THE MIE CANAL PROJECT

【Project History】 Main project history is the following.

Aug.1951	The Mie Canal Project Request Union is established.
Oct.1951	The Kiso River System Comprehensive Irrigation Office is opend.
	The Water Use Research is started.
Apri.1964	The Design of the National Mie Canal General Execution is started.
Dec.1965	The National Mie Canal Land Improvement Project Commencement is adopted.
Aug.1966	The Mie Canal Land Improvement District is authorized.
Oct.1966	MOAF(Ministry of Agriculture& Forestry) Irrigation Water Use Office is opened.
Feb.1971	Directive of the Project Execution Principle is given.
Mar.1971	Above plan is approved and succeeded by MOAF.
	The Mie Canal Project Office is started.
Mar.1972	The Nakazato Dam construction is started. (completion is Mar.1977)
	Multipurpose Main Canal construction is started.
Jan.1977	Directive of Project Execution Principle is given. (the first policy is changed)
Jun.1977	The Miyakawa Dam construction is started. (completion is Mar.1980)
Mar.1978	Directive of Project Execution Plan is authorized.(the first plan is changed)
	The Kasado Dam construction is started. (completion is Feb.1983)
Jan.1983	The Inabe Multipurpose Main Canal construction is started. (whole completion is Mar.1986)
Jun.1983	Multipurpose Main Canal from the Nakazato Dam to the Miyakawa Dam is complete.
Apr.1984	Paddy field irrigation water supply is provisionally started.
Mar.1986	The Uchiage Dam construction is started. (completion is Jul.1989)
	The Komono Dam construction is started. (completion is Oct.1989)
Apr.1986	Tado industrial water supply is provisionally started.
Mar.1987	The construction of Multipurpose Main Canal from the Miyakawa Dam to the Yuge Diversion Works is complete.
Jul.1990	Directive of Project Execution Principle is given. (the second principle is changed)
Aug.1990	Directive of Project Execution Plan is authorized. (the second plan is changed)
Apr.1991	Domestic water supply is provisionally started.
Mar.1993	Directive of Facilities Management Principle is given.
	Authorization of Facilities Management Regulation is approved.
Apr.1993	The Mie Canal Office & Management is established.
Oct.2003	Japan Water Agency is founded.

【Construction Period and Construction Cost】

Construction Period Apr1964 ~ Mar1992

Total Cost 100 bil. Yen

The construction cost sharing is the following, pie graph fig.1

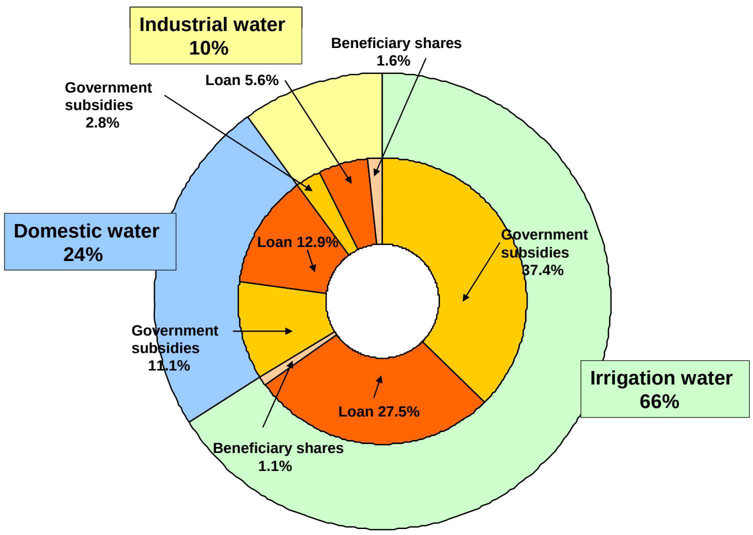


Fig.1 Construction cost sharing

【Overview of the Mie Canal Project】

Mie Prefecture is located in Japan and is adjacent to Aichi Prefecture. In Northwest Mie is a very large rice field that spreads from the foot of the Suzuka Mountains to the Ise-bay. Even though the farmers' main sources of water were springs, small reservoirs, creeks and rivers, it was necessary for farmers to protect their sources so that they were guaranteed water in the future. In addition, in the fields at the foot of the mountains, farmers didn't have any water source at all, and they strongly favored reclamation so that they didn't have to continually depend on rainfall.

