Ex-Post Project Evaluation 2019
Package Ⅲ-1 (Viet Nam, Morocco)

October 2020

JAPAN INTERNATIONAL COOPERATION AGENCY

IC Net Limited.

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Socialist Republic of Vietnam

FY2019 Ex-Post Evaluation of Japanese ODA Loan
"National Highway No. 1 Bypass Road Construction Project / National Highway No. 1 Bypass Road Construction Project (II),
Cuu Long (Can Tho) Bridge Construction Project / Cuu Long (Can Tho) Bridge Construction Project (II)"

External Evaluator: Ryujiro Sasao, IC Net Limited

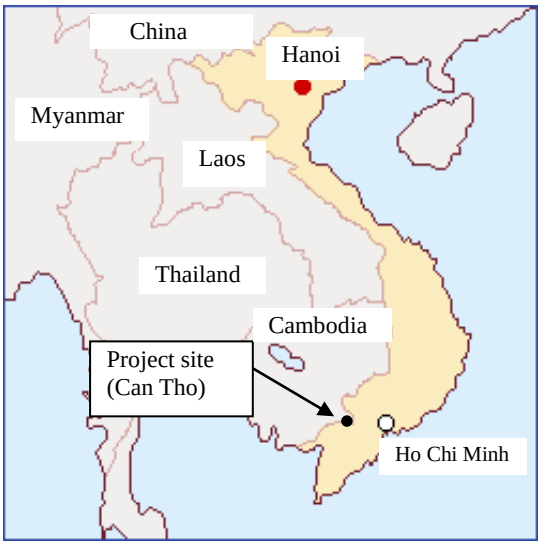
0. Summary

This project aims to improve the efficiency of logistics in the Mekong Delta region by constructing the Cuu Long (Can Tho) Bridge crossing the Hau River, a tributary of Mekong River and related approach roads in the South Vietnam.

Its implementation fully matches the Vietnamese government's development plan, needs and Japan's ODA policy to Vietnam, indicating the project's high relevance. The project budget was revised because of the global rise in prices of construction materials after the first appraisal and the changes in the extent and design of the construction in line with the site condition (soft ground). Further, the tentative piers of the bridge collapsed. Nevertheless, the bridge was constructed successfully and the number of vehicles that pass the bridge significantly increased after the completion of the project. In addition, local residents are not required to wait for ferry departure times anymore and the bridge offers many concrete benefits such as reduced travel time, decreased influence of bad weather, and improved traffic access to many places. Furthermore, socio-economic statistics seem to indicate the realization of an impact brought by the project. Accordingly, we find that both effectiveness and impacts have reached the originally expected level. However, the project's efficiency is low, because the project cost could not be confirmed for a lack of information, and the actual project duration exceeded the planned one significantly. The operation and maintenance of this project has no particular problem in its institutional/organizational, technical, and financial aspects. The sustainability of the project's effects is high.

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

1. Project Description



Project Location

Can Tho Bridge

1.1 Background

Geographically, Vietnam has an elongated shape: it extends 1,650 km from north to south, and the country's widest portion from east to west is 600 km. Because of the difference in the natural environment and plantations between the south and north, the types and amounts of agricultural products grown in each region also differ. Regarding underground resources, high-quality coal, bauxite, and iron ore are abundant in the north, while crude oil is confirmed to exist in the south. The improvement of traffic between the north and south regions is important for seamlessly connecting both regions and their markets, making the two regions complement each other, reducing their income difference, and promoting national economic growth. Therefore, it is critical to establish transport infrastructure to improve traffic between the north and south as well as surrounding areas.

In Vietnam, the share of road transport in passenger traffic is about 90%, and its share in cargo traffic is about 70%. Thus, road transport is still a major means of transport. However, in the total length of road network of about 240,000 km, the length of trunk lines is 40,000 km, which is only about 17% of the total, and the road network among cities, which is highly selective, is underdeveloped. In addition, because of the damage from the Vietnam War and insufficient road maintenance owing to budget constraints, the roads' transport functions are insufficient, and the level of services in cargo and passenger traffic is still low. As of 2007, the pavement proportions are 98% for national roads, 87% for provincial roads, 55% for local roads, and only 46% for rural roads. These statistics show the poor road conditions in the local living environment. As the number of registered vehicles rapidly increases with economic development, the insufficient road network becomes an obstacle to smooth flow of traffic. Moreover, Vietnam is at the early stage of establishing highways. National Highway No. 1 is a critical one that joins its northern border with China and Nam Can in the south across the country. However, the highway has yet to be constructed across the river between Can Tho and Ving Long; that part depends on ferry transport. It was a traffic bottleneck and unreliable in abnormal weather.

1.2 Project Outline

This project aims to improve the efficiency of logistics in the Mekong Delta region by constructing the Cuu Long (Can Tho) Bridge crossing the Hau River, a tributary of Mekong River and related approach roads in the South Vietnam, thereby contributing to strengthening of international competitiveness of and socio-economic development in the Mekong Delta.

<ODA Loan Project>

Loan Approved Amount/ Disbursed Amount	(Loan Approved Amount) National Highway No. 1 Bypass Road Construction Project: 8,393 million yen National Highway No. 1 Bypass Road Construction Project (II): 4,141 million yen Cuu Long (Can Tho) Bridge Construction Project: 24,847 million yen Cuu Long (Can Tho) Bridge Construction Project (II): 4,626 million yen	(Disbursed Amount) National Highway No. 1 Bypass Road Construction Project: 8,297 million yen National Highway No. 1 Bypass Road Construction Project (II): 3,996 million yen Cuu Long (Can Tho) Bridge Construction Project: 24,358 million yen Cuu Long (Can Tho) Bridge Construction Project (II): 3,952 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	(Exchange of Notes Date) National Highway No. 1 Bypass Road Construction Project: March 2001 National Highway No. 1 Bypass	(Loan Agreement Signing Date) National Highway No. 1 Bypass Road Construction Project: March 2001 National Highway No. 1 Bypass Road Construction Project (II): November

