

Financial management of Kashima Rinkai specified sewage works

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Abstract The Kashima Rinkai Specified Sewage Works (KRSSW) is located at the northern side of the Kashima Coastal Industrial Zone, facing the Sea of Kashimanada (Pacific Ocean). It straddles one city and two townships: the city of Kashima, which boasts Kashima Port, a transportation center that was constructed on Kashimanada Beach by digging into the virgin sands, and the towns of Kamisu and Hasaki. The industries located there include steel, petrochemicals, chemicals, foodstuffs, livestock feeds, electric power and machinery metals. Industrial wastewaters with public sewage, except steel industry, are treated by the Fukashiba Treatment Plant which is managed by the Ibaraki Prefectural Government. The financial management of KRSSW is analysed to show its stand-alone condition.

Keywords Flow of office work; rate system; treatment plant management

Outline of KRSSW

Industrial effluent is classified into categories: primary effluent (unpolluted water) and secondary effluent (polluted water). The secondary effluent is treated at Fukashiba Treatment Plant. Fukashiba Treatment Plant is the central treatment plant of KRSSW. Its capacity of wastewater treatment was 33,000 m³/d when it started up in 1970, and it has reached now 165,000 m³/d. The plant treated 131,415 m³/d of wastewater in the fiscal year 2003. The project is planned to run from 1969 to 2015. The area planned to be covered by treatment in 2015 is 6,654 ha with a total population of 108,460, a maximum daily treatment volume of 330,000 m³/day, a 35.7-km long main pipeline length, and a treatment plant area of 15 ha.

As shown in [Figure 1](#), as of April 2004, KRSSW received sewage from Kamisu and Hasaki towns, which was 10% of the total discharge volume of the towns, and wastewaters from 116 factories.

Operation status of Kashima Rinkai specific public sewerage services

The Fukashiba Treatment Plant is managed by the Ibaraki Prefectural Government under the Sewerage Law, its ordinances and other provisions, while maintaining the nature of a common facility from institutional viewpoints. The plant is subsidised by the central government for construction of its facilities, but to which the financial provisions of the Law for Municipal Enterprises are applied and into which an accounting system is introduced fundamentally on a stand-alone basis. Based on the accounting system, all costs associated with operation and management of the plant are covered by utility bonds (debt) and service revenues, such as sewage payment and shared costs from users.