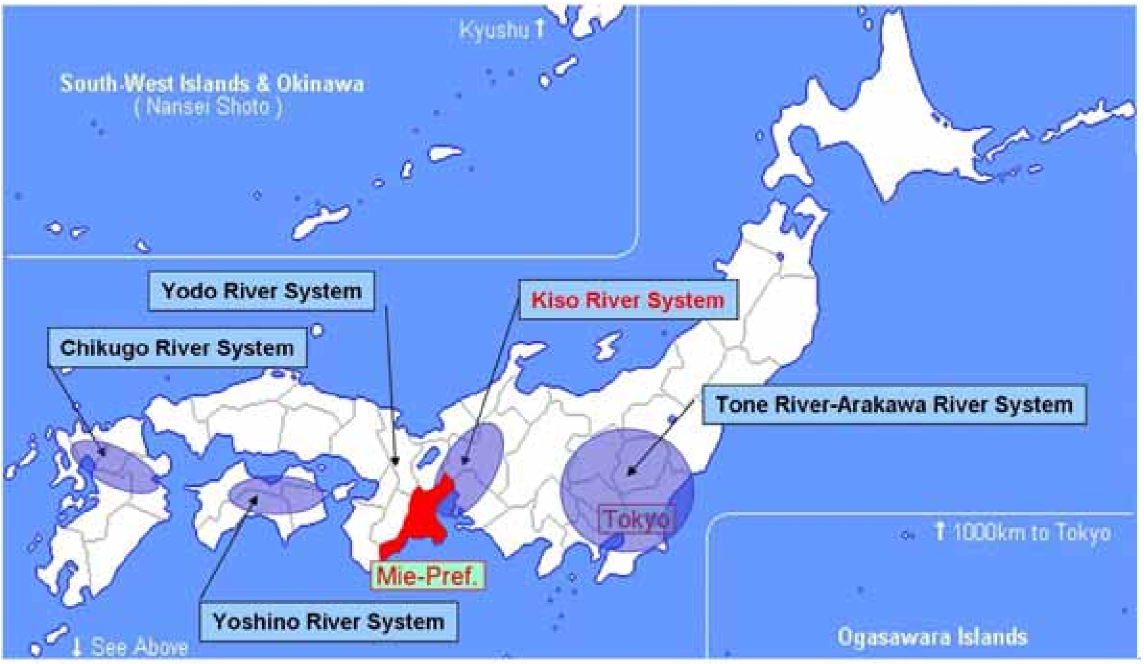


Fig. 2 Location of Mie prefecture

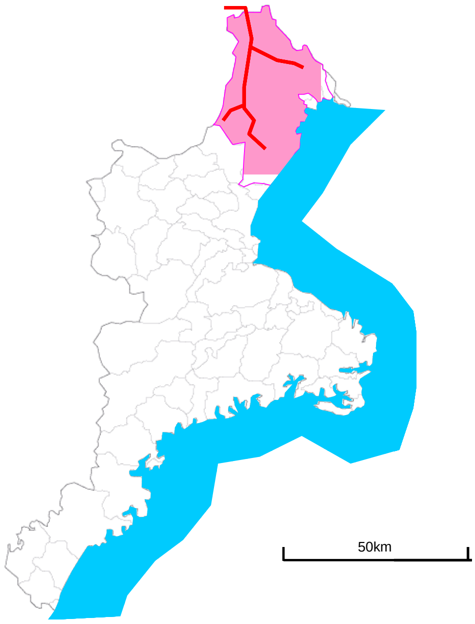


Fig.3 Mie prefecture and location of the Mie Canal Project

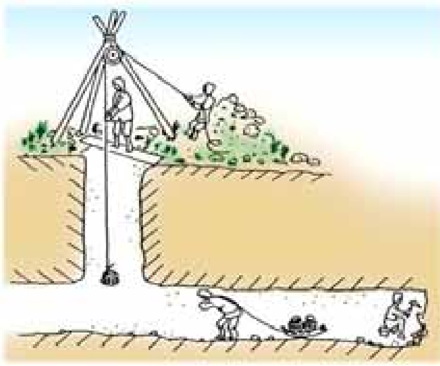
On the one hand, with industrial development and the increase in the population in this area, the demand for water had increased, and the lack of water had become an urgent problem.

The Mie Canal Project was introduced in response to this problem. The project is as follows:

Water is taken from the Makita River, which belongs to the Ibi River tributary of the Kiso River system in Gifu Prefecture, and diverted to the Nakazato Dam Reservoir. Also, the water from the Inabe River, the Kouchidani River, and the Hie River, all flowing into Mie Prefecture, is diverted.

In addition, we built the multipurpose main canals to connect with the Miyakawa Dam, the Komono Dam, and the Kasado Dam. Water from the Tabika River, the Mitaki River, the Utsube River, and the Onnbe River is stored in the Komono and the Kasado Dams.

Manbo(kind of qanāt)



