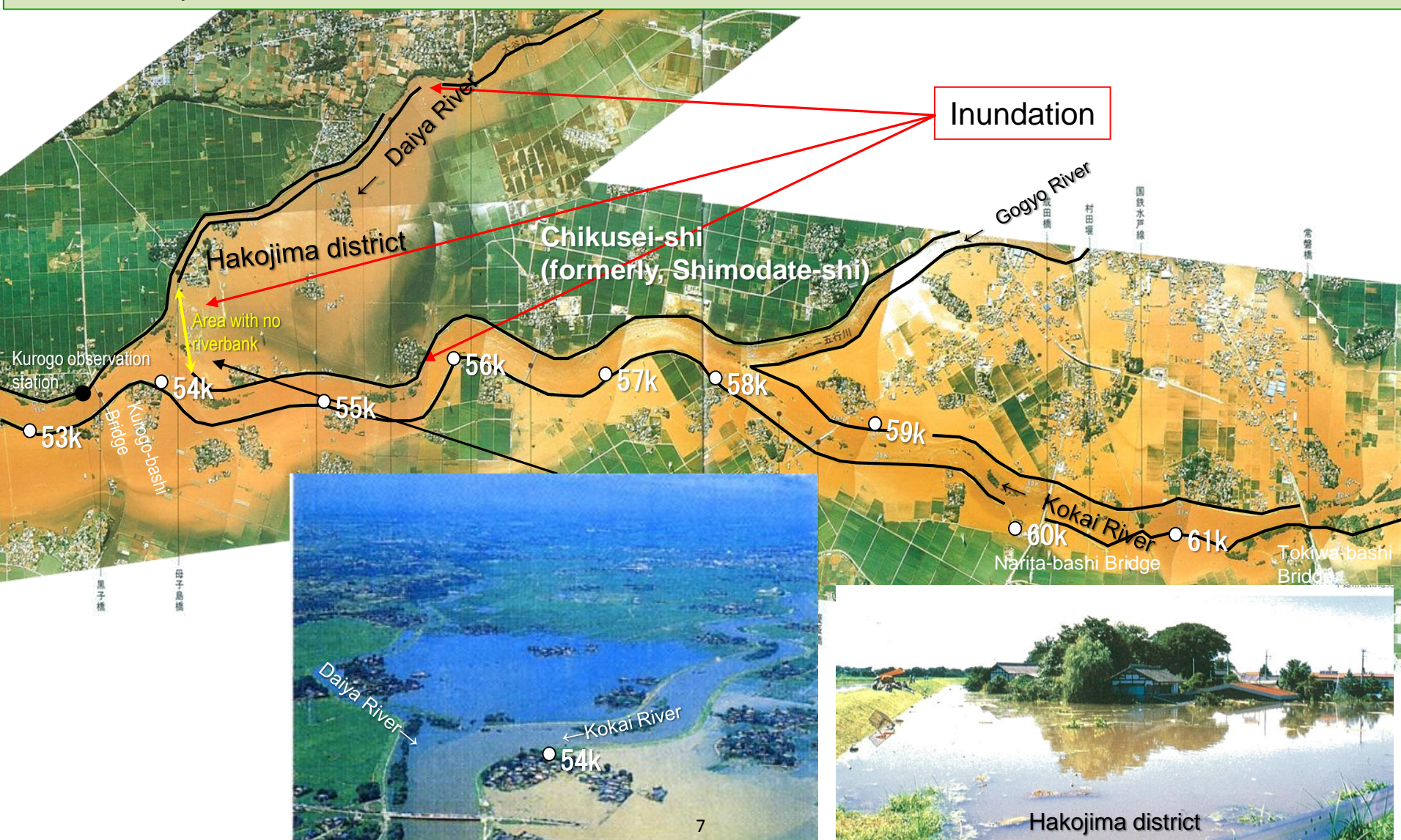
(4) Riverbank collapse for about 60 meters

Flood damage in August 1986; overview of damage (overflow of the Hakojima retarding basin)

Flooding in Kurogo, downstream of the Hakojima retarding basin:

- exceeded the warning water level (3.80 m) at 24:00 on the 4th.
- exceeded the estimated high-water level (6.08 m), and reached 6.86 m at 14:00 on the 5th.