	Road Construction Project (II): October 2009 Cuu Long (Can Tho) Bridge Construction Project: March 2001 Cuu Long (Can Tho) Bridge Construction Project (II): March 2010	2009 Cuu Long (Can Tho) Bridge Construction Project: March 2001 Cuu Long (Can Tho) Bridge Construction Project (II): March 2010
Terms and Conditions	National Highway No. 1 Bypass Road Construction Project (L/A No. VNVIII-6)	
	Interest Rate	1.8%
	Repayment Period	30 years
	(Grace Period	10 years)
	Conditions for Procurement	General untied
	National Highway No. 1 Bypass Road Construction Project (L/A No. VNVIII-6A)	
	Interest Rate	0.75%
	Repayment Period	40 years
	(Grace Period	10 years)
	Conditions for Procurement	Tied between two countries
	National Highway No. 1 Bypass Road Construction Project (II) (L/A No. VNVIII-4)	
	Interest Rate	1.2%
	Repayment Period	30 years
	(Grace Period	10 years)
	Conditions for Procurement	General untied
	National Highway No. 1 Bypass Road Construction Project (II) (L/A No. VNVIII-4A)	
	Interest Rate	0.01%
	Repayment Period	30 years
	(Grace Period	10 years)
	Conditions for Procurement	General untied
	Cuu Long (Can Tho) Bridge Construction Project	
	Interest Rate	0.95%
	Repayment Period	40 years
	(Grace Period	10 years)
	Conditions for Procurement	Japan tied (Special Terms for Economic Partnership (STEP)), Consultant part: General untied
	Cuu Long (Can Tho) Bridge Construction Project (II)	
	Interest Rate	0.2%
	Repayment Period	40 years
	(Grace Period	10 years)
	Conditions for Procurement	Japan tied (Special Terms for Economic Partnership (STEP))
Borrower / Executing Agency(ies)	Vietnamese government / Vietnam Ministry of Transport	
Project Completion	March 2010	
Target Area	Project site: Cuu Long (Can Tho) Bridge crossing the Hau River, a tributary of	

	the Mekong River and related approach roads Beneficiary area: Mekong Delta region
Main Contractor(s) (Over 1 billion yen)	National Highway No. 1 Bypass Road Construction Project: Thang Long Construction Corporation (Vietnam) / Civil Engineering Construction Corporation NO.8 (Vietnam) / Civil Engineering Construction Corporation NO.6 (CIENCO 6) (Vietnam), Quyet Tien Construction Investment Company (Vietnam) / Van Cuong Construction Union Company (Vietnam), China State Construction Engineering Corporation (People's Republic of China), Traffic Trade and Project Joint Stock Company (Vietnam) / Material Equipment and Civil Engineering JSC 624 (MECESCO624) (Vietnam) National Highway No. 1 Bypass Road Construction Project (II) : Thang Long Construction Corporation (Vietnam) / Civil Engineering Construction Corporation NO.8 (Vietnam) / Civil Engineering Construction Corporation NO.6 (CIENCO 6) (Vietnam) Cuu Long (Can Tho) Bridge Construction Project / Cuu Long (Can Tho) Bridge Construction Project (II): Taisei Corporation (Japan) / Kajima Corporation (Japan) / Nippon Steel Corporation (Japan)
Main Consultant(s) (Over 100 million yen)	Nippon Koei Co., Ltd. (Japan) / Chodai Co., Ltd. (Japan) (Note: in charge of all projects)
Related Studies (Feasibility Studies, etc.)	The basic design study on the Can Tho Bridge construction in the socialist republic of Vietnam (1997) The feasibility study on the Can Tho Bridge construction in the socialist republic of Vietnam (1998)
Related Projects	Yen loan: "National Highway No. 1 Bridge Rehabilitation Project" (January 1994; April 1995; March 1996), "Second National Highway No. 1 Bridge Rehabilitation Project" (March 1996; March 1997; March 1999), "Third National Highway No. 1 Bridge Rehabilitation Project" (March 2003) Technical Cooperation: "The Comprehensive Study on the Sustainable Development of Transport System in Vietnam (VITRANSS2)" (2007-2010), "Project for Capacity Enhancement in Construction Quality Assurance" (2010-2013), "The Project for Capacity Enhancement in Road Maintenance" (2011-2014), "The Project for Capacity Enhancement in Road Maintenance Phase 2" (2015-2018) Projects of other organizations: Asian Development Bank: Road parts of National Highway No. 1, "Lang Son – Hanoi," "Nya Trang – Quang Ngai," "Nha Trang – HCMC" World Bank: Road parts of National Highway No. 1, "Hanoi – Vinh," "Vinh – Dong Ha," "Quang Ngai – Dong Ha," "HCME – Can Tho," "Can Tho – Nam Can"

2. Outline of the Evaluation Study

2.1 External Evaluator

Ryujiro Sasao, IC Net Limited

2.2 Duration of Evaluation Study

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

Duration of the Study: October 2019 – November 2020
Duration of the Field Study: November 24, 2019 – December 22, 2019

2.3 Constraints during the Evaluation Study

In evaluating efficiency, the project cost was managed within the original plan, but information on tax, which is part of the cost, was not obtained. Although the sub-rating on the project cost may be ③ (High), it was regarded as ② (Fair) because a lack of information made it impossible to make accurate determination.

Although the expected second field trip was canceled because of the influence of COVID-19 infection and the evaluator was not able to visit Vietnam again, he communicated with the executing agency and JICA office by documents. In addition, the assistant researcher (local consultant) also conducted supplementary researches by telephone and e-mail communication and the evaluation team was able to obtain the minimum necessary information.

