WATER FOR THE FUTURE

WATER RESOURCES DEVELOPMEMT PUBLIC CORPORATION
TOYOGAWA CANAL MANAGEMENT & CONSTRUCTION DPT.
440-0801 IMAHASHICHO 8, TOYOHASHI, AICHI, JAPAN TEL:0532-54-6501

ORGANIZATION

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● TOYOHASHI BRANCH OFFICE	441-3213	OHSAKA 993, NISHIAKAZAWA-CHO, TOYOHASHI, AICHI	(0532)23-2223
● OHSHIMA BRANCH OFFICE	441-1634	DAIMON 29-1, NAGASHINO, HORAI-CHO, MINAMISHITARA, AICHI	(05363)2-1838
● OHSHIMA DAM OPE. OFFICE	441-1603	SUGIMOTO 57-3, MYOGO, HORAI-CHO, MINAMISHITARA, AICHI	(05363)3-0515
● WATER SOURCE CONTROL OFF.	441-1601	OHSHIMA 26, KAWAI, HORAI-CHO, MINAMISHITARA, AICHI	(05363)3-0021, (05363)3-0702
● FURIKUSA H.W. OPE.OFFICE	449-0211	SOTO-TOMITA 4, NAKASHITARA, TOEI-CHO, KITASHITARA, AICHI	(05367)6-0224, (05367)6-1775
● OHNO CONTROL OFFICE	441-1615	HANASHI 48, OHNO, HORAI-CHO, MINAMISHITARA, AICHI	(05363)2-1079, (05363)2-2065
● KANSAGAWA H.W. OPE.OFFICE.	441-1945	OHMAGARI 38-5, KUROSE, HORAI-CHO, MINAMISHITARA, AICHI	(05363)5-1222
● TAHARA CONTROL OFFICE	441-3427	SHINKO 42-1, KAJI, TAHARA-CHO, ATSUMI, AICHI	(0531)22-0780, (0531)22-7917
● GOYU CONTROL OFFICE	441-0211	INOKUCHI 35, GOYU-CHO, TOYOKAWA, AICHI	(0533)87-2834, (0533)88-6366

REVISED EDITION (2001.3)

PROJECT OUTLINES OF TOYOGAWA CANAL

The Project, originally started in Sep. 1949 was solely for agricultural purposes as one of state-run projects. It went to a multipurpose one in 1958 by including domestic and industrial water supply, and was then handed over to Aichi Canal Public Corporation in 1961 for overall project construction including relevant local administration/group-run projects. The Project was completed in 1968. Since then, Water Resources Development Public Corporation (WARDEC) has been undertaking a systematic water management of the facilities, and has served much for the regional development.

Following to designation of Toyo River System as one of river systems for national water resources development in 1990, Toyogawa Canal Emergency Reconstruction Project was programmed for reconstruction of major worn-out facilities for water source, intake, regulating, etc. The Project was completed in 1998.

In order to take necessary measures against frequent water shortage in current years in the region, Toyogawa Comprehensive Canal Project, which had been implemented jointly by the Ministry and Aichi Public Enterprise Bureau of additional water resources, was handed over to Water Resources Development Public Corporation in June 1999.

Being passed over 30 years since start of water delivery by the Project, accidents such as water leaks or structural failures have so frequently come to appear that a new Toyogawa Canal Stage Ⅱ Project started in Dec 1999 for rehabilitation of the worn-out canal facilities.

Toyogawa Canal Management & Construction Office is, as of date, simultaneously implementing 3 programs; Toyogawa Comprehensive Canal Project, Toyogawa Canal Stage Ⅱ Project and overall management of Toyogawa Canal.