Digging Manbo by hand

Spring

Small reservoir

Fig. 4 before the construction of the Mie Canal

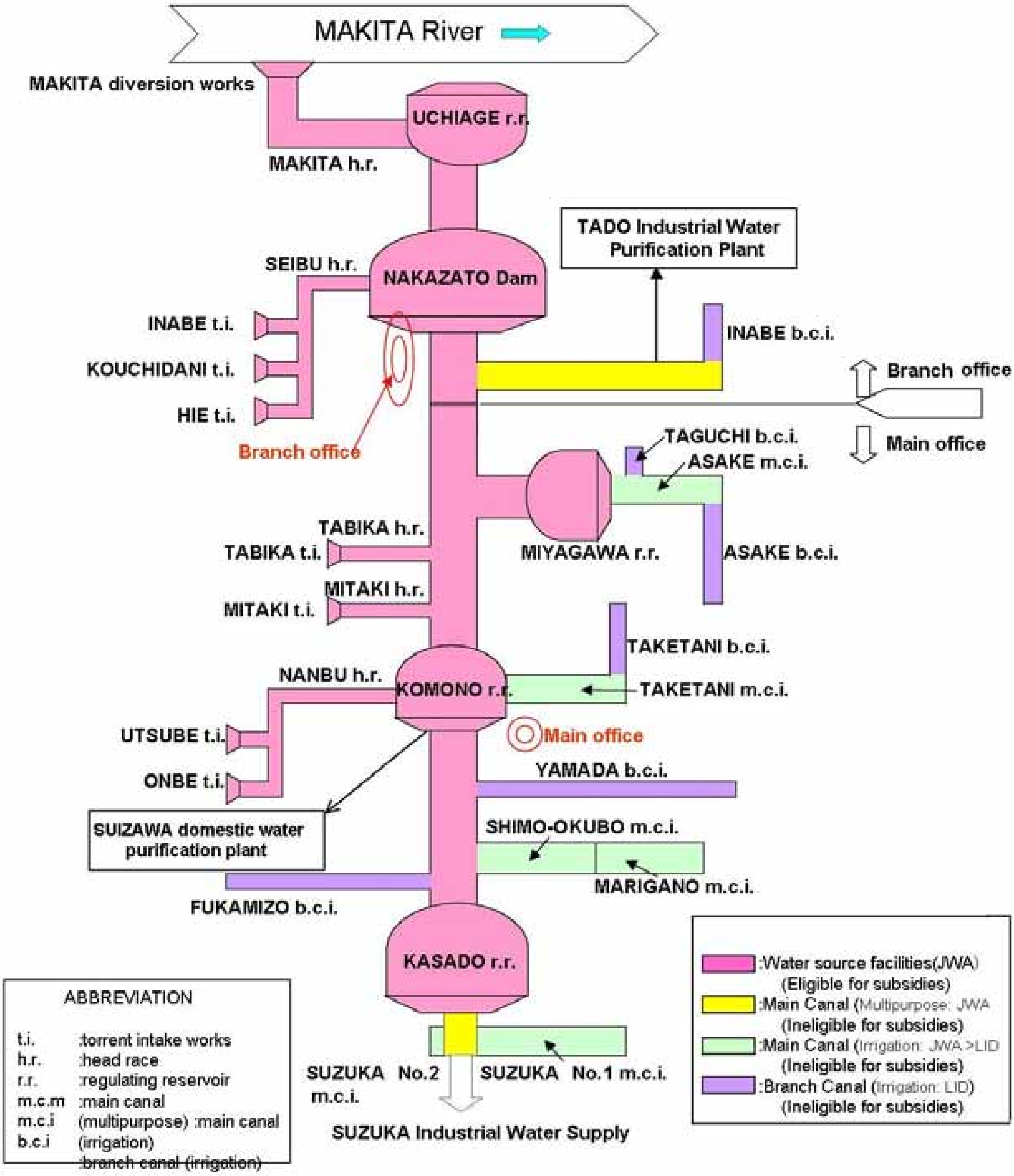


Fig.5 Schematic view of the Mie Canal Project General Plan

By instituting the plan above, we supply a maximum of 5.99m^3/s of irrigation water for 7300ha of farmland near four cities and two towns. In addition, we supply a maximum of 0.194 m^3/s of industrial water and a maximum of 0.668m^3/s of domestic water to a water purification plant.