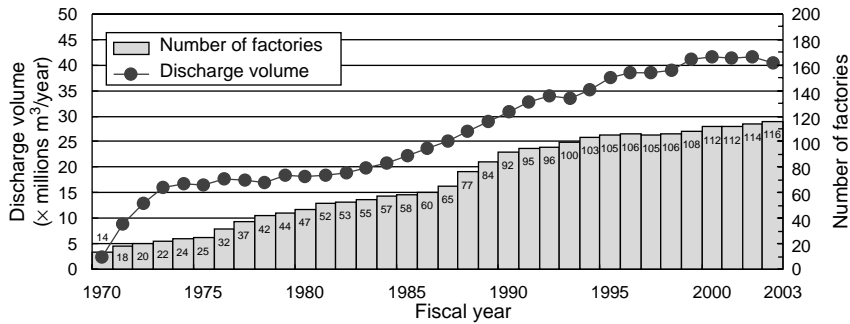


Figure 1 Discharge volume and number of factories

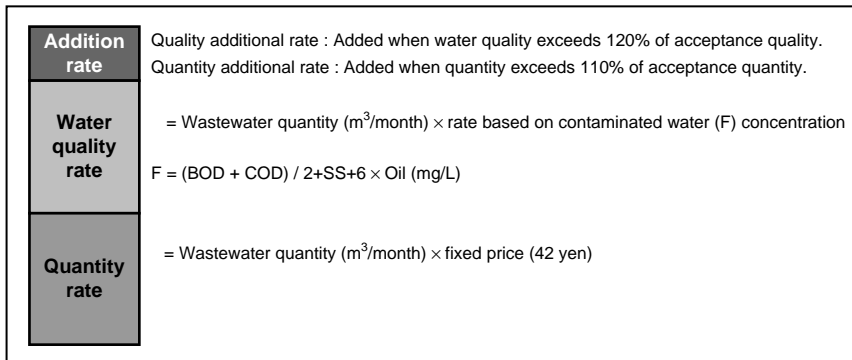


Figure 2 Sewage tariff

Maintenance cost

All costs required for O&M are paid by users through a water tariff under which a rate is calculated from discharge volume and water quality with extra charge when water quality and quantity exceed acceptance values. Since the opening of the plant in 1970, wastewater treatment charges were raised by approximately 70% in 1974, approximately 110% in 1975, and approximately 30% in 1996, to reduce the deficit caused by the price increases that have resulted from both economic changes and the cost of modifying and

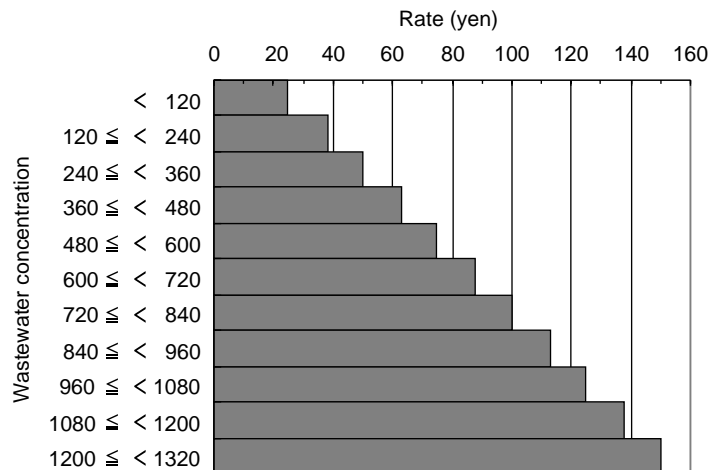


Figure 3 Wastewater concentration and rate

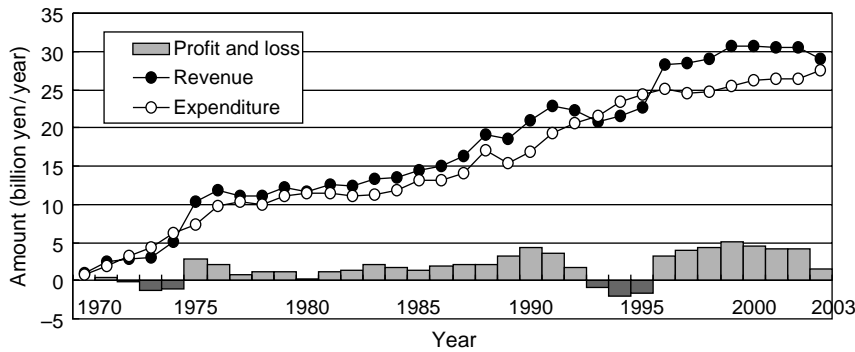


Figure 4 Change of the balance

repairing the plant facilities as they age. The sewage tariff and the rates table are shown in [Figures 2 and 3](#).

Our sewage tariff is 76 yen/m³ on the annual average. This tariff is lower than tariffs of other public sewage treatment plants of Ibaraki Prefecture (50–130 yen/m³), because other tariffs do not include the cost of construction facilities.

A rate balance from 1997 to date has been continuing at surplus, so it can be said that KRSSW management is relatively stable ([Figure 4](#)).

However, repair of the facilities due to aging is assumed to deteriorate its financial position, so KRSSW took various measures for cost reduction such as cutting construction costs and extending the facility's lifetime. The balance in the fiscal year 2003 is shown in [Table 1](#).

Facility construction cost

The costs for the facility construction were covered by the Japanese governmental subsidies (3/8), bonds (3/8), and user's expenses (2/8). Therefore, the revenues of KRSSW are not supported by the public finance of Ibaraki Prefecture.

