

1.1 Background

Hanoi City is located about 100 km from the estuary of the Red River delta. At the time of the appraisal, the average monthly rainfall here during the typhoon season between May and September was approximately 250 mm. Low-lying areas along the Red River were particularly susceptible to flooding because of the limited capacity of the river and rainwater drainage facilities and because some areas had no drainage facilities. Therefore, it was needed to install and improve drainage systems. Moreover, while the amounts of industrial and domestic waste water were increasing sharply because of recent rapid industrialization and urbanization, sewage treatment plants had not been developed, and much of the city's sewage was being discharged untreated into rivers. As a result, pollution of closed bodies of water, such as canals and lakes, had become critical. Much of the sewer pipes had not been upgraded since they were first installed during the French colonial period, and the system needed to be expanded in order to accommodate advances in urbanization. Furthermore, pollution in the river water flowing through Hanoi City was so serious that residents in the city and neighboring provinces were demanding a reduction in the pollutant loads discharged from the city.

In response to this situation, JICA implemented Hanoi Drainage Project for Environmental Improvement (I) (1995) and (II) (1998) (hereinafter the "First Project"), through which drainage facilities were developed, including construction of drainage pumping stations and upgrading of drainage canals. Although the projects did result in a decrease in flood damage in the target area, some areas continued to suffer inundation damage as the drainage system at the location of flood was still hardly adequate for the drainage demands during heavy rains. With regard to sewage treatment capacity too, although the projects had resulted in the development of sewage treatment systems, including the installation of two pilot treatment plants, the recent advance of urbanization and urban sprawl brought about by population growth meant that drainage and sewage were increasing in volume, and larger-scale sewerage and drainage systems needed to be established.

1.2 Project Outline

The objective of this project is to decrease flood damage, to prevent the pollution in the river water and to improve the rate of waste water processing in Hanoi City by developing drainage and sewerage systems, thereby contributing to the improvement of the city's urban sanitation and living environment.

<ODA Loan Project>

	The Second Project (I) (VNXIII-4)	The Second Project (II) (VNXVI-3)
Loan Approved Amount/ Disbursed Amount	3,044 million yen/ 2,934 million yen	29,289 million yen/ 20,900 million yen
Exchange of Notes Date/	March 31, 2006/	March 31, 2009/

Loan Agreement Signing Date	March 29, 2006	March 31, 2009
Terms and Conditions	Interest Rate 0.75%	Interest Rate 0.55% (construction) 0.01% (consulting)
	Repayment Period (Grace Period 40 years) 10 years)	Repayment Period (Grace Period 40 years) 10 years)
	Conditions for Procurement General Untied	Conditions for Procurement General Untied
Borrower/ Executing Agency	The Government of the Socialist Republic of Vietnam/Hanoi People's Committee	The Government of the Socialist Republic of Vietnam/Hanoi Department of Construction
Project Completion	December 2016	
Target Area	To Lich River Basin, Hanoi City	
Main Contractor(s) (Over 1 billion yen)	<ul style="list-style-type: none"> - Kubota Corporation (Japan) - Civil Engineering Incorporation No. 18 (Vietnam) - Thang Long Construction Corporation (Vietnam)/Civil Engineering Construction Corporation No. 8 (Vietnam)/319 General Corporation (Vietnam)/68 Trading Construction and Service JSC (Company 68) (Vietnam) 	<ul style="list-style-type: none"> - Civil Engineering Construction Corporation No. 8 (Vietnam) - Kolon Global Corporation (South Korea) - Song Hong Construction Corporation (SHC) (Vietnam) - Urban Infrastructure Development Investment Cooperation (Vietnam)/Bach Dang Construction Corporation (Vietnam) - Thang Long Construction Corporation (Vietnam)/Civil Engineering Construction Corporation No. 8 (Vietnam)/319 General Corporation (Vietnam)/68 Trading Construction and Service JSC (Company 68) (Vietnam) - Kanematsu Corporation (Japan) - Hanoi Construction Corporation (Vietnam)
Main Consultant(s) (Over 100 million yen)	Nippon Koei Co., Ltd. (Japan)/Vietnam Water Sanitation and Environment Joint Stock Company (Vietnam)	
Related Studies (Feasibility Studies, etc.)	F/S (Feasibility Studies) by Hanoi People's Committee and I/P (Implementation Program) Report (October 2005)	
Related Projects	(Development Study) <ul style="list-style-type: none"> - The Study on Urban Drainage and Waste Water Disposal System in Hanoi City (1995) - The Comprehensive Urban Development Program in Hanoi Capital City of the Socialist Republic of Vietnam (HAIDEP) (2007) 	

	<p>(ODA Loans)</p> <ul style="list-style-type: none"> - Hanoi Drainage Project for Environmental Improvement (I) (April 1995) - Hanoi Drainage Project for Environmental Improvement (II) (March 1998) - Hanoi City Yen Xa Sewerage System Project (I) (March 2013) <p>(JICA Partnership Program)</p> <ul style="list-style-type: none"> - Project for Strengthening Capacity in O&M Works at Sewerage Treatment Facilities and Water Environment Enlightenment in Hanoi (I) (2007 – 2009) - Project for Strengthening Capacity in O&M Works at Sewerage Treatment Facilities and Water Environment Enlightenment in Hanoi (II) (2010 – 2012) - Project of Capacity Building on Management of Sewage Works in Hanoi (2014 – 2016)
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2. Outline of the Evaluation Study

2.1 External Evaluator

Mariko Homma, IC Net Limited

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: October 2019 – November 2020

Duration of the Field Study: December 8, 2019 – December 27, 2019

2.3 Constraints during the Evaluation Study

Because of the impact of COVID-19, the planned second field study in this evaluation was cancelled and the evaluator was not able to visit Vietnam. Accordingly, the evaluator communicated with the executing agency and JICA office by document. The assistant researcher (local consultant) carried out the additional study, using email, phone, and other means and the critical information was collected.

3. Results of the Evaluation (Overall Rating: B¹)

3.1 Relevance (Rating: ③²)

3.1.1 Consistency with the Development Plan of Vietnam

This project was planned based on *Master Plan for Urban Drainage and Waste Water Disposal System in Hanoi City up to 2010*, which was completed in 1995, and on the revised Master Plan (*Urban Development Master Plan of Hanoi up to 2020*) formulated in 1998 on the basis of the earlier master plan. At the time of the first-phase appraisal (2006), according to

¹ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

² ③: High, ②: Fair, ①: Low

Vietnam's 10-Year National Environmental Protection Strategy 2001-2010 (2003), the problem of water pollution caused by the discharge of industrial and domestic waste water into public waters was one of the factors in urban environmental problems. Furthermore, the goals of *the Orientation on Urban Drainage and Sewerage Development up to 2020* (adopted in 1999) were to: raise the installation rate of drainage systems to 80% or more in major urban areas such as Hanoi City and Ho Chi Minh City; promote urban flood control and the sanitary treatment of sewage; and develop a mechanism for raising funds necessary for installing urban drainage systems nationwide. At the time of the second-phase appraisal (2009), numerical targets for environmental improvement had been included in the *Socio-Economic Development Plan 2006–2010* (2006): 40% of urban areas and 70% of industrial and export processing zones should have installed centralized waste water treatment systems by 2010; and 100% of urban areas and industrial and export processing zones should be connected to centralized waste water treatment systems by 2020. This project was consistent with these objectives, and was positioned to achieve the objectives.

At the time of the ex-post evaluation, according to the Prime Minister's decision regarding *the Orientation for Development of Water Sewage and Drainage Systems in Vietnam's Urban Centers and Industrial Parks Leading to 2025, and Vision for 2050*, which had been approved in November 2009, 40–50% of urban areas should have sewerage systems developed by 2025, and this project was positioned to contribute to the target. It is also consistent with *Master Plan for Drainage Planning of Hanoi Capital up to 2030* which was prepared in 2013.