COMPLETED PROJECTS

Project	Const. year	Project cost
Toyogawa Canal	1949-1967	¥48,000,000,000
Emergency Reconst.	1989-1998	¥30,800,000,000

CHRONOLOGY

1949 SEP	Toyogawa Canal Project Office of the Ministry established. Ure Dam started construction. Beneficial 10,469ha.
1954 APR	Revision of the Project plan (first revision). Beneficial 12,474ha.
1958 MAY	Agreement on supply from Sakuma Dam concluded.
	2nd revision of the Project plan. Beneficial 21,330ha. Domestic & industrial water supply newly included.
DEC	Ure Dam completed. Ohno Headworks & Ohno Link Canal started construction.
1961 SEP	Aichi Canal Public Corporation succeeded the project.
	Project plan : beneficial 21,884ha, and domestic & industrial water supply.
1967 DEC	Revision of the Project plan : beneficial 20,182.5ha, and domestic & industrial water supply; total project cost ¥48,800million.
1968 APR	Toyogawa Canal Management Office opened.
OCT	The Office organization merged into WARDEC.
1972 APR	Study of Toyogawa Comprehensive Canal Project started by the Ministry.
1977-79	Overall engineering designs of the Project components by the Ministry.
1980 OCT	Toyogawa Comprehensive Canal Project Office of the Ministry established.
1986-88	Functional survey of Toyogawa Canal facilities.
1989 MAY	Toyogawa Canal Emergency Reconstruction Project newly designated for implementation.
	Study on Toyogawa Canal Stage Ⅱ Project started.
1990 FEB	Toyo River System designated as one of river systems for national water resources development.
MAY	Base plan for water resources development in Toyo River System approved in the Cabinet.
SEP	Toyogawa Canal Emergency Reconstruction Project started.
1993 NOV	Reconstruction of branch canals started.
1994 APR	Overall engineering designs of the Stage Ⅱ District newly approved by the Ministry.
1997 MAR	Original portions of the Reconstruction Project completed.
1999 MAR	The Reconstruction Project totally completed.
APR	Partial amendment of "Base Plan for Water Resources Development" in Toyo River System.
	Implementation policy for Toyogawa Comprehensive Canal Project instructed.
JUN	Toyogawa Comprehensive Canal Project succeeded by WARDEC.
DEC	Toyogawa Canal Stage Ⅱ Project started construction.

SYSTEM MANAGEMENT

Toyo River System, water source of The Toyogawa Canal, is small in catchment and the flow alone can not meet water demands required in the downstream. The Project is therefore supplying water from a number of various sources (Ure Dam, Ohnyu and Furikusa trans-basin facilities, Sakuma Link Canal and 3 regulating reservoirs in main canal systems) and through 2 canal systems (one from Ohno Headworks and another from Muro-Matsubara Headworks).

For O&M of a number of water source facilities and a large sum of long canals, Management of Toyogawa Canal system consists of 3 major services; water delivery , maintenance & repair and property management. Water delivery service not only supplies water daily in precise manner as requested by users but also leads to and stores surplus river water in the wet periods into regulating reservoirs constructed in the canal systems. Maintenance & repair service conducts inspection, maintenance and repair of the facilities. Property management service undertakes cooperation with other near-by development programs, administration for maintaining the facilities and coordination with relevant irrigation plans on branch canal facilities.

Since FY1996, completed portions of Toyogawa Comprehensive Canal Project are under tentative operation in stepwise manner.

UNIQUE FEATURES IN WATER MANAGEMENT

①A small river basin and a large water demand, ② a small storage capacity and a large water demand, ③ a large rainfall variation in months (average 330mm/month in Jun-Aug while 50mm/month in Dec-Jan), and ④ a long open canal system.