This flood caused inundation in an area of approx. 4,300 ha, and about 4,500 houses were flooded, resulting in damage totaling about 45 billion yen.

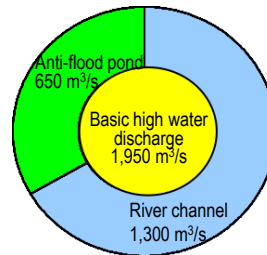


Flood control plan for the Kokoi River

- Plan before the floods in August 1986
1,300 m³/s at reference point Kurogo
Flow distributed to river channel: 1,300 m³/s

- When adopting the Special Emergency Projects for the Control of Severe River Disasters
- 1,500 m³/s at reference point Kurogo (Estimated flood flow rate of the floods in August 1986)
Flood control facility: 200 m³/s
Flow distributed to river channel: 1,300 m³/s

- Planned high water discharge
1,950 m³/s at reference point Kurogo
Flood control facility: 650 m³/s
Flow distributed to river channel: 1,300 m³/s



- Flood control facility
The river runs through the flatlands where no location is suitable for constructing a dam.



Construction of anti-flood ponds

Kokoi River watershed
Flatlands account for 71% of the watershed.
Cultivated land accounts for 93% of the flatlands.

From **technical** and **socioeconomic** standpoints regarding the **Hakojima anti-flood pond** in the watershed, the construction of anti-flood ponds at individual sites was selected as a **measure to mitigate flooding** ⇒ reduction by 650 m³/s (60 m³/s on Hakojima).

Diagram of planned high water discharge of the Kokoi River

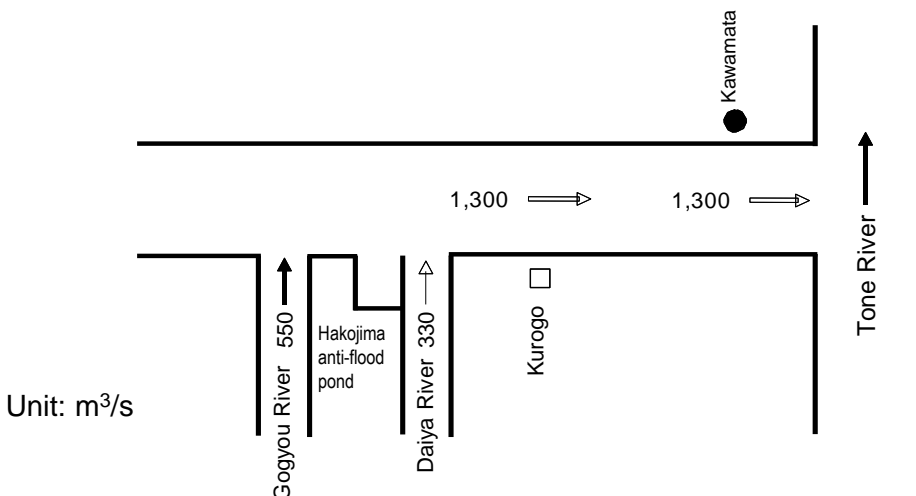
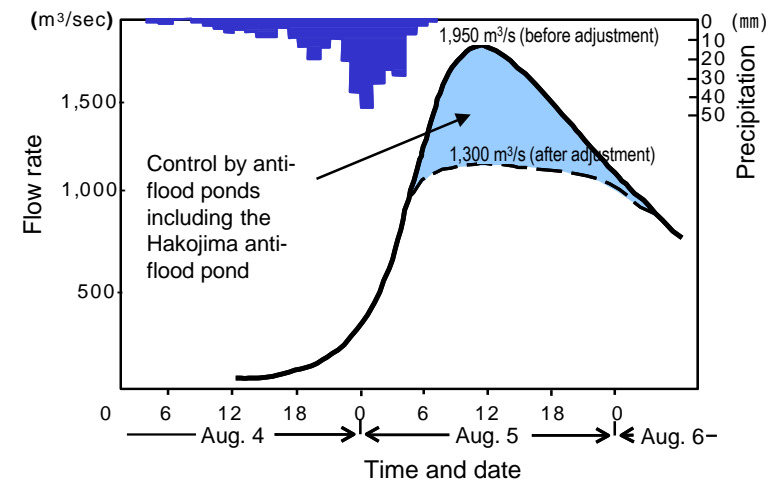