Thus, the consistency of the project with Vietnam's development policy can be observed.

3.1.2 Consistency with the Development Needs of Vietnam

River and rainwater drainage facilities in Hanoi City had limited capacity, and some areas had no drainage facilities. Low-lying areas along the Red River were particularly susceptible to flooding, and installation and improvement of drainage systems was an urgent issue. Despite increases in industrial and domestic waste water in urban areas as a consequence of Vietnam's industrialization and concentration of the population in urban areas, there had been no progress in the development of sewerage systems. Sewage was being discharged directly into rivers, which had led to serious pollution of the water environment. In response to this situation, from 1995, JICA undertook the development of drainage facilities through the First Project. At the time of the appraisal of this project, which is the Second Project, although flood damage had been mitigated by the First Project, the capacity of river and rainwater drainage facilities was still hardly adequate, and drainage systems had to be strengthened.

In response to this situation, in addition to merely developing sewerage and drainage facilities, the number of target rivers and canals was increased; along with upgrading canals, the project strived to develop service roads and footpaths, install pumps and repair walls at

rainwater outlet canals (lakes), and improve water quality. By extending the Yen So Pumping Station, which had been constructed during the First Project, the capacity to process waste water was enhanced. Furthermore, in addition to building a new sewage treatment plant, sewage treatment capacity was enhanced by strengthening the maintenance capacity of facilities developed during the First Project. Piecing the above together, it can be said that the Second Project addressed the outstanding development needs remaining after the First Project.

At the time of the ex-post evaluation, remarkable improvements had been made to drainage systems in Hanoi City. As shown in Table 1, although there have been increases and decreases in precipitation from year to year, no serious damages from flooding and inundation were reported after the completion of the project. Considering that there has been no real relative decline of precipitation since the time of the ex-ante evaluation (appraisal) in 2006, the usefulness of sewerage and drainage systems through projects are recognized.

Table 1: Rainfall in Hanoi*

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Amount of rain water (mm)	1,240	1,659	2,268	1,612	1,239	1,795	1,801	1,935	1,941	1,190	1,419	1,998	1,866	1,519

* General Statistic Office of Vietnam (FY2006 – 2013); Average annual rainfall data (FY2014 – 2019) provided by HSDC (Hanoi Sewerage Drainage Company)

3.1.3 Consistency with Japan’s ODA Policy

In Japan’s *Country Assistance Program for Vietnam* (revised in April 2004), which was current at the time of the appraisal, “environmental conservation” was identified as a priority sector. Cooperation was mainly focused on “priority efforts for supporting the development and maintenance of sewerage and drainage facilities” and “considering assistance for systems and policies related to waste management and assistance related to efficient and proper treatment.”

The Medium-Term Strategy for Overseas Economic Cooperation Operations for Vietnam, which was current at the time of the first-phase appraisal (March 2006), positioned support for “global issues and peace-building” as a priority area, and specifically identified support for water pollution measures. Furthermore, shaped by the aforementioned Country Assistance Program and Medium-Term Strategy, providing support to environmental measures was also specified as a priority sector in Japan’s assistance policy for Vietnam. At the time of the second-phase appraisal (March 2009), “environmental conservation” was one of the priority areas of assistance for Vietnam and focused on urban environmental management.

The above indicates that this project was consistent with Japan’s assistance policy at the time of the appraisal.

This project has been highly relevant to Vietnam’s development plan and development needs, as well as Japan’s ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ①)

3.2.1 Project Outputs

Table 2 shows a comparison between planned and actual outputs of the project.

Table 2: Outputs (Plan/Actual)

Items	Package	Plan	Actual
1) Sewerage System (Bay Mau Lake Sub-Basin, 2.2 km ²)			
Construction of Waste Water Treatment Plant of standard activated sludge method (Bay Mau Waste Water Treatment Plant)	CP8	13,300 m ³ /day	As planned
Construction and repair of sewer and stormwater pipes	CP9, CP9.1	29.1 km	24.447 km (shortened according to the site condition) No other modifications
Procurement of Dredging Equipment and Spare Parts	CP10, CP10.1	1 package CP10	2 packages, CP 10.1 was added.
2) Drainage System (To Lich River Basin, 77.5 km ²)			
Extension of Yen So Pumping station	CP1, CP2	9 pumps, capacity of 45 m ³ /second	As planned
Drainage Canal Improvement (dredging of sludge and installment of box culvert)	CP3, CP4	27.4 km	24.303 km (shortened according to the site condition) No other modifications
Repair of Bridges related to Drainage Canal Improvement	CP5.1	9 bridges	As planned
Construction of Service Roads	CP5.1, CP5.2	30.5 km	30.605 km (extended according to the site condition) No other modifications
Lake Improvement and Extension of outlet canals	CP6.1, CP6.2, CP6.3, CP6.4, CP7	10 lakes and 2 regulating reservoirs	11 lakes, 2 regulating reservoirs and 3 pumping stations and maintenance of exhaust pipes
Establishment of Disposal Site for the sludge from Waste Water Treatment Plant	CP1	64.3 ha	As planned
3) Consulting Service			
Detail Design			As planned (including additional packages)
Tender Assistance, Construction Supervision			As planned
Capacity Building of O&M of sewage and drainage system			As planned
Formulation of O&M Plan of Sewerage and Drainage sector in Hanoi City (including the research on sewage rate charge)			Not implemented due to low necessity
Preparation of the F/S for the large-scale sewerage treatment plant (to be constructed in west Hanoi)			As planned (feasibility study of the Hanoi City Yen Xa Sewerage System Project)
(MM of Experts, Results/Plan)		FS	
International Experts		51.0/50.8	Detail Design 138.5/138.3
Vietnamese Experts			50.0/50.0
Supporting Staff			236.0/235.9
			Construction Supervision 375.3/375.1
			1,783.9/1,701.9
			658.7/657.6

The main output of the project was the development of sewerage and drainage systems covering the central part of Hanoi City. Although there were a number of modifications and additions, the project was implemented mostly as planned.

With regard to developing sewerage systems, the new Bay Mau Waste Water Treatment Plant (Bay Mau WWTP) was constructed in the 2.2 km² catchment area surrounding Bay Mau Lake. Using the standard activated sludge method, it is capable of treating 13,300 m³ of waste water per day. The processed water is discharged into three adjacent lakes, and is used in landscape irrigation. In addition, a total of 24.447 km of sewer and stormwater pipes was laid or upgraded. The length of the construction works was truncated from the original plan of 29.1 km based on Detail Design survey, which seems to be appropriate. The project also involved purchasing spare parts and components for maintenance in connection with equipment and facilities that were constructed during the First Project, including two sewage treatment plants. These spare parts and components were selected in cooperation with Hanoi Sewage and Drainage Company (hereinafter “HSDC”), which is responsible for maintenance, and some were added following requests after the eligible areas were expanded (CP10.1).

With regard to developing drainage systems, the project covered the 77.5 km² basin of the To Lich River. First, nine vertical shaft centrifugal pumps (5 m³/sec) were installed at the Yen So Pumping Station, which had been constructed during the First Project. As for drainage canals, a total of 24.303 km of canals were upgraded by dredging sludge from open waterways and strengthening the walls to improve flow or by covering them (laying box culverts). The project also involved the construction of service roads along canals (30.605 km) and the replacement of nine bridges. The total length of service roads was extended slightly from an initial planned length of 30.5 km to 30.605 km. With regard to developing drainage systems, the project improved the water quality in 11 lakes by strengthening the walls and preventing the inflow of domestic waste water from the surrounding area. Moreover, in addition to dredging the lakes to increase the volume of water stored, drainage pumps were installed at weirs to enhance flow control function. The project covered one more lake than originally planned, as well as the additional installation of three pumping stations and the maintenance of exhaust pipes at the Yen So Pumping Station (CP6.4).