Users bear construction expenses that are determined on discharge volume, quality and pollution load applied, as described in the calculation model of [Table 2](#).

[Figure 5](#) shows an administrative process on a new drainage facility that will be constructed within the service area of the Fukashiba Treatment Plant which can drain wastewater into the sewage works.

Table 1 Balance details for fiscal year 2003 (Unit: thousand yen)

Revenue	Sewage rate	2,908,008
	Other	2,713
	Total	2,910,721
Expenditure	Labor costs	241,412
	Heat, light and water	97,280
	Power	164,002
	Fuel	36,572
	Chemicals	52,532
	Repair	575,904
	Subcontract	577,395
	Depreciation	685,420
	Bond interest	260,042
	Other	59,104
	Total	2,749,663
Profit		161,058

Table 2 Calculation model for construction bearing costs

	Unit price A	Acceptance water quality B	Load C	Initial bearing cost D	Interest equivalent E	Total bearing cost yen F
Discharge volume in final fiscal year	2,460 yen/(m ³ /d)	20 m ³ /d		49,000	69,000	118,000
Discharge volume	6,925 yen/(m ³ /d)	20 m ³ /d (B2)		139,000	194,000	333,000
BOD	64,993 yen/(kg/d)	100 mg/L	2 kg/d (C3)	130,000	182,000	312,000
COD		100 mg/L				
SS	242,692 yen/(kg/d)	60 mg/L	2 kg/d	485,000	680,000	1,165,000
Oil and fat content	773,770 yen/(kg/d)	4 mg/L	0.1 kg/d	77,000	108,000	185,000
Uniform bearing cost	1,986,000 yen			1,986,000	2,780,000	4,766,000
Construction bearing cost (ΣF)						6,879,000
Consumption tax						343,950
Total						7,222,950

C: When the number exceeds 0.1, the fractional portion of the number is rounded up to an integer. When the number is 0.1 or less, it is rounded up to 0.1. When the number is 0.01 or less, it is rounded up to 0.01. $F = ((B \times B2 = C3) \times A = D) + (D \times 1.4 = E)$; $C3 = (BOD + COD)/2 \times B2$; D, E: 1,000 or less is rounded off