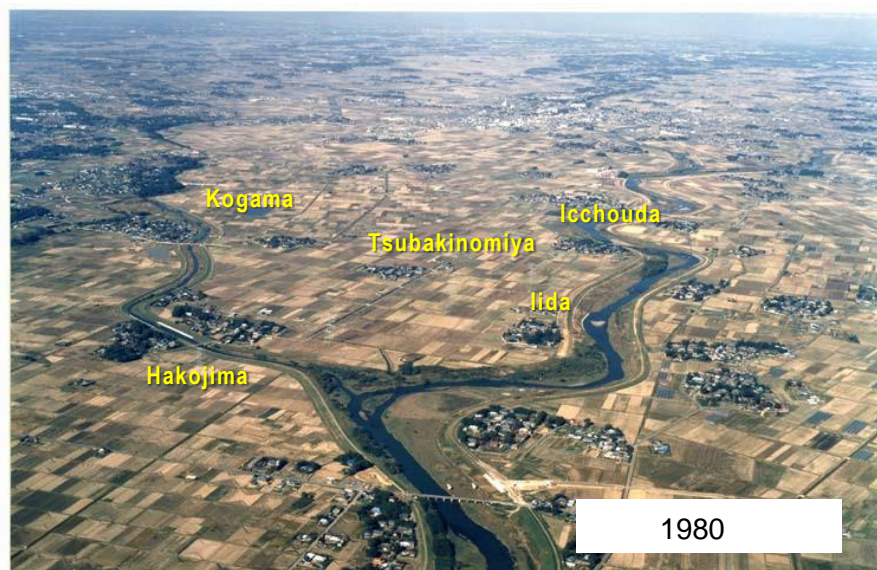
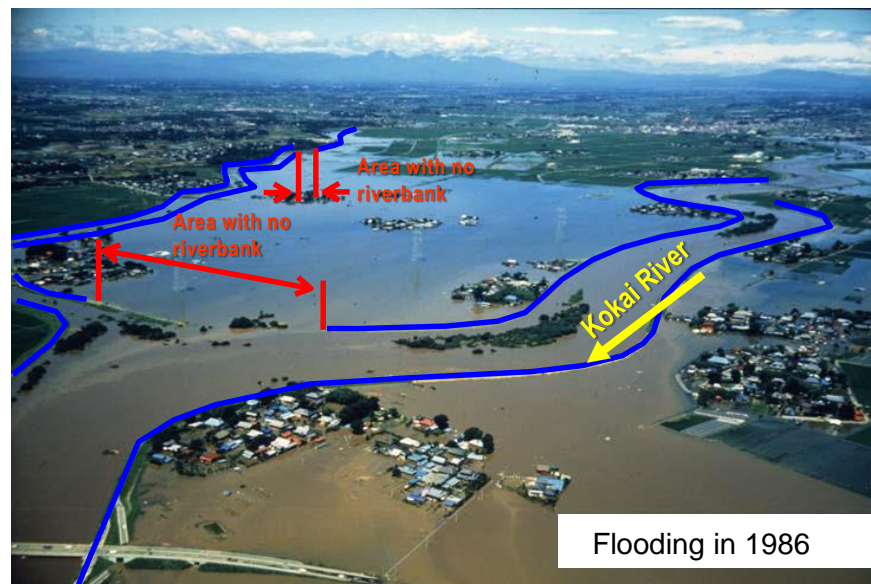
Diagram of planned high water discharge (Kurogo waveform diagram)



Hakojima retarding basin

- The floods in August 1986 flooded five settlements.
- For permanent flood control in the five settlements and improved safety in the watershed, the Special Emergency Projects for the Control of Severe River Disasters and the construction of anti-flood ponds were adopted (1986-1990).

September 1986	The Special Emergency Projects for the Control of Severe River Disasters of the Kokai River was adopted.	Retarding Basin Renovation of bridges Embankment, excavation, etc.
July 1987	Collective relocation decided.	
- FY1988	Acquisition of land for collective relocation completed.	
February – April 1990	Contract on land sales or exchange for land of collective relocation signed.	
March 1991 – March 1992	Relocation completed with some exceptions.	