With regard to consulting services provided through this project, detail design, tender assistance and construction supervision were carried out to facilitate implementation of the project. Furthermore, while the project only covered the central part of Hanoi City (the inner city), a feasibility study for a large-scale sewage treatment plant on the outskirts of Hanoi City (in a new section situated in the western part of the city) was also conducted via consulting services provided through the project. Based on this feasibility study, the Hanoi City Yen Xa Sewerage System Project has been implemented since 2013. The project also involved capacity building for the HSDC and Phu Dien Construction and Commerce Investment JSC

(hereinafter “Phu Dien”), which were responsible for the operation and maintenance of facilities including the two pilot sewage treatment plants and the Yen So Pumping Station, which were set up through the First Project, as well as the Bay Mau WWTP, which was being developed through this project. In relation to the capacity building of HSDC, capacity building was also provided by administrative bodies in Japan (Chiba Prefectural government and Yokohama City government) through related JICA Partnership Program³ (see Impacts for details). On the other hand, formulation of an operation and maintenance plan for Hanoi City’s sewerage and urban drainage sector had been intended for this project, but was removed from the project scope, because the following measures seem to be sufficient.

Under the scope of project, training on operation and maintenance for staff of water sewerage company was implemented under Package 10, Package 10.1 and Package 2. Training on operating the WWTP was conducted for Phu Dien company.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total project cost was 42,607 million yen (100.7% compared to the plan), exceeding the planned 42,309 million yen.

Table 3: Inputs (Plan/Actual)

Unit: million yen

Items	Plan ^{*1}					Actual			
	JICA	(First)	(Second)	Vietnam	Total	Foreign currency	Domestic currency		Total
						JICA	JICA	Vietnam ^{*2}	
Construction	24,310	1,723	22,587	0	24,310	3,506	16,352	0	19,858
Consulting Service	2,077	1,195	882	0	2,077	1,848	634	0	2,482
Price Escalation	2,290	11	2,279	0	2,290	0	994	0	994
Physical Contingency	2,668	87	2,581	0	2,668	0			
Interest during construction	756	28	728	0	756	501	0	0	501
Commitment Charge	232	0	232	0	232				
Land Acquisition	0	0	0	6,064	6,064	0	0	16,212	16,212
Administration Cost	0	0	0	517	517	0	0	136	136
Value Added Tax & Duties	0	0	0	3,395	3,395	0	0	2,425	2,425
Total	32,333	3,044	29,289	9,976	42,309	5,855	17,980	18,772 ^{*3}	42,607 ^{*4}
						23,835			

³ Japanese experts were dispatched and HSDC technicians were invited to Japan as part of the Project for Strengthening Capacity in O&M Works at Sewerage Treatment Facilities and Water Environment Enlightenment in Hanoi (I) (2007-2009) and the Project for Strengthening Capacity in O&M Works at Sewerage Treatment Facilities and Water Environment Enlightenment in Hanoi (II) (2010-2012), which were implemented by Chiba City and Bridge Asia Japan, and the Project of Capacity Building on Management of Sewage Works in Hanoi (2014-2016), which was implemented by Yokohama City.

- *1. Exchange rate at the planning stage: VND 1.00 = JPY 0.00670 from Second Project Appraisal document
 *2. Average exchange rate from 2007 to 2016: VND 1.00 = JPY 0.00510 (USD 1.00 = VND 19,513.71 = JPY 99.54, <https://data.imf.org/regular.aspx?key=61545850>)
 *3, *4. Two total figures are different from simple total figures of the above cells because of the effect of “rounding off”.

Planned and actual costs of the project were compared in the above table. The total of expenditure based on the ODA loan and expenditure of Vietnamese side (converted to Japanese yen based on IFS rate) was 42,607 million yen and it exceeded the planned figure slightly.

When we look at the breakdown of the expenditure, construction cost was smaller than the plan because of the scope adjustment and the effect of yen’s appreciation. However, the cost of consulting services increased by about 20% as a result of the significant extension of the contract term from the time of the first-phase plan to four years. On the other hand, compensation costs (including Assistance) for land acquisition increased considerably to more than double of the planned figure. This is due to the impact of the significant protraction of time needed to acquire the land and the significant widening of the pool of applicable residents. In summary, as a whole, total project cost exceeded the original plan.

3.2.2.2 Project Period

In total, the actual project period over the first and second phases of the project was 10 years and ten months (130 months; March 31, 2006–December 2016) as compared to the planned project period at the time of the first-phase appraisal of five years and seven months (67 months; March 31, 2006 – September 2011). This is significantly longer than planned (194% of the planned period).

Table 4: Project Period (Plan/Actual)

Item	Plan	Actual
L/A signing	2006/3/31	2006/3/31 (1st), 2009/3/31 (2nd)
Selection of Consultant	2006/10 – 2007/8 (11 months)	2006/10 – 2007/8 (11 months)
Consulting services	2007/8 – 2013/9 (74 months)	2007/8 – 2016/11 (112 months)
Land Acquisition and Relocation of Residents	2008/6 – 2009/4 (11 months)	2008/6 – 2016/10 (101 months)
Detail Design, Tender Assistance	2007/12 – 2009/10 (23 months)	2007/12 – 2015/3 (88 months)
Procurement	2008/1 – 2009/10 (22 months)	2008/1 – 2015/3 (87 months)
Construction and Supervision	2008/11 – 2011/9 (35 months)	2008/11 – 2016/12 (98 months)
Warranty period	2010/3 – 2013/9 (43 months)	2011/4 – 2018/12 (93 months)
Completion ^{*1}	2011/9	2016/12

Source: JICA, PCR prepared by the Executing Agency

*1. Completion date of construction

The biggest factor of the extension of project period was the significant delay in acquiring land. Land acquisition was expected to be completed in 11 months, but in reality, it took

about 101 months. Holdups in land acquisition had been a factor in delays during the First Project as well. Complexity in the approval procedure had been cited as a factor. In this project, there were substantial holdups in land acquisition, and this led to delays in construction (actually taking 98 months versus the planned 35 months) and delays in the overall project (see Impacts for details). Nevertheless, as the target area in this project was extensive, land acquisition and construction were carried out in parallel. Construction was advanced one area at a time as land acquisition procedures were completed.

3.2.3 Results of Calculations for Internal Rates of Return (Reference only)

The Economic Internal Rate of Return (EIRR) for the project was 7.7% at the time of the first-phase appraisal, and 8.2% at the time of the second-phase appraisal. EIRR was recalculated during the ex-post evaluation in accordance with the method used at the time of the second-phase appraisal. The following is a comparison between the time of the appraisal and the time of the ex-post evaluation.

Table 5: Comparison of the EIRR before and after the Project

	At the time of the second-phase appraisal	At the time of the ex-post evaluation
EIRR	8.2%	18.0%
(Basis of calculation)		
Project life* ¹	40 years	40 years
Cost	Project costs (excluding taxes), maintenance costs	Project costs (excluding taxes),* ² maintenance costs
Benefit	Decrease in amount of flood damage	Decrease in amount of flood damage

Notes:

*1. From the time of the first-phase appraisal, project life was regarded as 40 years, but considering the period over which benefits appear, it was recalculated as 43 years at the time of the second-phase appraisal. When recalculating EIRR at the time of the ex-post evaluation, the value is the same no matter whether the same project life as at the time of the second-phase appraisal is used or whether it is calculated in line with the ex-post evaluation reference starting from the year in which the loan agreement for the ODA loan project was signed.

*2. In principle, actual values have been used. Reasonable estimates have been used for maintenance costs, though, as actual values are difficult to obtain.