3. Results of the Evaluation (Overall Rating: B[1])

3.1 Relevance (Rating: ③[2])

3.1.1 Consistency with the Development Plan of Vietnam

At the time of the appraisal, the Vietnamese government's *The 5 years Socio-Economic Development of Vietnam (2006–2010)* issued in 2006 prioritized the improvement of existing roads and new road construction. Thus, the improvement of National Highway No. 1, a major trunk road in Vietnam, had high priority. In addition, the *Study on the National Transport Development Strategy in the Socialist Republic of Vietnam* (July 2000), a development study by the Japan International Cooperation Agency (JICA), formulated the *National Transport Development Master Plan*. The plan includes a 10-year blueprint to give clear direction to the traffic system and services in order to develop the transport sector, conserve the environment, and promote integration with neighboring countries for globalization. In addition to infrastructure establishment, the plan seeks to strengthen the competitiveness of the transport sector, secure fairness[3], minimize transport cost, and increase user satisfaction. For the blueprint, the plan estimates that the Vietnamese government would need to invest about US$ 10.5 billion, in which the share of road-related investment accounts for 65% of the total.

At the time of the ex-post evaluation, the following policy documents were identified:

The 5 years Socio-Economic Development of Vietnam (2016–2020) published in 2016 informs the policy of extension of the highway system, emphasizing on investments in north–south highways and linkage among big cities in "4. Constructing infrastructure systems and urban areas" under "V. TASKS AND MAJOR SOLUTIONS" in PART 2 of the document.

The Prime Minister (PM)'s decision on strategy for Vietnam transportation development published in February 2013 states the importance of the development of a transport system in southern Vietnam, including the improvement and extension of National Highway No. 1, as "the development goal for 2020."

The *PM's decision on construction planning of Mekong delta* published in January 2018 states the importance of continuing investment in addition to the existing transport infrastructure in order to strengthen the local transport system and the development of the Mekong Delta region. It also states the necessity of further extending National Highway No. 1 and of cross-sectional roads in the south area of the Hau River.

As mentioned above, there is no change in policies, or no drastic change in economic environment and social values, affecting the project's relevance. Therefore, there is strong conformity between the borrower country's development plans (before/after the project) and the purpose of the project subject to the evaluation.

[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[2] ③: High, ②: Fair, ①: Low
[3] Fairness means "balanced development of the entire nation" and "support to the poor and the socially vulnerable."

3.1.2 Consistency with the Development Needs of Vietnam

Can Tho City is located 167 km southwest of Ho Chi Min City and faces the Hau River, a tributary of the Mekong River. It is the most important city in the Mekong Delta region for collecting rice and other agricultural products. At the time of the appraisal, there was no bridge across the river, and transport by ferry between Ving Long Province and Can Tho City was a traffic bottleneck on National Highway No. 1. This necessitated the construction of a bypass road of National Highway No. 1 consisting of the bridge across the Hau River as well as approach roads. According to the executing agency and stakeholders, it took 30 minutes to move across the river by ferry, but, on average, more than 1½ hours in waiting. Citizens also unanimously claim that the ferry was risky during bad weather, indicating the need for a stable and rapid transport mode.

A comparison of the daily average traffic volume passing Can Tho before and after the project shows a rapid increase in volume after the bridge construction. This increase verifies the potential demand of the bridge (*see* section 3.3.1 Effectiveness). According to the statistics of the annual passenger and cargo traffic in Can Tho City, we see a steady increase in traffic amount even a few years after the opening of the bridge as follows.

Table 1: Trend of Annual Passenger Traffic and Cargo Traffic in Can Tho City

Item	2015	2018 (tentative)	Annual growth rate (%)
Passenger (thousand people)	10,560	13,309	8.0
Cargo (thousand ton)	2,899	3,485	6.3

Source: Can Tho City Statistical Yearbook 2018

In summary, the project is in conformity with both pre- and post-project development needs.

3.1.3 Consistency with Japan's ODA Policy

According to the country-wise assistance policy (of the then JBIC) at the time of the first appraisal of the Cuu Long (Can Tho) Bridge Construction Project, roads and bridges were emphasized as the subject of ODA Loan projects, because better transport infrastructure was essential to the economic development of Vietnam and had high priority in Vietnam's development plan. The Ministry of Foreign Affairs' *Country Assistance Program for Vietnam* formulated in 2000 recognized five subjects as important, of which one was development of infrastructure such as power and transport.

In the Ministry of Foreign Affairs' *Country Assistance Program for Vietnam* issued in July 2009 at the time of the second appraisal of the project, "Urban development, transport and traffic, and improvement of telecommunication network" was considered an important development subject. This program also prioritizes support for the "Establishment of network such as urban ring road, inner city roads and bypass roads around the cities" and "Establishment of trunk road network among cities" in order to cope with the increasing traffic demand, while JICA also lists in its *Country Assistance Implementation Report for Vietnam (April 2009)* "Urban development, transport and traffic, and improvement of telecommunication network" as important development subjects. The JICA report recognizes the establishment of a trunk traffic network as a major pillar to support development subjects.

The project suits the aims of the above Japanese governmental aid policies and is an example of concretization of the aims. Accordingly, the conformity between the project and Japan's aid policy is high.

Cuu Long (Can Tho) Bridge Construction Project is also a project belonging to the categories of special ODA Loans and STEP projects. The Can Tho bridge is one of the longest cable stayed bridges[4] in Southeast Asia with mixed concrete and steel structure,

[4] A cable-stayed bridge is a form of bridge that directly connects cables, which are stretched obliquely from one or

requiring advanced technologies to ensure quality and service of life. The executing agency states that Japan is one of the world's leading countries in bridge construction technology, especially of steel structure and, therefore, the application of Japanese technologies to the Can Tho Bridge as the special ODA Loan and STEP project was appropriate. Accordingly, the relevance of project is verified with regard to necessity and the merit of using Japanese technology as well.