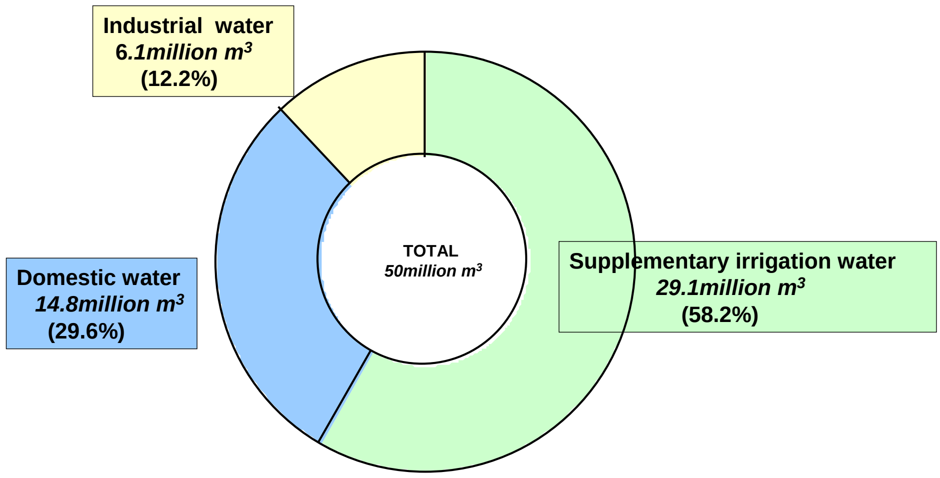


Fig.6 Annual Irrigation Water Source Plan

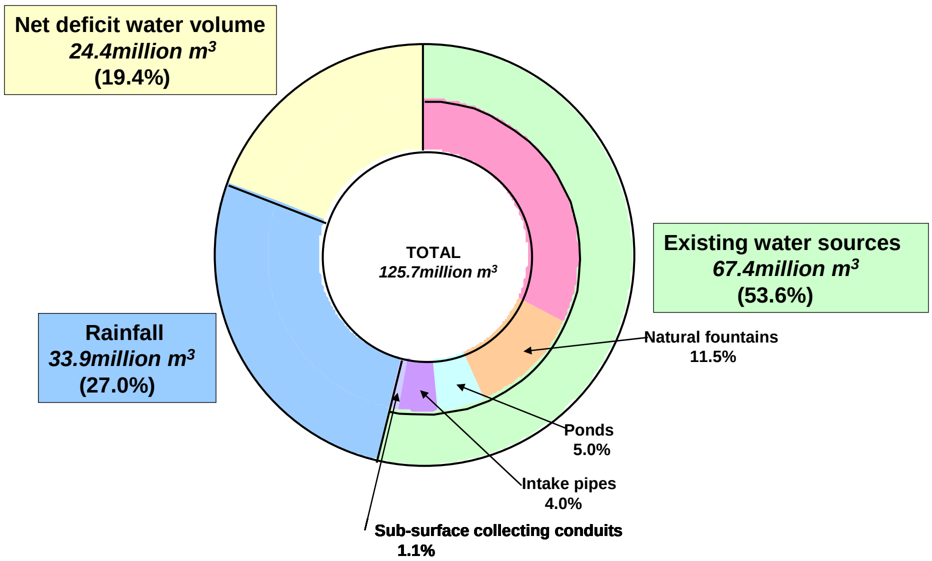


Fig.7 Annual Irrigation Water Source Plan

【Dams and Reservoirs】

The purposes of the Uchiage Dam, the Nakazato Dam, the Miyakawa Dam, the Komono Dam, and the Kasado Dam are the following.

Name of dam	Purpose of dam
UCHIAGE	The purposes of the Uchiage Dam are the following. This dam stores the water ($5m^3/s$ at the maximum) drawn from the Makita River and supplies the coast of the Makita River. In addition, the water is conducted into the Nakazato Dam with $5m^3/s$ at the maximum, 10 mil.m 3 per year.
NAKAZATO	The purpose of this dam is to store the water of the self-basin and, in addition, water conducted from the Makita River, the Inabe River, and the Kochidani River. Stored water is supplied to the user area. Furthermore, water from this dam supplies water to the Miyakawa Dam, the Komono Dam, and the Kasado Dam when necessary.
MIYAKAWA	The purpose of this dam is to store water, from a self-basin and conduct it from the Nakazato Dam; it also conducts paddy field irrigation water from the Miyakawa Regulating Reservoir through the Asake Irrigation Canal.
KOMONO	This dam is located in the center of the Mie Canal Project. The purpose of this dam is to store and conduct the water from the Naakazato Dam, the Tabika River, the Mitaki River, the Utsube River, and the Onnbe River. The water is supplied as irrigation water through the Taketani Irrigation Canal and is used as domestic water purifying it.
KASADO	This dam is located at the end of the project. The purpose of the dam is to store the water of the self-basin and conduct it into the Komono Dam. The stored water is used for irrigation and industry in Suzuka city.

The specification of five dams and reservoirs are the following.

Name of dam	Catchment area		Nomal water level	Effective storage ($1,000m^3$)	Type of dam	Heigh of dam (m)	Lengh of crest (m)	Volume of dam body ($1,000m^3$)
	Direct (km^2)	Indirect (km^2)						
UCHIAGE	1.4		EL.213.1m	2,200	Zoned earth	29.7	140.0	620
NAKAZATO	4.0	42.7	EL.192.0m	16,000	Zoned earth	46.0	985.0	2,970
MIYAKAWA	1.8		EL.125.2m	800	Zoned earth	27.0	350.0	390
KOMONO	0.8	34.3	EL.124.5m	1,600	Zoned earth	28.4	674.0	990
KASADO	6.9		EL 46.8m	3,000	Zoned earth	28.7	310.0	520