EIRR increased from 8.2% at the time of the second-phase appraisal to 18.0% at the time of the ex-post evaluation. The following is a variation analysis of the rate between the time of the second-phase appraisal (recalculated) and the time of the ex-post evaluation:

- Costs are generally as planned, and did not increase that much even after adjusting for inflation.
- Benefits, however, increased significantly. The benefit of this project increases in proportion to the increase in GDP, but, for instance, whereas the GDP index in the first year of recording a benefit (the parameter for adjusting from the time of the first-phase

appraisal to the time of the second-phase appraisal) was 2.34 times of the original figure at the time of the second-phase appraisal, it was 3.71 times of the original figure in the second recalculation (meaning a 58% increase from the time of the second-phase appraisal). Furthermore, the United States dollar (USD) has appreciated against the Vietnamese dong (VND), from VND 16,119 per USD 1.00 at the time of recalculating during the second-phase appraisal, to VND 21,698 in 2015, meaning that the amount of benefit converted into VND has risen (representing a 34% increase). Combining the increases of both factors gives an increase of 112%. When EIRR was re-calculated by modified cashflow, it became about 9.2% by using figures of each year divided by 2.12. 9.2% is close to the figure at second appraisal. Therefore, increase of GDP and fluctuation of exchange rate seem to be the main causes of the above increase of EIRR.

While the project cost slightly exceeded the plan, the project period exceeded the plan significantly. Therefore, efficiency of the project is low.

3.3 Effectiveness and Impacts⁴ (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

(1) Operational Status of Sewage System

In relation to the development of sewage treatment systems, targets were set for two to three years after the completion of the project. Targets were set for the number of people served by sewage treatment systems, the volume of sewage treated, and biochemical oxygen demand (BOD) concentration at a sewage treatment plant. The plan at the time of appraisal was for the project to be completed in 2011; thus, 2013 was made the target year. However, the actual year of completion was 2016. Therefore, the value in 2016 when the project was completed and the value in FY2019 when the ex-post evaluation was conducted were used as the actual values.

Table 6: Operation and Effect Indicators of Sewage System

Indicators	Baseline	Baseline ^{*1}	Target	Actual ^{*4}	Actual
	2006	2008	2013-14	2016	2019
			2-3 years after the project completion	Year of project completion	2-3 years after the project completion
Population Treated (person)	—	25,300 (Kim Lien, Truc Bach)	166,500 ^{*2}	25,300 (Kim Lien, Truc Bach) 41,200 (Bay Mau)	24,067 (Kim Lien, Truc Bach) 41,200 (Bay Mau)
Amount of Wastewater Treated (m ³ /day)	—	6,000 (Kim Lien, Truc Bach)	57,300 ^{*3} (19,300, Kim Lien, Truc Bach, Bay Mau)	6,000 (Kim Lien, Truc Bach) 13,300 (Bay Mau)	6,000 (Kim Lien, Truc Bach) 13,300 (Bay Mau)

⁴ Sub-rating for Effectiveness is to be put with consideration of Impacts.

BOD concentration at Bay Mau WWTP (mg/l) (Influx, Effluent and the Removal ratio)	—	—	Inf: 200 mg/l Eff: 20 mg/l Removal ratio: 90%	Inf: 200 mg/l Eff: 20 mg/l Removal ratio: 90%	Inf: 200 mg/l Eff: 17.8 mg/l Removal ratio: 91%
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Source: Documents provided by JICA and PMU

Notes:

*1: Total of 2 model plants constructed in the First Project (Kim Lien, Truc Bach)

*2: Total of Kim Lien, Truc Bach and Bay Mau to be constructed in this project and another waste water treatment plant constructed by “Hanoi Urban Infrastructure Development Project” (signed in March 1997) and located in an industrial park.

*3: Total amount of Kim Lien, Truc Bach, Bay Mau and a new plant (38,000m³/day). The figure in () is the total of three plants, targets of the project.

*4: Total of Kim Lien, Truc Bach, Bay Mau

This project involved strengthening the maintenance capacity of two model treatment plants which had been constructed during the First Project (Kim Lien and Truc Bach), as well as establishing a new sewage treatment plant (the Bay Mau WWTP). At the time of the ex-ante evaluation (appraisal), work was also being done in Hanoi City on a sewage treatment facility (treatment capacity: 38,000 m³/day) in an industrial park, which had been constructed through the Hanoi Urban Infrastructure Development Project (signed in March 1997). Therefore, as an operation indicator for population treated and sewage treatment capacity, a target for the treatment capacity of these four plants was set. However, as “the treatment plant located in the industrial park which was constructed by Hanoi Urban Infrastructure Development Project” is outside of the project scope, we conduct analysis excluding this treatment plant.

First of all, with regard to Population Treated (persons), although the target volume broken down by plant was not clear (information was not available), there is a strong positive co-relationship between Population Treated and Amount of Wastewater Treated in general. Therefore, it is assumed that the target Population Treated would have been achieved if the target Amount of Wastewater Treated had been achieved. With regard to the Amount of Wastewater Treated, when we exclude the plant in the industrial park, the result is 19,300 m³/day, while the target is 19,300 m³/day. Accordingly, the target is judged to be achieved.

Another operation indicator was BOD concentration at the Bay Mau WWTP. In 2016 when the project was completed, the target value of 20 mg/l had already been achieved. At the time of the ex-post evaluation, the value was 17.8 mg/l, indicating that the removal ratio had further improved to 91%.

Thus, it can be judged that the development of sewage treatment systems through this project resulted in materialization of the targeted operational effect.

(2) Operational Effect of Drainage System

In relation to drainage systems, two benchmarks were set as an indicator of the level of

achievement two years after the completion of the project: maximum flow and highest water level for one-in-ten year rainfall events; and area inundated by flood water and number of flooded households (zero target) as a result of inundation by overflow.

Table 7: Operation and Effect Indicators of Drainage System

	Baseline	Baseline* ¹	Target	Actual
	2005	2008	2013	2019
	(in First Ex-ante evaluation sheet)	(in Second Ex-ante evaluation sheet)	2 years after the project completion	3 years after the project completion
Maximum flow for 1/10-year rainfall (m ³ /s)	45 m ³ /s	99 m ³ /s Yen So spillway C	86 m ³ /s Yen So spillway C	90 m ³ /s Yen So spillway C
Highest water level for 1/10-year rainfall (m)* ¹	—	5.61 m Thanh Liet floodgate	4.64 m Thanh Liet floodgate	4.38 m Thanh Liet floodgate
		5.74 m Yen So spillway C	4.56 m Yen So spillway C	2.96 m Yen So spillway C
Year's largest inundated area by overflow of inland waters (km ²) (Inundation by overflow for 1/10-year rainfall)	13.2 km ²	13.2 km ²	0 (Estimate at the time of expected flood)	Almost achieved (explained below)
Number of inundated households by overflow of inland waters (HH)	~1,000	~1,000	0	Almost achieved (explained below)

Source: Information provided by JICA and O&M agency

*1: Measured at two points, Thanh Liet Floodgate and Yen So spill way C

When we look at the achievement status of respective indicators in Table 7, with regard to the maximum flow level for one-in-ten year rainfall events, the result figure is the one recorded in July 2017, which is the biggest after project completion. Although the result figure exceeds the target slightly, it is clearly lower than the baseline figure. With regard to the highest water level for one-in-ten year rainfall events, the result figure, which is also the biggest after project completion, is far below the target figure. It shows that water flow is properly controlled.

With regard to “the year’s largest inundated area by overflow of inland waters” and “number of inundated households by overflow of inland waters,” unfortunately, neither official statistics nor records remained. Then, it is difficult to present the degree of achievement quantitatively. However, according to an interview with the operation and maintenance agency, the following facts were confirmed. Although in Hanoi City, there is heavy rainfall in the rainy season and inundation by overflow of inland waters is observed

around July every year, the duration and areas of inundation has been decreased apparently after the project completion. Similarly, the number of inundated households by overflow of inland waters became very small.