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

3.2 Efficiency (Rating: ①)

3.2.1 Project Outputs

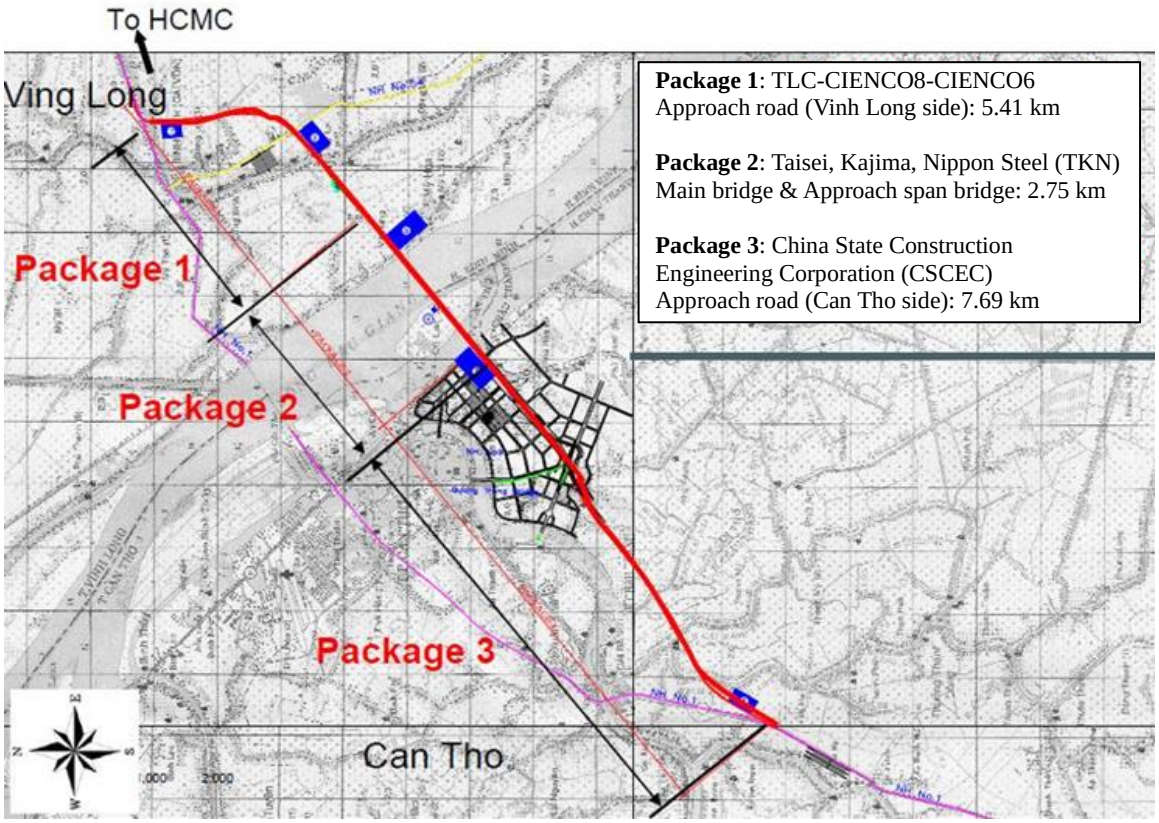
The following is a comparison between the plan and results of outputs of the project.

Table 2: Cuu Long (Can Tho) Bridge Construction Project

Item	Plan (At first appraisal)	Plan (At second appraisal)*	Results
1.Civil work	Hybrid (Steel and Prestressed Concrete) Cable bridge - Center span arrangement: 550 m - Length: 1,090 m - Foundation Type: Cast in place RC Pile of 100 m depth	Hybrid (Steel and Prestressed Concrete) Cable bridge - Center span arrangement: 550 m - Length: 1,010 m - Foundation Type: Cast in place RC Pile of 100 m depth	Hybrid (Steel and Prestressed Concrete) Cable bridge - Center span arrangement: 550 m - Length: 1,010 m - Foundation Type: Cast in place RC Pile of depth of 92 m (north) and 94 m (south on water)
	Approach span Bridge Vinh Long side (Connected PC-I Girder, length: 480 m)	Approach span Bridge Vinh Long side (Connected PC-I Girder, length: 520 m)	Approach span Bridge Vinh Long side (Connected PC-I Girder, length: 520 m)
	Approach span Bridge Can Tho side (Connected PC-I Girder, Connected PC Box-Girder, length: 1,180 m	Approach span Bridge Can Tho side (Connected PC-I Girder, Connected PC Box-Girder, length: 1,220 m	Approach span Bridge Can Tho side (Connected PC-I Girder, Connected PC Box-Girder, length: 1,220 m
2. Equipment for administration	Inspection and maintenance vehicle: 1	Inspection and maintenance vehicle: 1	Inspection and maintenance vehicle: 1
Additional outputs		Countermeasure for settlement at north side Approach span Bridge (Vinh Long side)	Countermeasure for settlement at north side Approach span Bridge (Vinh Long side)
		Structure Health Monitoring System	Structure Health Monitoring System
			Additional countermeasure (piling) for settlement in north side Approach span Bridge, Vinh Long side

*Note: Additional loans were made for both sub-projects because the necessary cost had increased significantly from the original estimate, owing to the global increase in construction material prices and the change in amount and design change made in line with the site condition (soft ground).

more towers (also known as pylons), to the beam and supports it.



Map of the project site

Table 3: National Highway No. 1 Bypass Road Construction Project

Item	Plan (At first appraisal)	Plan (At second appraisal)	Results
1.Ving Long side	Length: 5,410 m	Length: 5,410 m	Length: 5,410 m
	Minor bridges: 3	Minor bridges: 4	Minor bridges: 4
	Interchange: -Semi-Y Type (NH.1) -Diamond Type (NH.54)	Interchange: -Semi-Y Type (NH.1) -Diamond Type (NH.54)	Interchange: -Semi-Y Type (NH.1) -Diamond Type (NH.54)
	Service area: 21,000 m^2	Service area: 21,000 m^2	Service area: 21,000 m^2
2. Can Tho side	Length: 7,690 m	Length: 7,690 m	Length: 7,690 m
	Minor bridges: 7	Minor bridges: 7	Minor bridges: 9
	Interchange: -T-type Grade Intersection (NH.1), -Diamond Type (NH 91)	Interchange: -T-type Grade Intersection (NH.1), -Diamond Type (NH 91)	Interchange: -T-type Grade Intersection (NH.1), -Diamond Type (NH 91)
	Additional items	Flyover at interchange	Flyover at interchange
	Service area: 21,000 m^2	Service area: 21,000 m^2	Service area: 21,000 m^2
	Toll gate: 1	Toll gate: 1	Toll gate: 1 (installed once but removed later because of suspension of toll collection)

The change in the project scope from the original is minimal and mostly related to adjustments made with respect to the actual site condition; thus, the scope is not too different from the content at the time of the first appraisal. Most substantial changes in the scope are items added at the time of the second appraisal, such as "Countermeasure for soft ground at approach span bridge, Vinh Long side," "Flyover at interchange at Can Tho side," "Structure health monitoring system for the bridge structure," and the following "Countermeasure (additional piling) for settlement in approach span bridge, Vinh Long side."