MANAGEMENT OF PROJECT FACILITIES

CATEGORY		FEATURE					
DIRECT CONTROL	TOYOGAWA CANAL	URE-DAM	Eff.storage:	28.42mill.m³	Type: Conc. gravity; straight-spill	Dam height:	65m
			Dam length:	245.9m	Basin: 26.26km²	Max.release:	30.9m³/s
		OHNYU H.W.& LINK CANAL	Max. intake:	5m³/s	Weir type: Roller gated	Weir length:	30m
			Basin:	75.57km²	Canal: 2.6km		
		FURIKUSA H.W.& LINK CANAL	Max. Intake:	15m³/s	Type: Flap gated	Weir length:	34m
			Basin:	72.64km²	Canal: 6.1km		
		SAKUMA INTAKE	Max. intake:	14m³/s	Ann' l max.: 50mill.m³/yr	Canal:	14.2km
		OHNO H.W.	Max.intake:	30m³/s	Type: Conc. gravity; straight-spill	Dam height:	26m
			Dam length:	66.21m	Basin: 129.91km²		
		OHNO LINK CANAL	Length:	6.3km			
		MURO-MATSUBARA H.W.	Max. intake:	8m³/s	Type: Roller gated	Weir length:	181.2m
			Basin:	559.3km²			
		OHNO MAIN CANAL SYSTEM	EASTERN MAIN CANAL:	75.7km	WESTERN MAIN CANAL: 36km	Total:	111.7km
		MURO-MATSUBARA MAIN CANAL SYSTEM	MURO-MATSUBARA CANAL:	5.3km	MURO CANAL: 7.7km	MATSUBARA CANA L:	0.4km
		MITSUKUCHI Reg. Res.	Eff.storage:	0.2mill.m³	Type: Inclined core fill dam	Dam height:	12.5m
			Dam length:	280m			
		HATTACHI Reg. Res.	Eff.storage:	1.6mill.m³	Type: Center core fill dam	Dam height:	22.5m
			Dam length:	451.5m(with sub-dam)			
		KOMANBA Reg. Res.	Eff.storage:	0.8mill.m³	Type: Inclined core fill dam	Dam height:	24.6m
			Dam length:	187.5m			
		Common Branch Canal	2 branch canals:	2.9km			
	BY EMERGENCY RECONSTN	Water Source Structure	URE DAM:	Intake/release facilities, control office building & appurtenant structures			
			Trans-basin canal:	Concrete lining of OHNYU TUNNEL 1.13km & FURIKUSA TUNNEL 2.25km			
		Intake Structures	OHNO H.W.:	Release facilities & appurtenant structures			
			MURO-MATSUBARA H. W.:	Total reconstruction			
		Regulating Reservoir	HATTACHI Reg. Res.:	Inlet structure			
			KOMANBA Reg. Res.:	Inlet structure			
BY CONSIGNMENT		OHNO SYSTEM	Toyogawa Comprehensive Canal L.I.D.	Branch canal:	163 canals;566km in total (81km of 12 canals by Emerg. Reconst. inclusive)		
				Field Irrig. Facilities:	296 farm ponds & 329 pumping stations		
				On-farm canals:	approx. 2.660km in total		
			Kosai Canal L.I.D.	Branch canal:	2 canals; 18km in total		
		MURO-MATSUBARA SYSTEM	Muro Canal L.I.D.	Main canal:	1 canal; 9km		
			Matsubara Canal L.I.D.	Main canal:	1 canal; 0.6km		

N.B. L.I.D. denotes Land Improvement District

TOYOGAWA COMPREHENSIVE CANAL PROJECT

The Toyogawa Canal has much contributed to the regional development. However, development of farming technologies and advantaged locations being near from urban zones, have brought rapid changes of cropping patterns. Water demands for agriculture are accordingly growing and the water allocation is becoming tighter. Meanwhile, demands for domestic water are also growing every year in accordance with growth of service population and improved quality of life.

In order to meet the demands, The Project constructs Ohshima Dam in Ohshima River (a branch of Ure River) as a new water source and Kansagawa Headworks in upstream reach of Toyo River for intaking 15m³/s at max. The water is lead to Ure River through a 5km-long Kansagawa Link Canal diverted from Ohno Headworks. It also constructs 4 regulating reservoirs (Ohhara, Banba, Ashigaike & Gamagori Reg. Res.) in the main canal systems to prepare for dry periods, and improves water management facilities such as division works for stable supply.

Project construction started as a joint project by the Tokai Regional Bureau of the Minstry and Aichi Enterprise Corporation in 1980, and was handed over to Water Resource Development Public Corporation in Jun. 1999 for securing good harmony with the completed Toyogawa Canal facilities.

Most of facilities, other than Ohshima Dam and water management facilities, have already been completed, and tentative operation is being carried out as of date.