Reference information: Pages 18-19 in the “Final Report on the Survey for Information Collection to Formulate the Strategy for the Disaster Prevention Sector in Vietnam (2018)” present the numbers of casualties, missing persons, and damage costs caused by floods and rainstorms (including landslide disasters and high tides), and the geographical distribution of the numbers of casualties and missing persons caused by landslide disasters (including floods and storms) for the period between 2007 and 2017. The Report also states, “Compared with the size of their economy, Hanoi and its vicinity with high population density suffered less damage. This suggests that flood prevention measures helped reduce damage. However, in 2008, Hanoi recorded a large damage cost (VND 3,000 billion, which is 20% of the total national disaster damage cost of the year). This indicates that any flood near the capital causes major damage.” The period for the research above includes 2017, the year when more than one typhoon made landfall in Vietnam. It is assumed that, even in that year, there was no serious flood damage in Hanoi.

In summary of the information above, it is fair to say that mostly expected outcomes were realized with regard to drainage system as well.

3.3.1.2 Qualitative Effects (Other Effects)

(1) Perception of Beneficiaries

To measure the qualitative effects of this project, a simple survey on the perception of beneficiaries was conducted, using the ex-post evaluation⁵ from the First Project as reference. Neighboring residents and business operators (store operators) were interviewed about two of the upgraded drainage canals (Lower Lo Nguu River and K5A Canal) and about one of the improved lakes (Lake Khuong Trung 2).⁶ The results of this survey (Table 8) have also been used in the impact analysis in the following section.

⁵ The ex-post evaluation of the First Project was carried out in 2009 as a joint evaluation between Vietnam and Japan. Covering all target areas of the projects, interviews were carried out on the beneficiaries, namely, local residents, business operators, transportation companies, medical clinics and school officials, and changes in perception toward the drainage systems were measured. (Source: https://www2.jica.go.jp/ja/evaluation/pdf/2009_VNV-1_4_f.pdf, https://www2.jica.go.jp/ja/evaluation/pdf/2009_VNII-7_4_f.pdf) Despite significant differences in project size and scale of the survey (number of days, number of people), in this evaluation, reference was made to the survey items and the method of selecting survey subjects in the ex-post evaluation of the First Project.

⁶ Regarding the selection of survey sites, three types of sites (rivers, canals and lakes) were chosen given the characteristics of the facilities developed in the project, and based on this, HSDC prepared a list of candidate sites. From this, the evaluator selected one of each site type at random. Interviewees were selected by approaching residents met while inspecting the relevant sites as follows.

Along the Lower Lo Nguu River: 5 interviewees (4 residents, 1 business operator), K5A Canal: 6 interviewees (4 residents, 2 business operators), Lake Khuong Trung 2: 7 interviewees (4 residents, 3 business operators). The business operators were owners of shops, but also local residents. Supplementary information concerning the Lower Lo Nguu River was also collected from a doctor at a health center.

Table 8: Perception of Beneficiaries toward the Effects of the Project

Target area	Project description	Satisfaction with project* (4-point scale)	Perceptions
1. Along the Lower Lo Nguu River	Upgrade of canal, development of roads/pavement along canal	Average: 2.9 points (2 respondents gave less than 3 points)	<ul style="list-style-type: none"> • Areas improved: Decrease in flood damage and improvement in canal sanitation level (less garbage, fewer mosquitoes, flies, and mice) due to upgrade of canal. Further improvement to traffic flow due to development of road. • Areas not yet improved or problems: Water quality in canal has not been improved, offensive odors of canal, risk of traffic accidents due to increase in traffic.
2. Along the K5A Canal	Upgrade of canal (some parts of the canal road were unpaved; in some parts, the drain was underground and the entire surface became road)	Average: 3.25 points (Average only for unpaved section of road: 2.8 points)	<p><Along box culverts></p> <ul style="list-style-type: none"> • Areas improved: Improvement in offensive odors as a result of covering canal, improved convenience as a result of road infrastructure. <p><Along canal></p> <ul style="list-style-type: none"> • Areas improved: Decrease in flood and inundation damage, and improvement in canal sanitation level (less garbage, fewer mosquitoes, flies, and mice) due to upgrade of canal. • Areas not yet improved or problems: Water quality in canal has not been improved, offensive odors due to water quality, sense of unfairness stemming from comparison with areas where box culverts have been constructed.
3. Around Lake Khuong Trung 2	Repair of lake, improvement of water quality, development of promenade around perimeter	Average: 3.47 points (All respondents gave at least 3 points)	<ul style="list-style-type: none"> • Areas improved: Improved water quality of lake, better community sanitation (less garbage, fewer mosquitoes, flies, and mice), further improvement to traffic flow due to pavement of road, increase in customers visiting shops as a result of further sanitation and transportation improvements.

*Note: 4 points = Very satisfied. 3 points = Somewhat satisfied. 2 points = Somewhat unsatisfied. 1 point = Completely unsatisfied.

As shown above in the table, the figures of average on the satisfaction about the project is relatively high.⁷ The achievement of project targets such as “to decrease flood damage, to prevent the pollution in the river water and to improve the rate of waste water” were confirmed in the above quantitative evaluation and “to decrease flood damage” was also confirmed by the interview to residents.

3.3.2 Impacts

3.3.2.1 Intended Impacts

(1) Improvement of the urban sanitation and living environment in Hanoi City

After the project, HSDC’s cleaning activities became more thorough than before and water and basin environments were improved, leading to a decrease in mosquitos, flies, mice, etc.

⁷ For reference, the average figure of similar research on satisfaction in the ex-post evaluation (4 grade evaluation) of the First Project is 2.79.

Therefore, it has been recognized by residents that the sanitary conditions have improved and waterborne diseases have decreased. Moreover, the convenience of road use has increased through road improvement, and positive impacts on living environment improvement and distribution have been observed.⁸ Residents have been changing their lifestyles through drainage system improvement. According to an interview survey, residents living around lakes tend to open the doors on the lakes' side, which they had been closed, to spend daily life and leisure time on the lake side, because the lakes' water quality, lakeshores, and access roads have improved, and odor from the lakes decreased.



The improved lake (Dinh Cong Lake)

This project adopted a combined flow system that collects rain water and sewage in one pipe line. In the area where such pipe line is buried in a box culvert, there is no odor from sewage. However, the odor from sewage remains in the area where rainwater and sewage are collected and flow in an open canal.

(2) Improvement of residents' awareness on drainage and sewerage systems

Residents' hygiene awareness has improved because PR activities with radio and posters as well as environmental education in schools were actively conducted through the project. Although unlawful dumping of garbage by outsiders is observed, cases are reported in which residents and children warned people not to dump on the spot. This improvement in residents' and children's hygiene awareness contributes to reduction in garbage dumping into the improved canals and lakes as well as maintenance of drainage facilities. Moreover, the thorough cleaning by HSDC and townscape improvement after the project have brought about the effect of preventing unlawful dumping of garbage.

3.3.2.2 Other Positive and Negative Impacts

(1) Impact on natural environment

The project belongs to category B according to the "Japan Bank for International Cooperation Guidelines for confirmation of environmental and social considerations" (issued

⁸ However, in three areas the risk of increasing accidents owing to the increase of traffic volume caused by road repair along the canals was mentioned.

in April 2002), because the project did not belong to environmentally influential sectors or to an area which is environmentally fragile and the negative influence on the environment is not serious. With regard to the measures against pollution stated in ex-ante evaluation table, the following results were confirmed:

- The discharge from sewage-treatment plant was allowed by the national government.
- Dredged materials and sewage sludge are buried, as planned, and they are appropriately dumped into a specially controlled dumping site in the case where dredged materials and sewage sludge contain hazardous material beyond the national standard.