The issue of soft ground at an approach span bridge was difficult to foresee and not accounted for in the original design. Therefore, a design change for piling to strengthen the ground and a budget increase for the change were inevitable. The flyover at the interchange at the Can Tho side was constructed owing to the rapid increase in traffic volume after the first appraisal. In addition, it was considered too early to introduce the structure health monitoring system for monitoring the bridge because of the status in Vietnam at the first appraisal. However, the state council later requested the installation of the system in order to conduct proper maintenance of the bridge and for securing smooth traffic. All the above changes strengthened the facility's functions and contributed to the project's purpose.

Incidentally, the executing agency's evaluation of the contractors' performance was especially high for Japanese enterprises in charge of the bridge[5].

Table 4: Consulting Services

Item	Plan (At first appraisal)	Plan (At second appraisal)	Results
Details	・Review of Detailed Design (D/D) ・Support for bidding and making contract ・Construction management ・Technical guidance ・Environmental countermeasures	・Review of Detailed Design (D/D) ・Support for bidding and making contract ・Construction management ・Technical guidance ・Environmental countermeasures	・Review of Detailed Design (D/D) ・Support for bidding and making contract ・Construction management ・Technical guidance ・Environmental countermeasures

All the consulting services were conducted according to plan and were highly evaluated by the executing agency. Technical training (in Vietnam and abroad) was also conducted as per the originally planned subjects. In its evaluation, the executing agency noted that the trainees obtained much practical knowledge that was useful for their subsequent operation. Regarding the number of trainees, 20 people, as planned, participated in 10 days of training in Vietnam. In the case of training abroad, 29 people—higher than originally planned 15—participated in 2010 and 2011. This is owing to the increased demand for overseas training. Table 5 reports on the staff allocation (plan and actual) and reasons for the difference.

Table 5: Planned and Actual Person Months of Involved Personnel

Personnel	Plan	Actual	Reason for difference
Phase 1. Before construction			
Japanese experts	61	61	
Vietnamese experts	64	64	
Vietnamese support staff	64	109	More than originally expected number of staff were needed because of formulation of activity reports and design documents.
Phase 2. Construction			

[5] The summary of interview to the executing agency is as follows. "Japanese contractors have high technical capability and conducted tasks properly in terms of assignment of work and systematic approach. Knowledge-wise, they have experience of building a big bridge like Can Tho bridge, which is suitable to the project. They supervised sub-contractors appropriately."

Japanese experts	401	361	Micro adjustment of Person Month of each staff, based on the necessity of work, brought this total decrease.
Vietnamese experts	1,392	1,392	
Vietnamese supportive staff	694	694	

3.2.2 Project Inputs

3.2.2.1 Project Cost

The following are the budget and results by sub-project.

Cuu Long (Can Tho) Bridge Construction Project

Table 6: Budget of Project at First Appraisal

(Unit: million yen)

Item	Foreign currency		Local currency		Total	
	Total	Yen loan	Total	Yen loan	Total	Yen loan
Construction work	20,525	20,525	2,648	2,648	23,173	23,173
Price escalation	-	-	-	-	-	-
Physical contingency	1,027	999	132	0	1,159	999
Audit cost	8	8	0	0	8	8
Interest during construction	667	667	0	0	667	667
Commitment charge	-	-	-	-	-	-
Land acquisition	0	0	1,085	0	1,085	0
Administration cost	0	-	706	-	706	-
Tax and duty	0	-	2,434	-	2,434	-
Total	22,227	22,199	7,005	2,648	29,232	24,847

Conditions:
- Exchange rate: US$ 1.00 = 108 yen, 1 Vietnam Dong = 0.00766 yen
- Price escalation rate: Foreign currency; 0.8%, Local currency; 0.1%
- Physical contingency rate: 5%, Cost estimated as of October 2000

Note: The consulting service fee of the two projects is integrated into the fee item of the National Highway No. 1 Bypass Road Construction Project, based on the request of the Vietnamese government, while the costs of land acquisition, compensation for the resettlement of residents, infrastructure establishment (for residents) and administration are all included only in this project.

Table 7: Results at the Time of the Ex-Post Evaluation

(Unit: million yen)

Item	Foreign currency		Local currency		Total	
	Total	Yen loan	Total	Yen loan	Total	Yen loan
Construction work	17,451	17,451	9,914	9,914	27,365	27,365
Price escalation	n.a. (Not Applicable)	n.a.	n.a.	n.a.	n.a.	n.a.
Physical contingency	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Audit cost*1	-	-	18	-	18	-
Interest during construction	905	905	-	-	905	905
Commitment charge	16	16	-	-	16	16
Service charge	24	24	-	-	24	24
Land acquisition	-	-	1,029	-	1,029	-
Administration cost	-	-	573	-	573	-
Tax and duty						
Total	18,397	18,397	11,533	9,913	29,931	28,310

Exchange rate: 1 Vietnamese Dong = 0.005690989 JPY (Applied to the non-loan portion of local currency, IFS average rate was used.)

*1: The originally planned audit to be shouldered by the Japanese side was dropped, and the Vietnamese side conducted it instead.

Note: The above data were compiled by the evaluation team from the original data provided by the executing agency. As the information was not available for tax, the cells are left blank. As the administration cost cannot be divided between two projects, the table shows the total amount including the road project.