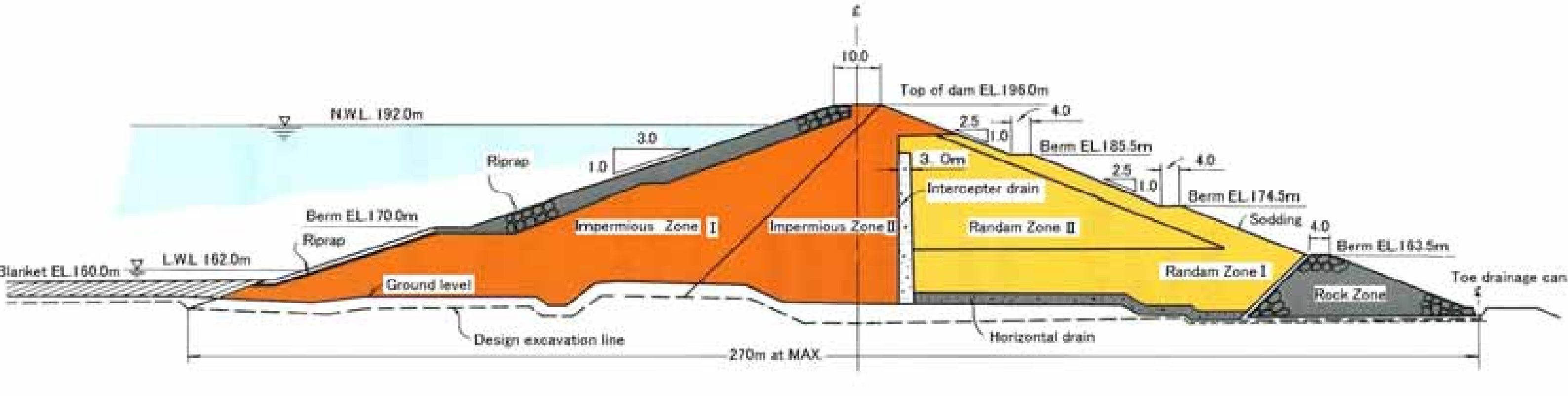


Fig8. Typical cross section of the Nakazato Dam

【Canals】

The canals in the Mie Canal Project are shown the following tables.

＜Multipurpose Main Canal＞

Name of Canal	Design canal discharge (m^3/s)	Length (m)	Kind of canal (m)							
			Flume	Tunnel	Inverted siphon	Closed conduit	Aqueduct (pipe)	Aqueduct (flum)	Regulating weir	Inlet
Multipurpose Main Canal	7.3〜2.5	41,920	1,830	13,630	24,400	1,330	200	110	330	90
Inabe Multipurpose Main Canal	1.7	17,410	0	1,330	16,080	0	0	0	0	0
Total		59,330	1,830	14,960	40,480	1,330	200	110	330	90
Ratio of kind of canal (%)		100	3.1	25.2	68.2	2.2	0.3	0.2	0.6	0.2

＜Main Irrigation Canal＞

Item \ Name of canal	ASAKE	TAKETANI	SIMO-OOKUBO /MARIGA	SUZUKA	Total
Design canal discharge (m^3/s)	1.68	1.41	0.43	3.26	-
Diameter of pipe (mm)	1,000	900	600	1,650	-
Length (m)	9,380	5,960	3,010	4,280	22,630

＜Branch Irrigation Canal＞

Item \ Name of canal	INABE	TAGUCHI	ASAKE	TAKETANI	YAMADA	FUKAMIZO	Total
Length (m)	9,450	1,460	6,970	7,760	11,310	6,590	43,540

＜Diving Channel＞

Name of h.r. / Item	MAKITA River h.r.	Nortern Toreent Intakes h.r.	Sourtern Torrent Intakes h.r.	TABIKA River Intake h.r.	MITAKI River Intake h.r.	total
Design canal discharge (m^3/s)	5.0	4.3	3.2	1.4	2.7	-
Length (m)	4,581	4,791	8,033	44	1,804	19,253

【Intake Work on the Torrent Streams】

Water from eight small or medium-sized streams in the foothills of the Suzaka Mountains is carried to the Nakazato Dam, the Miyakawa Dam, and the Kasado Dam through both tunnels and a canal.

When diverting water, it is important that we don't infringe on vested water users downstream and that we set the limited intake flows at each of the eight rivers during irrigation or non-irrigation periods, and that we give priority to letting water run downstream, and that we not take over the limited intake flow amount for compulsory hydraulic facility systems.

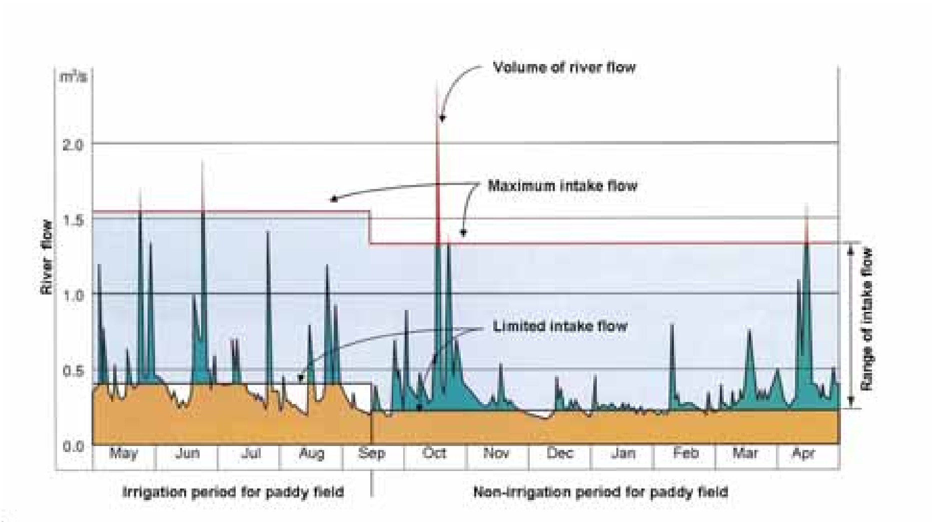


Fig. 9 Principal rule of taking water (the relation of river water, limited intake flow and maximum intake flow)