PROJECT OUTLINES

Structure		Feature			
OHSHIMA DAM		Type	Straight-spill, concrete gravity	Dam height	69.4m
		Eff. storage	11,300,000m³	Dam length	160.0m
KANSAGAWA HW		Type	Fixed	Dam-up height	3.8m
		Max. intake	15m³/s	Length	58.0m
KANSAGAWA LINK CANAL		Type: Standard horseshoe tunnel, length 5.34km & capacity 15m³/s			
Regulating Reservoir in canal system	OHHARA	Type	Center-core zoned rock-fill dam	Dam height	47.9m
		Eff. storage	2,000,000m³	Dam length	351m
	BANBA	Type	Asphalt facing earth-fill dam	Dam height	28.6m
		Eff. storage	5,000,000m³	Dam length	370m
	ASHIGAIKE	Type	Bank with steel sheetpile wall	Bank height	5.0m
		Eff. storage	2,000,000m³	Bank length	219m
	GAMAGORI	Type	Center-core zoned rock-fill dam	Dam height	43.2m
		Eff. storage	500,000m³	Dam length	178.0m

CONSTRUCTION TERM & PROJECT COST

■ Construction term FY1977-2001 ■ Total cost (FY1996 price) ¥117,700,000,000

OHSHIMA DAM

BANBA REG. RES.

TOYOGAWA CANAL STAGE Ⅱ PROJECT

Since start of water delivery, Toyogawa Canal system has served over 30 years. In current years, occasional accidents such as water leaks or structural failures have rapidly been increasing and causing difficulties in prompt water delivery as well as in maintaining safety of the facilities. In case some unexpected situations happen to occur, it is anticipated that serious losses and damages not only to the public in domestic water supply but also to the regional agriculture and other industries.

Objectives of the Stage Ⅱ Project are to recover safety of the canal system by reconstruction, to secure stable water intakes and proper system management/maintenance, and to achieve effective water use and rational water management by constructing a new parallel main-canal and improving the appurtenant facilities.

MAJOR PROJECT COMPONENT

Component	Quantity		Remarks
	Rehabili./reconst. of old canal	New construction of parallel canal	
Main canal rehabili./reconst.	L=34.2km	L=58.2km	
OHNO LINK CANAL	Seismo-proof canal bridge		
EASTERN MAIN CANAL	L=13.4km	L=34.1km	to BANBA REG.RES.
WESTERN MAIN CANAL	L= 7.4km	L=24.1km	to KOMANBA REG.RES.
MURO-MATSUBARA MAIN CANAL	L=13.4km		to Morioka
Branch canal rehabili./reconst.	L=51.0km		
Water manage./control facilities	L.S.		