National Highway No. 1 Bypass Road Construction Project

Table 8: Budget of Project at First Appraisal

(Unit: million yen)

Item	Foreign currency		Local currency		Total	
	Total	Yen loan	Total	Yen loan	Total	Yen loan
Construction work	3,467	3,467	2,978	2,673	6,445	6,140
Consulting service	1,775	1,775	0	0	1,775	1,775
Price escalation	-	-	-	-	-	-
Physical contingency	173	0	149	0	322	0
Interest during construction	270	270	208	208	478	478
Commitment charge	-	-	-	-	-	-
Land acquisition	-	-	-	-	-	-
Administration cost	-	-	-	-	-	-
Tax and duty	0	-	854	-	854	-
Total	5,685	5,512	4,189	2,881	9,874	8,393

Conditions
- Exchange rate: US$ 1.00 = 108 yen, 1 Vietnam Dong = 0.00766 yen
- Price escalation rate: Foreign currency; 0.8%, Local currency; 0.1%
- Physical contingency rate: 5%, cost estimated as of October 2000

Note: The consulting service fee of the two projects (bridge and roads) is integrated into the fee item of the National Highway No. 1 Bypass Road Construction Project, based on the request of the Vietnamese government, while the costs for land acquisition, compensation for the resettlement of residents, infrastructure establishment for residents, and administration are all included in the Cuu Long (Can Tho) Bridge Construction Project.

Table 9: Results at the Time of the Ex-Post Evaluation

(Unit: million yen)

Item	Foreign currency		Local currency		Total	
	Total	Yen loan	Total	Yen loan	Total	Yen loan
Construction work	896	896	8,412	8,248	9,308	9,144
Consulting service	1,901	1,901	464	464	2,365	2,365
Structure Health Monitoring System	82	82	1	1	83	83
Price escalation	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Physical contingency	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Interest during construction	682	682	-	-	682	682
Commitment charge	11	11	-	-	11	11
Service charge	9	9			9	9
Land acquisition	-	-	-	-	-	-
Administration cost	-	-	-	-	-	-
Tax and duty	-	-	-	-	-	-
Total	3,580	3,580	8,875	8,712	12,457	12,293

Exchange rate: 1 Vietnamese Dong = 0.005690989 JPY (Applied to the non-loan portion of local currency, IFS average rate was used.)
Note: The following data were summarized by the evaluation team from the original data provided by the executing agency. As the information was not available for tax, the cells are left blank.

In the project, the total budget was revised at the second appraisal. This is because for both sub-projects, the necessary cost had increased significantly compared with the original estimate, owing to the global increase in the prices of construction materials, change in the amount of material and design change made in line with the site condition (soft ground) (Additional loans were also made).

At the time of the ex-post evaluation, a comparison of the before (budget at first appraisal) and after (results) cost was conducted by adjusting (excluding from calculation) the additional scope. The details are as follows:

Before: Total budget 39,106 million yen (including 33,240 million yen of loan)
After: Total cost 42,388 million yen (including 40,604 million yen of loan)
After (After adjustment of added scope*): Total cost 38,908 million yen

* Details of the added scope are as follows.
1. Cost of installing a flyover at interchange (1,913 million yen)
2. Cost of introducing structure health monitoring (83 million yen)
3. Cost of the countermeasure for settlement (1,485 million yen)

Consequently, the rate of the actual (after the adjustment of added scope) against the original plan is 99%, and actual project cost is within the plan. However, the tax payment amount was not obtained[6]. Accordingly, the sub-rating of cost efficiency may be ③ (High), but was given ② (Fair) because information constraints made it impossible to make an accurate determination.

The cost was almost within the original plan because the increase in material prices was offset by a decrease in the yen amount owing to the appreciation of the yen in the foreign exchange rate. The price level of construction materials (governmental statistics) increased by 44% from 2005 to 2009, while the Japanese yen had appreciated by 32% between the first appraisal and the ex-post evaluation in the exchange rate against the Vietnamese dong.

3.2.2.2 Project Period

Table 10 reports the results of the comparison of the project period between the plan and the results.

Table 10: Plans and Results by Project Period

Stage	Plan/period (First appraisal)	Plan/period (Second appraisal)	Results
1. L/A Signing date	—	—	2001/3 (March 2001)
2. Selection of consultants	2001/1 – 2001/6	2001/4 – 2002/10*1	2001/4 – 2002/10*1
3. Selection of contractors	2001/7 – 2002/6	2003/3 – 2005/2	2003/3 – 2005/2
4. Construction	(Main bridge) 2002/6 – 2006/12 (Bypass road, Ving Long side) 2002/6 – 2006/4 (Bypass road, Can Tho side) 2002/6 – 2006/9	(Main bridge) 2005/2 – 2010/3 (Bypass road, Ving Long side) 2005/2 – 2009/10 (Bypass road, Can Tho side) 2005/2 – 2009/10	(Main bridge) 2005/2 – 2010/3*2 (Bypass road, Ving Long side) 2005/2 – 2009/10 (Bypass road, Can Tho side) 2005/2 – 2009/10
5. Land acquisition and resettlement of residents	2000/4 – 2001/7	2002/2 – 2006/8	2002/2 – 2006/8

*1. Source: JICA document
*2. Source: "Final Construction Report" This is the period of construction of main part. Later "Additional countermeasure (piling) for settlement in Approach span Bridge, north side" was implemented. This countermeasure was completed in July 2016.

The following are the analysis results of delay factors.

Table 11: Analysis of Delay Factors

Stage	Planned period (First appraisal)	Results	Main delay factors
1.L/A Signing date	—	March 2001	—
2.Selection of consultants	6 months	1 year and 7 months	Details unknown
3.Selection of contractors	12 months	2 years	Details unknown
4.Construction	(Main bridge) 4 years and 7 months	5 years and 2 months	Suspension of construction work caused by collapse of tentative piers
	(Bypass road, Ving Long side) 3 years and 11 months	4 years and 9 months	Countermeasure for settlement, increase of construction materials prices and financial problem of

[6] The total of originally expected tax amount is 3,288 million yen as the total of two projects and this amount exceeds the difference of planned total cost and actual total cost, 198 million yen.

			contractors and so on
	(Bypass road, Can Tho side) 4 years and 4 months	4 years and 9 months	Countermeasure for settlement, increase of construction materials prices and replacement of contractors and so on
2. Land acquisition and resettlement of residents	1 year and 4 months	4 years and 7 months	According to the executing agency, it may have taken time to establish infrastructure for the resettlement site, as resettlement negotiation itself did not take much time. However, the delay described in the left column did not affect progress of construction, because the land acquisition took place much earlier than the start of construction.