【Types of Intake Works on the Torrent Streams】

The eight torrent streams have small catchment's areas and have rapid currents, and they reach flood stage and low water levels very rapidly. The river runoff contains a lot of sand, gravel, and logs. We designed each intake facility to be suitable to each stream, testing the hydraulic model on weirs and channels. Based on experience with tentative management, we constructed the intake facilities, improving them as necessary. The types of intake facilities are as follows:

Name of intake works	Name of intake	Catchment area (km^2)	Type(*)	Limited intake flow		Maximum intake flow(m^3/s)
				Irrigation period(m^3/s)	Non-irrigation period(m^3/s)	
Makita River diversion	Makita River	26.0	Fixed weir	1.20	0.32	5.0
Northern torrent intake works	Inabe River	5.9	Tyrol→Tyrol II	0.29	0.11	1.2
	Kouchidani River	6.6	Back-stream →Tyrol II	0.43	0.23	2.6
	Hie River	2.8	Back-stream →Tyrol II	0.13	0.05	0.5
Central torrent intake works	Tabika River	6.6	Tyrol II	0.26	0.13	1.4
	Mitaki River	11.1	Tyrol II	0.46	0.29	2.7
Southern torrent intake works	Utsube River	7.1	Tyrol	0.25	0.14	1.5
	Onnbe River	9.5	Natural intake	0.54	0.18	1.7

*before or after improvement

<Tyrol Intakes>

This type of intake was constructed in rivers where soil saving dams (Sabo dams) were installed upstream, where the water routes were stable, and where there wasn't much gravel in the runoff. The water enters spaces between bars. The angle of the bar screens is about 30°.

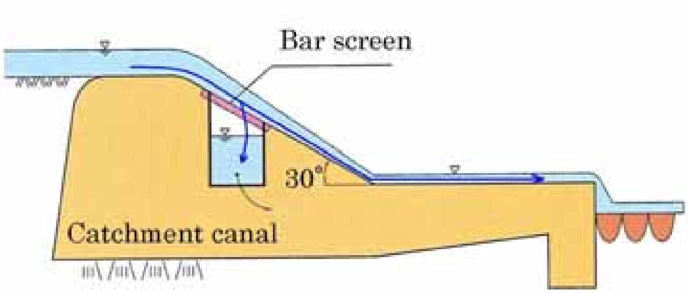


Fig10. Tyrol Type

<Back-stream Intakes>

This type of intake was constructed in rivers with unstable water routes and lots of gravel in the runoff. The water enters the spaces between the bars and the pool in front of the bar screens. The angle of the bar screens is about 57°. The depth of the pool is about 1 meter.

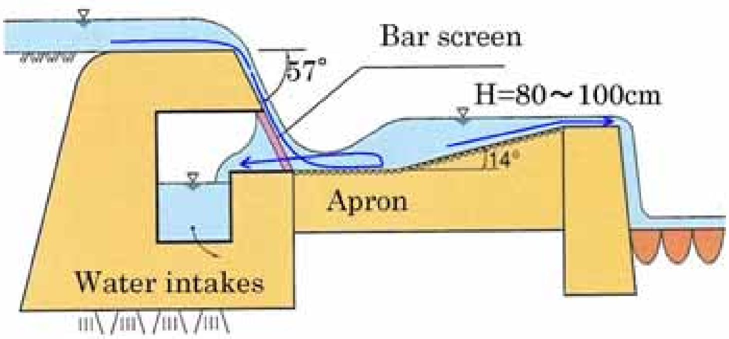


Fig. 11 Backstream Type

<Type II Intakes >

This type of intake was developed by Professor Mitsuo Yamamoto of Meiji University, who is the technical adviser for our project. Realizing our experience with tentative management, he suggested that the angle of the bar screens would be better if it were flatter-- about 45° --and if the depth of the pool was shallower-- about 50 cm-- to prevent a decrease in the intake efficiency from gravel filling the bar screens. This type of intake has both the merits of the Tyrol intake and the Back-stream intake. The Inabe River intakes work (i.w.), the Kouchidani River i.w., and the Hie River i.w. utilize this improved type of intake.