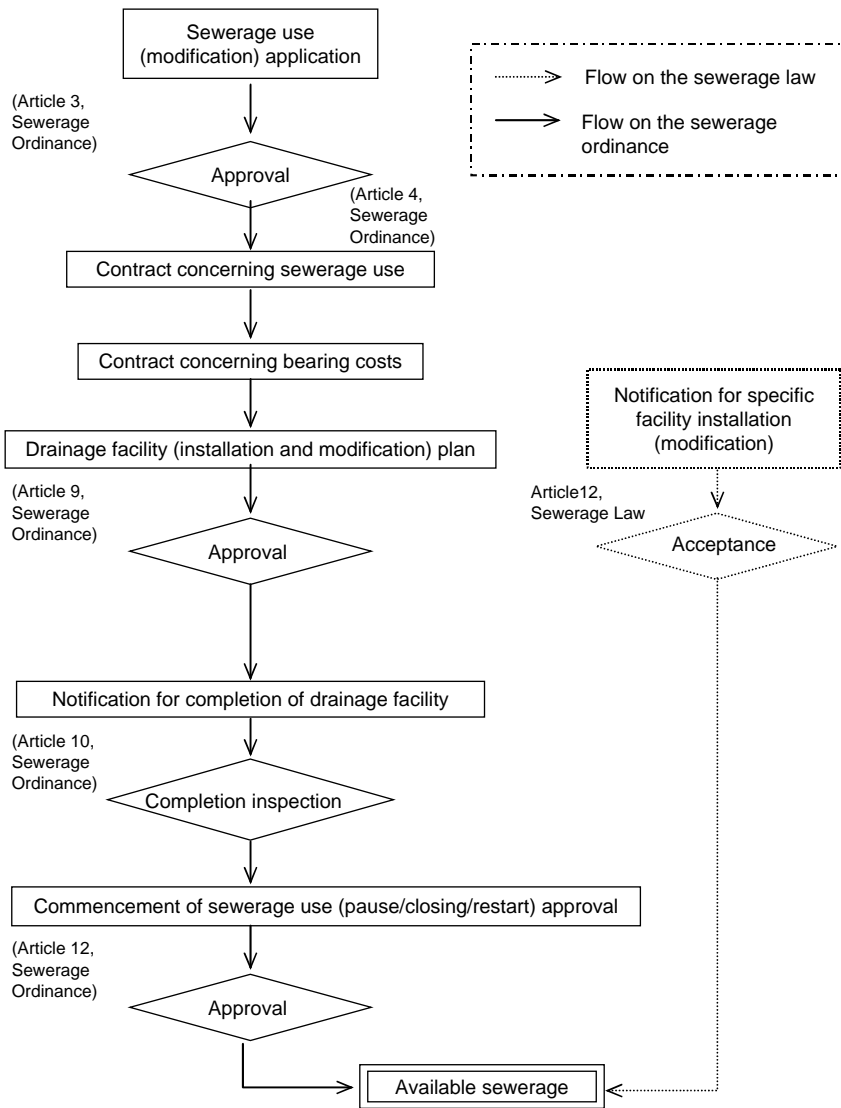


Figure 5 Procedure associated with sewerage use

The management structure of KRSSW

The management structure of the Fukushima Treatment Plant is shown in Figure 6. The plant is managed by a total of 74 staff members: 22 prefectural government employees and 52 private company employees of the subcontract.

The prefectural government’s sewage works section is responsible for handling contracts with beneficiaries; the administration section for matters related to the collection of charges and contractual matters related to operation and maintenance work; the water quality management section for confirming the quality of the water being treated, and providing guidance on effluent from industries; facility maintenance No.1 section for the operation and maintenance of water treatment facilities and pumping stations; and facility maintenance No.2 section for the operation and maintenance of the sludge dewatering facilities and incinerators, and the planning and design of the treatment plant.

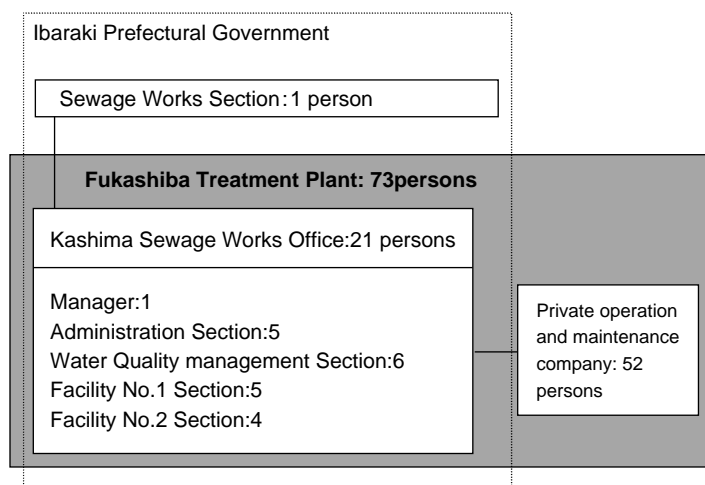


Figure 6 Organizational structure of Fukashiba Treatment Plant

Conclusions

KRSSW is managed on a stand-alone basis, so that a long-term financial stability and surplus in a single year are required. Under the current situations, proper maintenance including facility upgrading and modification is conducted in the plant, ensuring the stability and surplus.

In the future, it is difficult to assume steadily growing economy while a falloff in revenue is predicted. For this reason, it is required to manage the plant in a more efficient manner. The system of sewage treatment charges (based on the amount and quality of water) that is the main income source of the waste water treatment plant was established on the basis of the Sewage Ordinances for the Kashima Rinkai Urban Planning of Ibaraki Prefecture. The unit charges were reviewed by altering the ordinances. However, the basic system has not been modified since it was established, and it is considered that a review of the system based on fairer principles will be necessary in future.