The planned project period and actual period were compared, and the details are shown below.

Plan: March 2001-December 2006 (70 months)
Actual: March 2001-March 2010 (109 months)[7]

Consequently, the ratio of the actual period to planned period is 156%, that is, the actual project period was significantly longer than planned. Therefore, the sub-rating of time efficiency is ① (Low).

The accidental collapse of the piers at the Cuu Long Bridge affected time efficiency; had the accident not occurred, the construction period would have been reduced by about one year. The total project period without the delay from the accident is estimated to be 97 months, and the rate of the actual project period divided by the planned period would have improved from 156% to 139%.

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

(Economic Internal Rate of Return)

In this project, the constructed road stopped charging a toll against the original plan. Accordingly, the calculation of the financial internal rate of return (FIRR) was suspended, and only the EIRR was re-calculated.

The EIRR of this project was calculated to be 12.5% in the first appraisal and 15.7% in the second appraisal. Re-calculation at the ex-post evaluation was based on the method used at the first appraisal (F/S) and at the second appraisal. The following table shows the comparison between the appraisals and the ex-post evaluation. EIRR at the time of ex-post evaluation increased from the figure at the time of second appraisal by 2 % mainly because of the re-confirmed increase of benefit from the estimate as at second appraisal.

Table 12: Economic Internal Rate of Return (EIRR)

	Appraisal	Re-calculation at ex-post evaluation
EIRR	First appraisal: 12.5% Second appraisal: 15.7%	17.7%
(Calculation background)		
Project life	50 years	50 years

[7] As stated in the report (footnote of Table 10), to be precise, the entire construction work finished in July 2016. However, the road started to be used after the completion of the main part in 2010 and traffic volume smoothly increased. Accordingly, the end of project period was recognized to be the end of the main part in judging the efficiency.

Cost	Project cost (except for tax), Operation and maintenance fee	Project cost (except for tax), Operation and maintenance fee
Benefit	Saving of running cost (including the operation cost of ferry service), reduction of transport time and increase of land prices	Saving of running cost (including the operation cost of ferry service), reduction of transport time and increase of land prices

In summary, the efficiency of the project is low because of uncertainty about the obtained cost information and that the project period significantly exceeded the plan.

3.3 Effectiveness and Impacts[8] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

Table 13 reports the targets and results of the operation and effect indicators of the project.

Table 13: Target and Actual Values of Operation and Effect Indicators

Indicators	Baseline	Target	Actual	
	2008	2012	2012	2019
		2 years after the completion	2 years after the completion	9 years after the completion
Annual average daily traffic volume (units/day)	27,110	62,102	71,808	57,917
Reduction in travel time (million yen/year) **(Note 1)**	-	436	Achieved	
Passenger car units (PCU/day) **(Note 2)**	20,797	52,393	41,288	47,873
Reduction in ferry operating costs (million yen/year)	-	342	Achieved	
Rise in land value in neighborhood	As this item is suitable as "impact" level indicator, it is discussed at "impact."			

(Note 1) This assumes that transport time will be reduced by 25 minutes as a result of the implementation of two sub-projects.
(Note 2) Passenger Car Unit (PCU) is a unit converting the number of a range of transportation vehicles into the number of passenger cars. In principle, we use the conversion parameters used at the baseline for re-calculation.

The analysis for each indicator is shown below.

1. The annual average daily traffic volume (AADT): It is the number of vehicles that pass the bridge in a certain period. The annual average traffic volume of two years after the completion clearly exceeds the original target (The realization rate is 115.6%).

The increase in traffic volume slowed for several years after the opening of the bridge because of a shift of transport to other routes owing to the opening of the new ferry route and roads across the Hau River after opening of Can Tho Bridge. Among the four new traffic routes shown below, we were able to obtain the estimate of the annual average daily traffic volume of only Dai Ngai Ferry service. This traffic amount in 2019 was 7,100 (about 12% of AADT at the Can Tho Bridge in 2019); consequently, the total traffic volume of four routes would be significant.

[8] Sub-rating for Effectiveness is to be put with consideration of Impacts.

Table 14: Ferry Routes and Roads across Hau River after Opening of Can Tho Bridge

Bridge and ferry	Year of opening or starting service	Distance from Can Tho bridge
National Highway No N2	2011	75 km
Dai Ngai Ferry	2013	54 km
Cao Lanh Bridge	2018	73 km
Vam Cong Bridge	2019	64 km

Source: Executing Agency

On the other hand, plural industrial estates have been opened around the opening time of the Can Tho Bridge. This seems to be a factor leading to the increase in transport of cargo including final products and raw material, and an increase in traffic.

Table 15: Status of Opening of Industrial Estates in Vicinity of Can Tho Bridge

Name	Location	Opening year	Distance from Can Tho bridge
Hung Phu 2A	Phu Thu Ward, Cai Rang District	2009	10 km
Hung Phu 2B	Phu Thu Ward, Cai Rang District	2009	10 km
Thot Not	Thoi Thuan Ward. Thot Not District	2009	59 km
North O Mon	Thoi Long Ward, O Mon District	2011	40 km

Source: CEPIZA (Cantho Export Processing and Industrial Zone Authority)

In summary, there seem to exist the following factors of both suppression and acceleration related to the traffic increase.

- Suppression factor: There was a major shift in traffic volume because of the start of new ferry service and opening of roads in the neighborhood of the Can Tho Bridge after its opening.
- Acceleration factor: Plural industrial estates were opened in the neighborhood of the Can Tho Bridge around its opening time.

The opening of alternative traffic routes in and after 2011 and the opening of industrial estates mainly up to 2011 explain why the suppression factor seems to have been more influential in recent times.