In addition, there was no particular problem about air pollution, noise and water quality according to the environmental monitoring during the construction, as compared with the governmental standard.⁹

(2) Influence of Resettlement and Land Acquisition

1) Resettlement

Fifty households were subjected to resettlement. Based on the system for resettlement, the executing agency or Project Management Unit (PMU) prepared apartments to move into and compensation to perform the resettlement procedures. The number of subject households was limited, so there were no particular problems.¹⁰

2) Land Acquisition

About 9,000 households in 311.19 ha (64 areas of eight Districts) were subjected to land acquisition. The majority of the households subjected to this land acquisition were not legally registered residents who would be covered by a regular compensation process, but residents having no registration documents.¹¹ In Hanoi, where many residents have made no land registration, land acquisition for infrastructure project implementation is a big challenge. In this project, measures were taken through the following process, based on experience of past projects including the First Project.

First, the Project considered the impact received by residents not covered by regular compensation, and decided to fund them as “Assistance,” based on the status of their affected land and houses. For certification of the targets, the eight subject District People’s Committees were entrusted with the certification and Land Acquisition Steering Board was set up in HPC in order to conduct assessment of eligibility of targets. Moreover, the project team aimed at efficient certification by placing 30 staff members in the team in charge of land acquisition in PMU and having a person in charge by District. Specifically, people in charge visit all the applying households to measure the land and check the house condition.

⁹ Based on “Environmental monitoring report” (formulated by Nippon Koei and VIWASE in August 2016). Monitoring is continued after the project completion but detailed information was not obtained.

¹⁰ The executing agency did not hear any particular complaints.

¹¹ Compensation to not legally registered residents is not obligatory by law concerning land and it was conducted in the form of “Assistance.” However, in the case of construction such as houses, if the construction is permanent with official approval, it becomes the subject of compensation.

Based on the results, the amount of Assistance was determined.¹²

The project team aimed to acquire land with this system, as planned. In fact, it took time to confirm documents, measure land, and check conditions, requiring about 10 years, from 2007 to the end of 2016. This became the biggest cause of delay in project implementation and increase in the project cost. Specifically, the delay was caused by many recipients' amount negotiations because of the paid "Assistance" smaller than the regular compensation or the amount expected by recipients, and the time-consuming certification process. The executing agency thinks more efficient land acquisition could have been possible, if it had shared information with residents at much earlier stage. But it also considers that it was good to provide "Assistance" to residents having no official rights for compensation. The evaluator also positively acknowledges the fact the executing agency did not only conduct minimum compensation but also paid attention to more residents.

(3) Impacts of JICA Partnership Program on the Project

In this project, HSDC engineers were invited to Japan and Japanese engineers gave technical cooperation through Japan's administrations (Chiba prefectural government and Yokohama City government) in coordination with JICA Partnership Program.¹³

1) Capacity building for HSDC engineers

Through JICA Partnership Program by the Chiba prefectural government, three HSDC engineers were invited to Japan in each year from 2007 to 2011. Through JICA Partnership Program by the Yokohama City government, three HSDC engineers were invited to Japan in 2014 and six HSDC engineers in 2015. The main targets were the directors and deputy directors of waste water treatment plants, who are also engineers, and technical guidance focusing on operation and maintenance of waste water treatment plants was offered. In addition, Japanese engineers from Chiba prefecture visited Hanoi to conduct preparation of a checklist and guidelines about operation and maintenance of sewage processing facilities.

This coordination with JICA Partnership Program was expected to strengthen the capacity of HSDC engineers in charge of operation and maintenance of the sewage and drainage facilities improved in this project.¹⁴ However, it was decided that not HSDC, as originally planned, but Phu Dien, the private enterprise would be in charge of maintenance of the Bay Mau WWTP, which was improved in this project. Therefore, the impacts of coordination were limited to the two waste water treatment plants established in the First Project, whose operation and maintenance capacity were strengthened in this project (Truc Bach and Kim Rien) but some impact appeared, based on such coordination with JICA Partnership Program. Moreover, engineers engaging in management of the

¹² The executing agency did not hear any particular complaints about land acquisition, either.

¹³ Project for Strengthening Capacity in O&M Works at Sewerage Treatment Facilities and Water Environment Enlightenment in Hanoi (I) (2007-2009), Project for Strengthening Capacity in O&M Works at Sewerage Treatment Facilities and Water Environment Enlightenment in Hanoi (II) (2010-2012), Project of Capacity Building on Management of Sewage Works in Hanoi (2014-2016)

¹⁴ Written in the ex-ante evaluation sheet

lakes improved in this project have applied Japan's facility maintenance technology learned through training to their lake management. This creates the synergy and supplementary effect on the project.

2) Environmental education and change in perception of local residents

In the Cooperation by the Chiba prefectural government, an enlightenment activity on environmental education was conducted for residents living around the facilities improved in the First Project. However, this activity was conducted only once in 2013. Thus, it was difficult to assess the impact of the education.

On the other hand, participants in the training given by the Yokohama City government provided environmental education for students of schools near Truc Bach Waste Water Treatment Plant in 2015. As described in Impact above, environmental education for children seems to have contributed to maintenance of drainage facilities. In addition, some engineers who participated in the training given by the Yokohama City government are in charge of environmental education events for local residents, which are held by HSDC every year for residents living near waste water treatment plants.

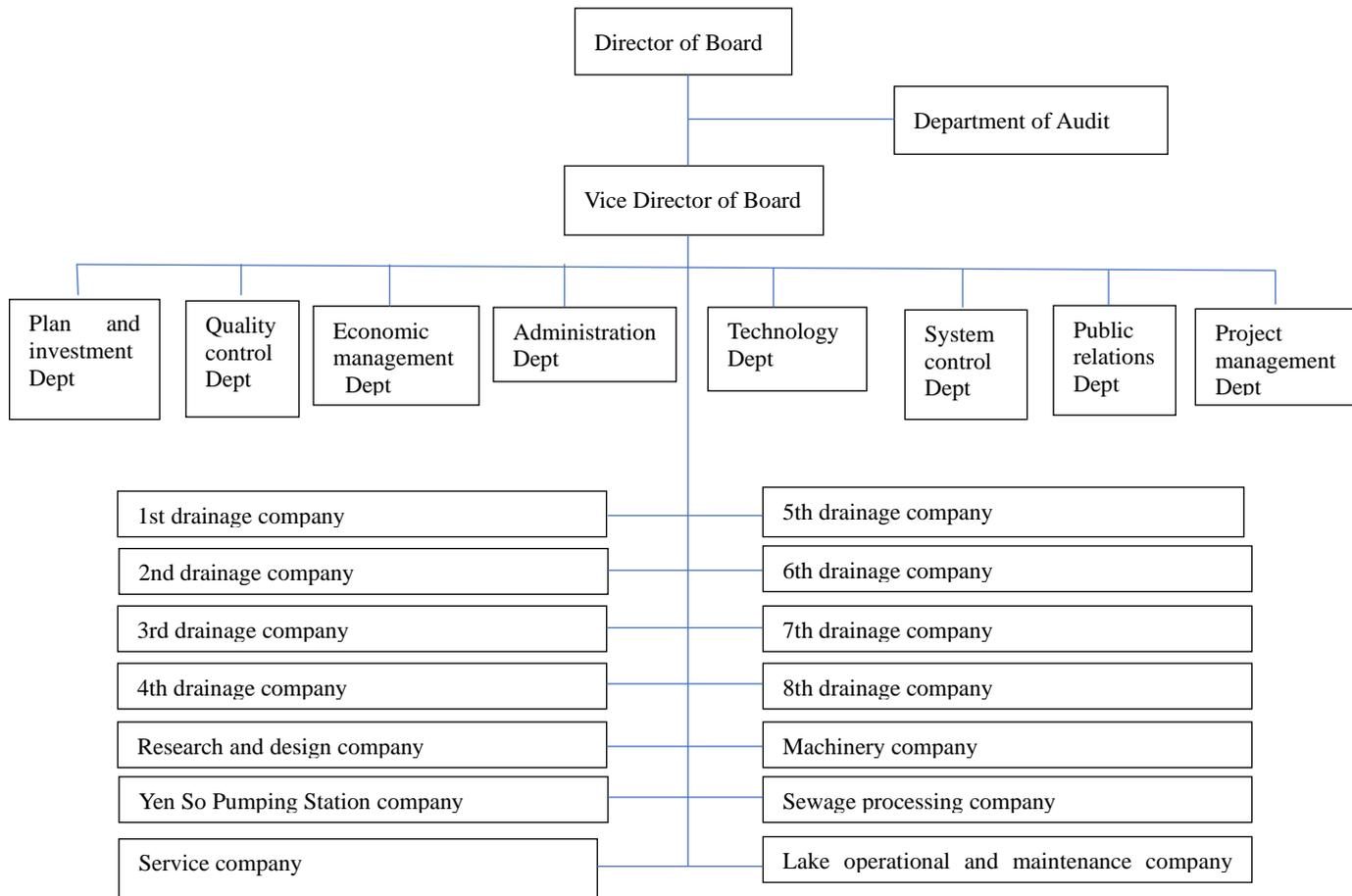
Thus, capacity building for HSDC has had the indirect impact of strengthening maintenance of facilities established or improved in the project and local residents' awareness of the environment.