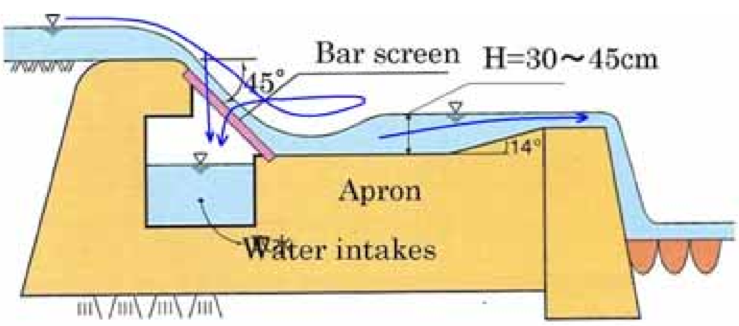


Fig. 12 Tyrol Type Ⅱ

Pic.1 Inabe River Intake

Incidentally, there is a waterfall above the Onnbe River intake; its intake uses the natural waterfall basin that already existed. The area around the Onnbe River intake is a national park, and we should protect the environment, the gates, the sand settling basin, and so on. All structures were constructed underground.

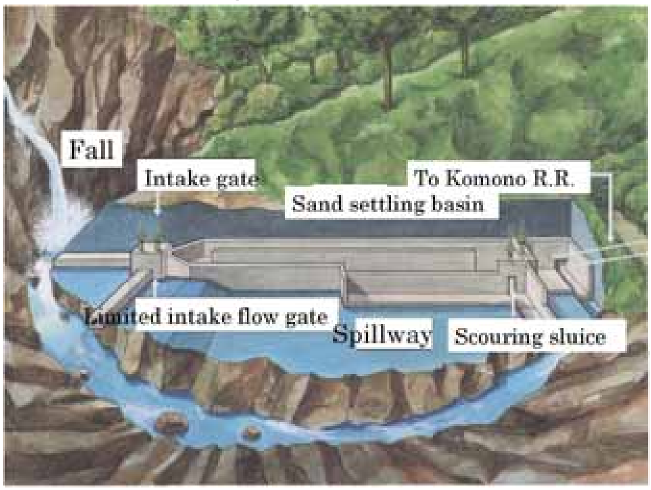


Fig.12 Onnbe Intake Facility by seeing through

【A Way of Taking Water from the Torrent Stream and Hydraulic Structure】

◎When the river water is less than the limited intake flow.

The river water is taken once and then is discharged immediately into the river by way of the discharge gate because the water cannot climb the uphill slope. In addition, the discharge gate is opened only twice: before and after the irrigation period.

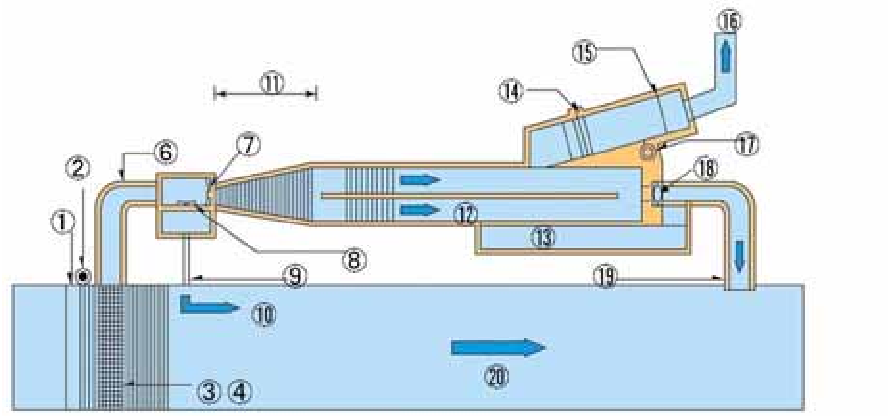
◎When the river water is more than the limited intake flow and less than the maximum intake flow.

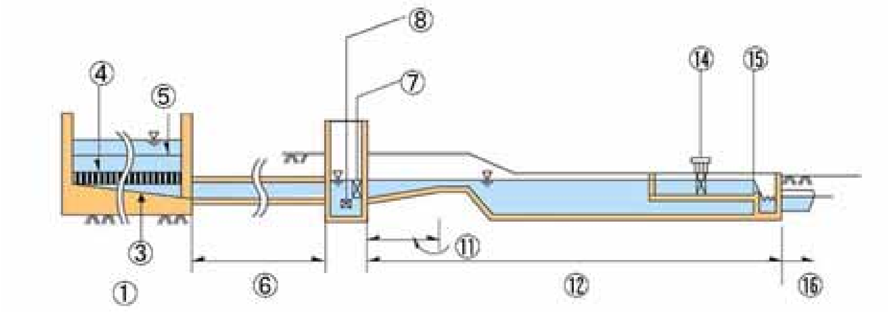
River water is taken, and the maximum limited intake flow is discharged as available water for downstream use. Only the water that makes it up the slope is diverted to the dam.

The sand and gravel that pass through the bar screen are deposited into the sand-settling basin before moving into the tunnel. When the discharge gate is open, the settled sand and gravel is drained away by the water.