Compensation

1) Relocation of residential areas

- Five residential areas (i.e. Hakojima, Iida, Icchouda, Tsubakimiya, Kogama) involving 109 families with 381 buildings are to be relocated.
- The opinion survey revealed that many residents desire collective relocation.
- Most residents are farmers.



- In order to promote smooth implementation of the project, **land for collective relocation was to be prepared in the Kogama area** that faces the National Route 294 bypass.

Area	Settlements to be relocated (5 settlements)	Land for relocation		
		Area	Height of embankment	Volume of embankment
160 ha	109 families with 381 houses	14.4 ha	Approx. 5.0 m	Approx. 0.81 mil m ³

- - "Promotion Committee for the Special Emergency Projects for the Control of Severe River Disasters," an organization formed by relocated residents in the five areas
 - "Committee of Voters for the Special Emergency Projects for the Control of Severe River Disasters of the Kokai River," an organization formed by four settlements that own land in the planned area
 - "Shimodate City Office for the Special Emergency Projects for the Control of Severe River Disasters"
- Arrangements were made for the three organizations above to smoothly proceed with the project.



2) Relocation of the graveyard

- Request on location and configuration from local residents

- Local residents formed a graveyard committee to discuss the location and configuration of the relocated graveyard. **The ground level of levees surrounding the Daiya River was raised for said relocation.**



3) Relocation of barns for cattle and pigs

- Nuisance facility (odor)
- Objection from neighboring settlements

- Barns for cattle were to be relocated to public land near the Hako Island anti-flood pond that secures easy access for the animal owners, after raising the ground level. The barns for pigs did not need relocation as the owner closed the business.



4) Land of anti-flood ponds

- Maintain current land use.
- Minimize the purchase of land.

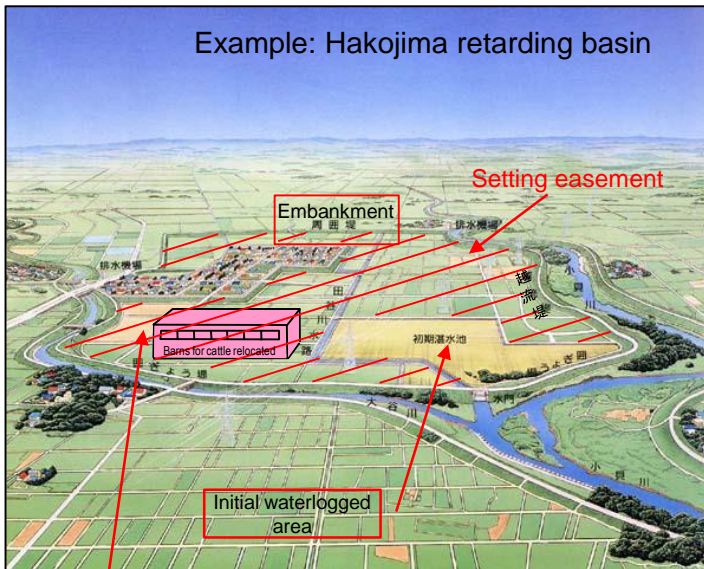
- Production activity on excellent farmland was maintained through compensation and by settling easement.
- The purchase of land was minimized and limited to embankments and the initial waterlogged area.

What is an easement method?

What is an easement method for retarding basin?

- Accommodate any floods caused by the installed reservoir.
- Ban the installation of workpieces and other actions that hinder maintaining the function of anti-flood ponds.
- Decide on a proper socioeconomic easement price by referring to the opinions of experts.

Example: Hakojima retarding basin



Ban on the installation of workpieces and other actions that hinder maintaining the function of retarding basin

Setting easement for waterlogged area

Easement was set at 25% of the purchase price in reference to the following:

- 1) Price difference due to removed embankments of land: 21 - 30%
- 2) Easement of compensation for under line of Tokyo Electric Power Company Fukushima Higashi main cable: 22%
- 3) Surface rights of Water Resource Development Corporation (Kasumigaura Service Water): 30%
- 4) Compensation for under line of Tokyo Electric Power Company: 25 - 30%
- 5) Two real estate appraisers: 25% (decided by referring to experts)