As discussed above, this project has mostly achieved its objectives. Therefore, effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

HSDC is in charge of operation and maintenance of the facilities improved in this project, except for some facilities. The Bay Mau WWTP is managed by Phu Dien, a private company, and service roads that are constructed together with drainage canals to strengthen the transportation capacity are managed by the Hanoi Department of Transportation (DOT), which is in charge of bulk administration of roads in Hanoi City.



(Organigram of HSDC)

Facilities are maintained as following.

Table 9: Maintenance System

Facility	Maintenance System	Situation
Yen So Pumping Station	The Yen So Pumping Station is managed by the Yen So Pumping Station Bureau. The number of staff members is about 200, of which 20-25 (increased in the rainy season) are engineers. There are 11 teams for the pumping station, gate, canal, culvert, and patrol. Two engineers are placed at each of four points, and the other engineers are stationed in the pumping station. The water levels are supervised in a lump around the clock at HSDC headquarters by camera, and each pump is operated by following the headquarters' instructions.	The placed personnel and system are sufficient for maintenance of the pumping station.
Lakes improved as outlet canals, and control pumps	Management of lakes and control pumps falls under the jurisdiction of the Lake Operational and Maintenance Company in the above organigram. Four engineers are placed at each point supervised around the clock. Based on the manual and checklist prepared in the project, the water level is measured every day, and the data are managed at the HSDC headquarters to analyze every month's trend.	Through this project, the management room of each lake's pumping station has been prepared, and no particular problems with maintenance have been observed.
Drainage canals	Drainage canals are under the supervision of each drainage company in the above organigram and are maintained focusing on daily cleaning basically done by two workers. In	No particular problems have been observed in the

	addition, full-time workers in charge clean gutters and drains (one to two times a day), dredge manholes (one to three times a month) and dredge underground drains (once a year or more often as needed). Cracks, etc. in manholes are repaired as needed.	maintenance system.
Bay Mau WWTP	Phu Dien, a private company, is in charge of Bay Mau WWTP. This company is a Vietnam-capital enterprise expanding its business across Vietnam, and is in charge of operation and maintenance of six waste water treatment plants in Hanoi City. It has also constructed some waste water treatment plants. Phu Dien maintains Bay Mau WWTP and six other waste water treatment plants with about 60 staff members. Moreover, the maintenance section of the Department of Construction (DOC), HPC, serves as a supervisory authority, and outsourced inspectors examine the water quality, etc. every week.	At the planning stage, HSDC was to be in charge of maintenance of Bay Mau WWTP, but HPC gave an instruction to change to Phu Dien. ¹⁵
Service roads and bridges established together with drainage canals	Roads and bridges in Hanoi city are basically maintained by the Department of Transportation (DOT) of the Hanoi People's Committee (HPC). The management authority of the roads and bridges improved in this project was transferred from PMU (The executing agency) to DOT of HPC. Moreover, DOT entrusted the operation and maintenance to Hanoi Transportation Works Company No. 3, a private company. About 60-80 people in charge make the rounds, conduct periodic inspections through cameras and videos, and conduct repairs once a year on average. The flower beds on promenades, streetlamps, and telephone wires in the road parts are maintained by Districts, Hanoi Lighting Company, and the Department of Information and Communication, respectively.	No particular problems have been observed in the system.

No major problems have been observed in the maintenance system for the facilities improved through this project.

3.4.2 Technical Aspect of Operation and Maintenance

Situation of Operation and Maintenance (O&M) of the main facilities in technical terms are as following.

Table 10: Technical Aspect of O&M

Facility	Technical Aspect of O&M
Yen So Pumping Station	The Pumping Station Bureau of HSDC has 200 staff members, of which approximately 10% are engineers. In 2010-11, 20-day training was given to engineers and other workers through consulting services. Out of the three engineers that received the training, two are using the training contents for their work even now. The manual and checklist distributed in the training are used for daily work.
Lakes and drainage pumps	Lakes and drainage pumps are maintained by technical workers of HSDC. No particular training has been given, but a checklist including a table showing the baseline water levels has been distributed to perform work based on it. In addition, under the supervision of HSDC, operational workers in Lake Operational and

¹⁵ It has been encouraged to outsource the public service in terms of efficiency since 2013 and this is one of such movement.

	Maintenance Company also operates the lake pumping stations to adjust the water level of regulatory reservoirs.
Drainage canals	The staff of HSDC in charge of maintenance of the canals are not engineers but technical workers. They have not received training but this does not affect their work, because their main task is to clean the canals.
Bay Mau WWTP	In this project, HSDC was planned to serve as the maintenance agency of this facility, and its capacity was strengthened. However, after the change in the maintenance agency before the end of the project, training was given also to Phu Dien in charge of this facility through consulting services. The manual and checklist on operation and maintenance of the facility and equipment were distributed, and its operation and maintenance capacity were strengthened by giving OJT over six months after handover. Some staff members have received Phu Dien's in-house training or JICA technical training. There are no problems with maintenance technique.
Service roads established together with drainage canals	The maintenance capacity of Hanoi Transportation Works Company No. 3 is to be checked every three years when the contract is renewed. No problems are seen so far.

As described above, no technical problems with maintenance of the facilities improved in this project have been observed.

3.4.3 Financial Aspect of Operation and Maintenance

The budgets for operation and maintenance of all the facilities constructed or repaired in this project are allotted by HPC. Although the operation and maintenance agency of Bay Mau WWTP was changed from HSDC to Phu Dien, the budget source has not been changed from HPC. Every maintenance agency makes a budget request to HPC and maintains the facilities within the allotted budget.

The budgets from HPC are allotted not according to facilities but according to agencies. The evaluation team was unable to obtain detailed information, including the concrete amount of budget, from each agency, but the team has confirmed that no agency has a problem with the budget amount and each agency can request an additional budget from HPC in an emergency such as in the event of a major failure.

A system revision for the financial aspect of the drainage and waste water disposal system in Hanoi City is currently in progress.¹⁶ In the existing system, the financial burden on users is not more than about 10% of tap water consumption, and the rest depends on the public works budget of the Hanoi City government. However, in order to secure the budget to repair the existing aged equipment and to increase the facilities in the uncovered area, the water tariff system will be revised and weighted more to users. The responsible organization¹⁷ under HPC has developed a road map to achieve installation of the new financial system by FY2023. In the new system by FY2023 the users of drainage system are planned to cover from 40% to 50% of the cost according to the usage. The road map was developed based on the above

¹⁶ Based on DECREE on water drainage and waste water management in 2014

¹⁷ The Inter-sectoral Department of Construction and Department of Finance

system revision in 2014. It, however, has not been implemented yet at the time of ex-post evaluation (April 2020) because it is taking time to be accepted by the users who are forced to provide financial contribution to the system.