◎When the river water is more than the limited intake flow and more than the maximum intake flow.

River water is taken and a limited amount of the intake flow is discharged for downstream use, and the maximum intake flow, which varies according to each river, is conducted to the dam. The maximum flow quantity is regulated by a fixed distributor.





＜Profile＞

①weir ②river water gage ③catchment cannel ④bar screen ⑤top of weir ⑥approach cannel ⑦intake gate ⑧limited intake flow gate ⑨discharge canal to river ⑩limited intake flow ⑪rectifying and uphill slope ⑫sand settling basin ⑬spillway ⑭distributor for limiting intake flow at maximum ⑮sharp crested weir ⑯diving tunnel ⑰water gage ⑱river

Fig.13 Mountain stream intake facility in the Mie Canal Project

【Management and Operation Facilities】

〇Characteristics of the Mie Canal Project

(1)Torrent Intake

These characteristics are noted above.

(2)Non-pumping System

Because most of the canals are tunnel, siphon, and pipe, it is possible to prevent people or garbage from entering the canal.

(3)Pipe Waterway

Because the multipurpose canal is higher than the irrigation area, the water can be carried to that area without using a pump.

(4) Canal Monitor Control System

To manage the much complicated facilities and save labors, we can monitor and operate them mainly.

(1989～2006) (2007～)

Fig.14 Electricity and Telecommunications equipment (operation room)

Our electricity and telecommunications equipment plays a key role in water management, which enables the collection of a large amount of data such as water levels reservoirs, canal discharge data, river water levels, rainfall at each facility, and so on. Gates and other equipment can also be operated remotely. All of this data is forwarded to our control office.

Due to age, our equipment was recently replaced with new equipment. Fig.13 above shows the operation room before and after an update. Fig14 below shows our Network of Telecommunications. The new IP network system is signified by a red line.

Characteristics of Electricity and Telecommunications Equipment:

1. We use an IP network and have updated all electricity facilities with TCP/IP.
2. We have the following electricity and telecommunications equipment:
 ・Water Control, Information Collection / Processing Device
 ・Surveillance Cameras × 15
 ・Telemetry, Mobile Radio, IP Telephone, Wireless LAN

The replacement of this equipment has improved our water management.

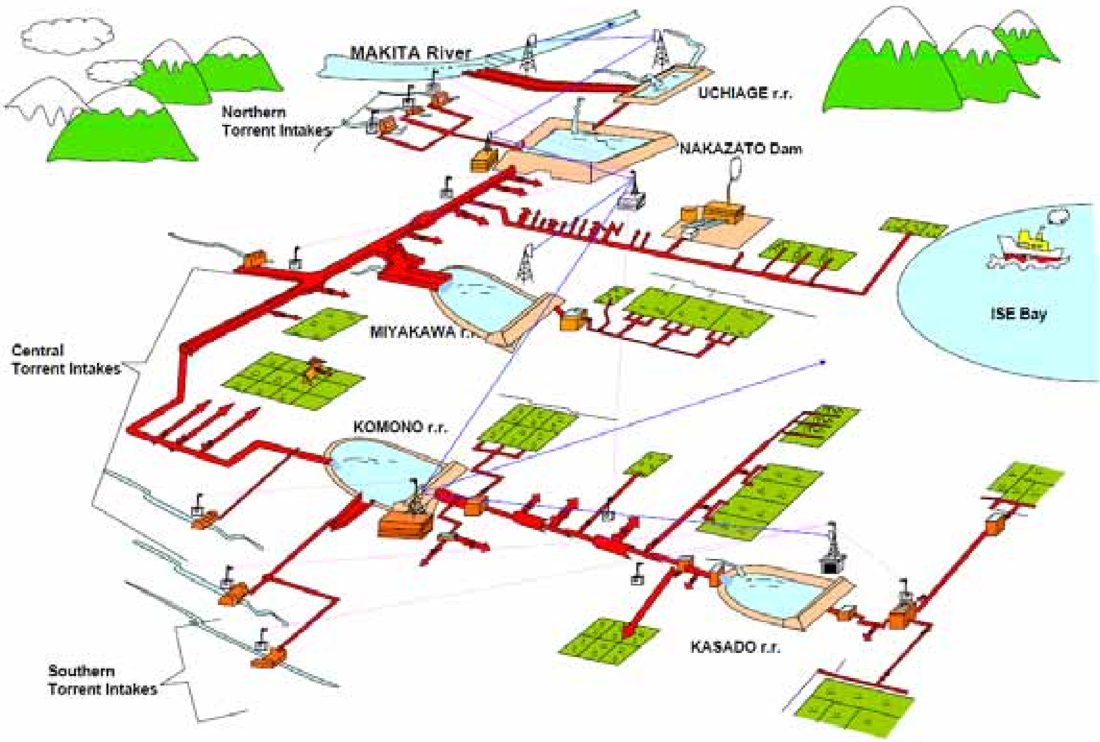


Fig.15 Electricity and Telecommunications equipment (Network of Telecommunications)