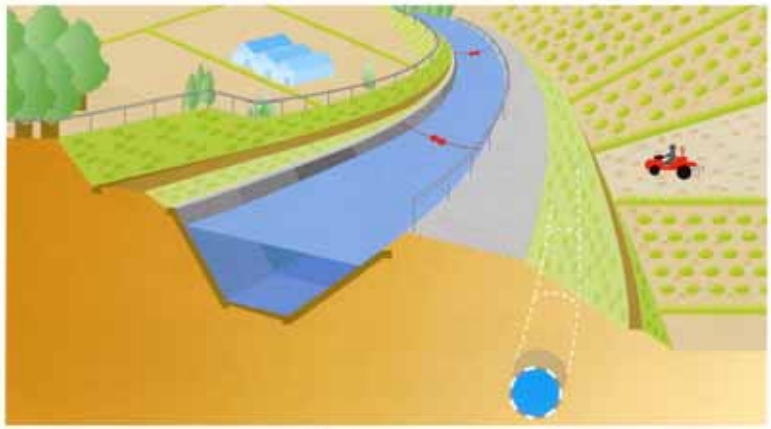
CONSTRUCTION TERM & PROJECT COST

■ Construction term FY1999-2008 ■ Project cost (FY1997 price) ¥111,500,000,000

CURRENT FEATURES

Lift of bed slab and cracks

Cracks on concrete lining



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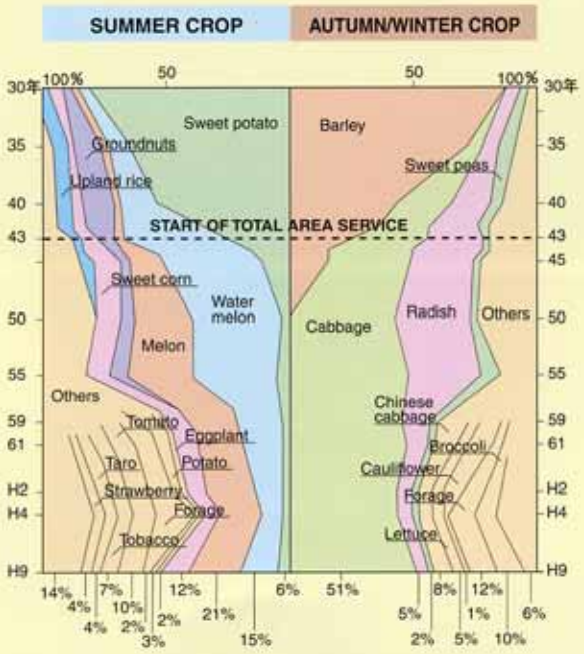
THE REGION AND TOYOGAWA CANAL

Toyogawa Canal has been supplying water for agriculture, domestic use and industrial use to the Region, and certainly contributing to development of the Region. The system has now come to one of indispensables in the Region.

WATER FOR AGRICULTURE

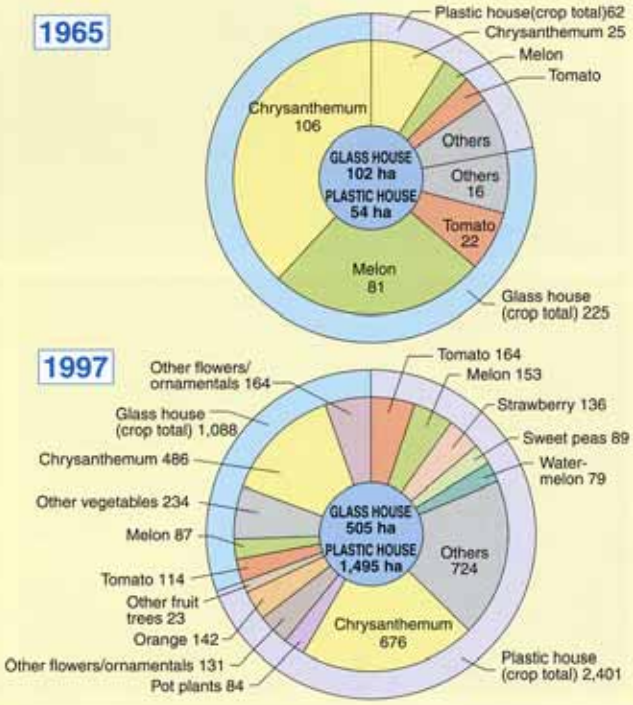
Since start of the service, with help of warm climate and advantages in location adjacent to cities, greenhouse horticulture is rapidly growing. In open fields, major crops have been changing from sweet potatoes and barley into vegetables and fruits.

SHARE OF CROPPED AREA IN OPEN FIELD



Surveyed area:Benefited area by Toyogwa Integrated Canal in Aichi
Date source:SATISTIC YEARBOOK OF AGRICULTURE, FORESTRY AND FISHERY IN AICHI (Ver. 1998.3)

CROPPED AREA IN GREENHOUSE CULTURE (ha)



DOMESTIC WATER

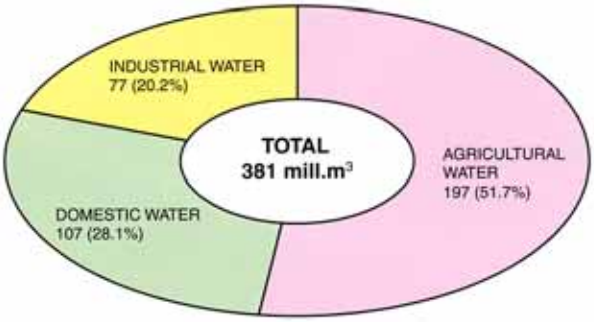
A service population of 420,000 in Toyohashi City and other 2 cities and 2 towns in 1979 has grown to 720,000 in 4 cities and 7 towns in FY1997. Natural water from Toyogawa Canal is processed into due quality by purification plants, and the clean water is supplied to the all houses.