As described above, operation and maintenance of the facilities improved in this project are financed by HPC, and no problems have been observed at the stage of the ex-post evaluation, although revisions may be made in the future.

3.4.4 Status of Operation and Maintenance

1) Main facilities in this project

All the facilities improved through this project were to be handed over from PMU to operation and maintenance agencies after the end of construction work. Although some of the implemented packages¹⁸ were not handed over at the time of the field survey for the ex-post evaluation in December 2019, handover process was completed by PMU at the end of June 2020. In the canals whose handover had not been completed, HSDC was maintaining the facilities, entrusted by HPC. However, the maintenance was weaker than in other canals. Thus, some problems with maintenance had been observed. Those problems included the decrease of accuracy of drainage because of accumulating sludge and increase of O&M cost in the case of stuck in the drain ditch (at the time of field visit). However, the maintenance of these facilities would be improved because of the completion of handover of authority. On the other hand, no particular problems with the operation and maintenance of the facilities already handed over have been observed.

2) Bay Mau WWTP

No problems with maintenance have been observed. Part of equipment has had structural problems such as foul odors in the treatment plant, and equipment causing inconvenience in operation because the installation place is too close to other equipment. However, it is acceptable for normal functioning of the plant.

3) Service roads established together with drainage canals

No particular problems with maintenance have been observed. At the time of the field survey, some bridges were rusted, or their paint had fallen off, but DOT said that repairs would be made in sequence. No particular problems have been observed in the road parts.

No major problems have been observed in the institutional/organizational, technical and financial aspects and current status of the operation and maintenance system. Therefore, sustainability of the project effects is high.

¹⁸ CP3 (some drainage canals), CP4 (part of drainage canals), CP5.1 (service road improvement), CP6.2 (the service road parts and the pump electrical systems of improved lakes), CP7 (the electrical systems of control pumps) out of the 17 packages

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project is to decrease flood damage, to prevent the pollution in the river water and to improve the rate of waste water processing in Hanoi City by developing drainage and sewerage systems, thereby contributing to the improvement of the city's urban sanitation and living environment. This objective has been highly relevant to Vietnam's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high. The project cost exceeded the plan and the project period was significantly longer than planned. Therefore, the efficiency of the project is low. Through implementing this project, drainage and sewerage systems were established in Hanoi City. The targets such as to decrease flood damage, to prevent the pollution in the river water and to improve the rate of waste water processing have been achieved to good extent. In addition, the improvement of entire urban sanitation and living environment was also realized. Therefore, the effectiveness and impacts of this project are high. No major problems have been observed in the institutional/organizational, technical and financial aspects concerning the operation and maintenance of the project. Therefore, sustainability of the project effects is high.

In light of the above, this project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Measures against the offensive odors of sewage in drainage canals

HPC should consider some countermeasures against the offensive odors of sewage in drainage canals not in the form of box culvert, as stated above.¹⁹

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

(1) Procedures for land acquisition

From the lesson that delay in land acquisition led to delay in implementation of the project as a whole, learned in the First Project, decision-making was transferred from the central PMU to the District level in this Second Project, and 30 staff members at the land acquisition section in PMU worked on smooth implementation of land acquisition by placing people in charge

¹⁹ The evaluator obtained the information that in the project "Hanoi City Yen Xa Sewerage System Project (I)," on which L/A was signed in March 2013, box culverts of sewer pipes will be set up under the ground along the canals in the target area of "Second Hanoi Drainage Project for Environmental Improvement" and sewerage water will be collected and processed in the Yen Xa Wastewater Treatment Plant. Therefore, it was confirmed that the executing agency recognizes that Yen Xa Sewerage System Project becomes a countermeasure for the Recommendation.

according to districts. Nevertheless, also in this project, land acquisition resulted in significant extension of the implementation period and increase in the project cost of the Vietnam side, partly because negotiations with many local residents were necessary in order to implement “Assistance” system.

Implementation of Assistance was important, because residents’ understanding would be less than now without “Assistance.” But as the executing agency is already aware, it is important to promote the local residents’ understanding of the purpose and necessity of a project in advance, and show the compensation (or assistance) system clearly to residents.

(2) Role of the executing agency about monitoring of the target indicators after the project completion

At the time of conducting field survey in the ex-post evaluation handover of the authority of facility management from PMU to the O&M agency (HSDC) was not completed. In addition, it was very difficult for two organizations to communicate under the COVID-19 infection situation. Consequently, it was insufficient to obtain indicator data and also it took a lot of time to collect such data. Since HDC is the supervising agency of both PMU and HSDC, the executing agency should take leadership, give proper instruction and promote monitoring of the target indicators after the project completion. In future, from the point of view of project supervision and, considering the importance of continuous monitoring of indicators, when similar situation takes place, the executing agency is expected to take leadership, to coordinate among related agencies and to make best effort in indicator monitoring after project completion.

End

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual	
1. Project Outputs			
1) Sewerage System			
Construction of Waste Water Treatment Plant of standard activated sludge method (Bay Mau WWTP)	13,300 m ³ /day	As planned	
Construction and repair of sewer and stormwater pipes	Total length: 29.1 km	Total length: 24.447 km	
Procurement of Dredging Equipment and Spare Parts	1 package	2 packages	
2) Drainage System			
Extension of Yen So Pumping station	9 pumps, capacity of 45 m ³ /sec added	As planned	
Drainage Canal Improvement (dredging of sludge and installment of box culvert)	Total length: 27.4 km	Total length: 24.303 km	
Repair of Bridges related to Drainage Canal Improvement	9 bridges	As planned	
Construction of Service Roads	Total length: 30.5 km	Total length: 30.605 km (as planned except for minor modifications)	
Lake Improvement and Extension of outlet canals	10 lakes and 2 regulating reservoirs	11 lakes, 2 regulating reservoirs and 3 pumping stations and maintenance of exhaust pipes	
Establishment of Disposal Site for the sludge from Waste Water Treatment Plant	64.3 ha	As planned	
3) Consulting Service			
Detail Design, Tender Assistance, Construction Supervision, Capacity Building of O&M		As planned (including modifications related to additional packages)	
Formulation of O&M Plan of Sewerage and Drainage sector in Hanoi City (including the research on sewage fee setting)		Not implemented	
Preparation of the F/S for the large-scale sewerage treatment plant (to be constructed in western Hanoi)		As planned (F/S of Hanoi City Yen Xa Sewerage System Project)	
[MM of experts, Results/Plan]	FS	Detail Design	Construction Supervision
International Experts	51.0/50.8	138.5/138.3	375.3/375.1
Vietnamese Experts		50.0/50.0	1,783.9/1,701.9
Supporting Staff		236.0/235.9	658.7/657.6
2. Project Period	March 2006–September 2011 (66 months)	March 2006–December 2016 (129 months)	
3. Project Cost			
Amount Paid in Foreign Currency	JPY 7,600 million	JPY 5,855 million	
Amount Paid in Local Currency	JPY 34,709 million (VND 5,180,448 million)	JPY 36,752 million (VND 7,206,275 million)	

Total ODA Loan Portion Exchange Rate	JPY 42,309 million JPY 32,333 million VND 1.00 = JPY 0.00670 (As of March 2008)	JPY 42,607 million JPY 23,835 million VND 1.00 = JPY 0.00510 (Average between January 2007 and December 2016)
4. Final Disbursement	December 2016	

End