INDUSTRIAL WATER

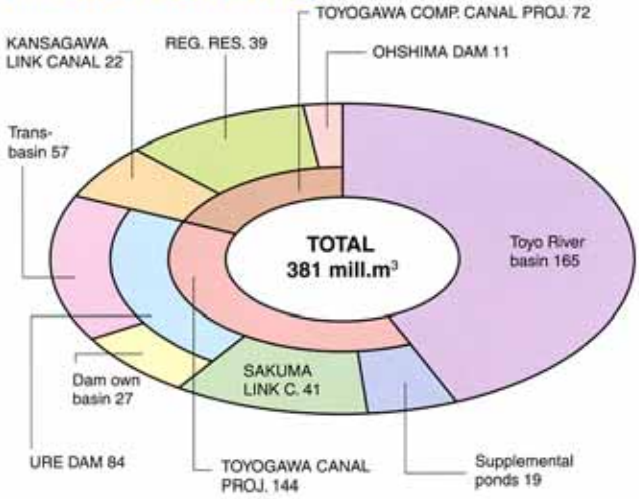
In a wide region centered by Toyohashi Port and extended to eastern Mikawa area of Aichi Pref. and Kosai of Shizuoka Pref., various private corporations such as steel mills, foods, transportation machinery, etc. are coming and start running business intensively. Natural water from Toyogawa Canal is processed into industrial water and supplied to 84 business corporations.

WATER USE CONTENTS

ANNUAL WATER SUPPLY



ANNUAL WATER INTAKE



AGRICULTURAL WATER SERVICE AREA (HA)

Land Imp. District	Paddy	Field	Total
Toyogawa Comprehensive Canal L.I.D.	4,990	10,886	15,876
Muro Canal L.I.D.	924	79	1,003
Matsubara Canal L.I.D.	604	73	677
Kosai Canal L.I.D.	73	500	573
Total	6,591	11,538	18,129
Prefecture	Municipality		
Aichi Pref.	Toyohashi, Toyokawa, Shinshiro, Tahara-cho, Akabane-cho, Atsumi-cho, Ichinomiya-cho, Kozakai-cho & Mito-cho		
Shizuoka Pref.	Kosai		

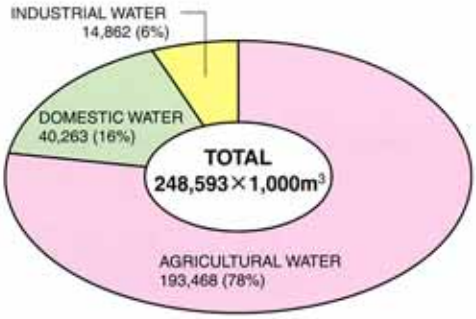
DOMESTIC WATER SERVICE

Municipality (760,000 service population)
Toyohashi, Toyokawa, Gamagori, Shinshiro, Tahara-cho, Akabane-cho, Atsumi-cho, Ichinomiya-cho, Kozakai-cho, Otowa-cho & Mito-cho

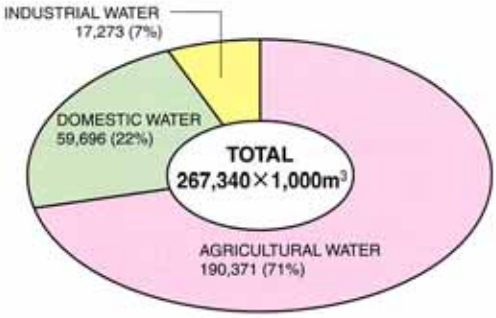
INDUSTRIAL WATER SERVICE

Region	Annual supply
Toyohashi	46mill.m³
Gamagori	18mill.m³
Kosai	13mill.m³

CURRENT WATER SUPPLY



1968-1999 AVERAGE



1999

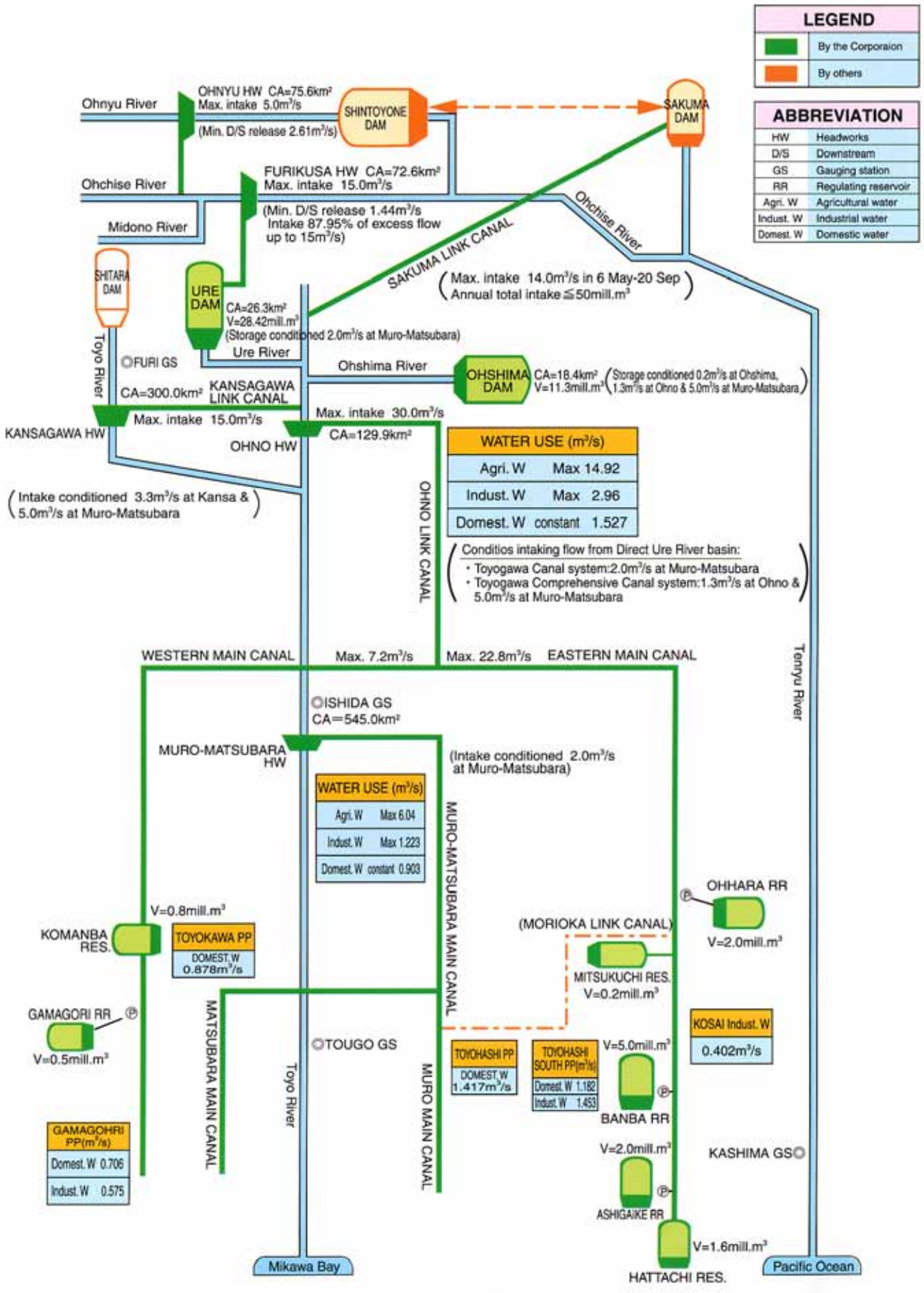
CURRENT WATER-SAVING OPERATON

In accordance with the rapid changes in current cropping patterns, agricultural water demands in dry periods have been steadily growing. Demands from cities/towns for domestic water have also been growing by population growth and improved quality of life every year, so that water-saving operations had to be applied since 1977 as indicated below.

YEAR & NO. OF OPERATION DAYS

FY	Day	FY	Day	FY	Day	FY	Day	FY	Day	FY	Day
1973	36	1980	365	1984	297	1988	67	1992	96	1996	187
1974	231	1981	161	1985	45	1989	14	1993	65	1997	130
1975	316	1982	22	1986	214	1990	42	1994	181	1998	10
1976	365	1983	87	1987	221	1991	27	1995	258	2000	28

TOYOGAWA CANAL SYSTEM DIAGRAM



DEMARCATION DIAGRAM OF THE SYSTEM MANAGEMENT

MAIN SYSTEM

TERMINAL SYSTEM