2. The reduction in travel time: It is an indicator referring to the total benefit of saving transport time compared with the case of passing along National Highway No.1 by crossing the river (by the ferry service) . Because the calculation details of the indicator shown in the ex-ante evaluation sheet were not available, precise re-calculation is impossible. However, as the most important parameter in the re-calculation—increase of traffic volume—was realized as planned, it is fair to say that the target indicator was achieved. The originally estimated saving time in calculating the target was 25 minutes. According to the executing agency, the passing time by the ferry was about 30 minutes and the actual passing time though the Can Tho Bridge was 2 minutes and 51 seconds (average of the two times measured by the evaluator). Therefore, the original estimate of the saving time is appropriate. Because travelers can save the waiting time to use the ferry (about 1.5 hours on average) in addition to the passing time reduction, the time-saving effect would be more than the target.

3. The passenger car units: This is the unit in which the number of various vehicles is converted into the one of passenger vehicles. This does not indicate the originally expected growth (The realization rate is 78.8%), but it is explained by the fact that the number of motorbikes whose conversion parameter is the smallest was more than that of other vehicles in 2012.

4. The reduction in ferry operating costs: With regard to this indicator, the basis for calculating the 2012 target value indicated in the ex-ante evaluation table was not available.

However, in re-calculating this indicator based on the expected saving effect right after the bridge opening stated in the F/S report, the amount was about 315 million yen per year, which is slightly lower than the original target of 342 million yen. Because the estimated saving effect of ferry operation at the F/S seems to be close to reality, and the estimated traffic volume up to 2010 on the assumption that this project was not implemented is close to the actual volume, we conclude that the originally expected effect is realized.

3.3.1.2 Qualitative Effects (Other Effects)

There are no originally expected items, and the qualitative effect was summarized in the item of "impact" in the ex-post evaluation.

3.3.2 Impacts

3.3.2.1 Intended Impacts

Impact is usually defined as an effect that appears several years after project completion. Concrete indicators on impact did not exist in the ex-ante evaluation sheet. Therefore, based on the key point of this project, we newly defined impact as "contribution to socio-economic development of the Mekong Delta region through strengthening of international competitiveness and improvement of the living environment," established concrete indicators, and measured them accordingly. Regarding the quantitative effect, an impact similar to the national average, or more, has been realized in most economic indicators. Although it is difficult to verify the cause–effect relationship between the project and items of impact, there is a strong relationship between the increase in traffic volume and increasing scale of economy in general. When we consider the above effect indicators as well, as expected in the original scenario, there is good possibility that an improvement in transport modes increased traffic, which, in turn, activated the local economy.

1) Quantitative effect (Increase in international competitiveness of industrial goods produced in the Mekong Delta region)

The increase in international competitiveness of the Mekong Delta region can be verified by comparing the statistics of region-wise exports, but such statistics are not available. Accordingly, we obtained alternative data such as region-wise industrial output and direct foreign investment.

Regarding industrial output, Table 16 shows that the growth rates of Ving Long Province and Can Tho City exceed the national average of Vietnam from 2010 to 2016.

Table 16: Trend in Industrial Outputs

(Unit: The figures between 2012 and 2016 are indexes with those in 2010 as 100. The figures of 2017 and 2018 are indexes with those in 2015 as 100.)

Year / Region	2012	2013	2014	2015	2016	2017	2018*2
1. Vin Long Province*1	102.1	112.0	109.8	111.6	111.3	109.1	109.6
2. Can Tho City*1	104.6	107.7	108.2	107.3	108.8	107.2	107.8
3. Whole Vietnam*1	105.8	105.9	107.6	109.8	107.4	111.3	110.1

*1. Source: HP of Vietnam Statistics Office, https://www.gso.gov.vn/default_en.aspx?tabid=776"

*2. Tentative figures

Regarding foreign direct investment, Table 17 shows that before and after 2010, the ratios of increase in Ving Long Province and Can Tho City exceed the national average of Vietnam. The increases in direct investment and trend of enterprises also conform with the results of the interviews with enterprises that began operating in the industrial estates (For an example, one enterprise decided to participate in the estate after knowing of this project).[9]

[9] The most important benefit from the bridge construction is the reduction of time to travel to Ho Chi Minh City according to the interviews of enterprises located in the industrial estate in Can Tho City. This is related more to the improved operation efficiency and increase in production than a decrease in transport cost.

Table 17: Trend in Foreign Direct Investment Amounts

(Unit is index with the average amount of registered capital from 2007 to 2010 as 100)

region \ year	2011	2012	2013	2014	2015	2016	2017	2018	Accumulation of invested amount (2011-2018)
1.Ving Long Province*1	41	220	27	299	552	1,305	1,124	1,472	5,040
2.Can Tho City*2	368	25	23	108	59	693	26	35	1,337
3.Entire Vietnam*3	46	48	66	64	71	79	109	107	590

*1. Source: Ving Long Province Statistical Yearbook 2018

*2. Source: Can Tho City Statistical Yearbook 2018

*3. Source: HP of Vietnam Statistics Office, https://www.gso.gov.vn/default_en.aspx?tabid=776"

2) Quantitative impact (Contribution to socio-economic development by improving the living
environment)

The tables below show trends in GDP, number of enterprises, and the income of residents of entire Vietnam, Ving Long Province, and Can Tho City. We find evidence of development in economic aspects after the completion of the project.

As per Table 18, although the GDP data before 2015 were not available for Can Tho City, both Ving Long Province and Can Tho City show increasing trends over time.

Table 18: Trend in GDP (Unit: 1 billion Vietnamese Dong at constant 2010 price)

region \ year	2010	2011	2012	2013	2014	2015	2016	2017	2018
1.Ving Long Province*1	21,535	23,333	24,827	26,457	28,227	30,241	31,784	31,043	32,863
2.Can Tho City*2	n.a.	n.a.	n.a.	n.a.	n.a.	49,182	53,431	56,928	60,923
3.Entire Vietnam*3	2,157,828	2,292,483	2,412,778	2,543,596	2,695,796	2,875,856	3,054,470	3,262,547	n.a.

*1. Source: Ving Long Province Statistical Yearbook 2015, 2018

*2. Source: Can Tho City Statistical Yearbook 2016, 2018

*3. Source: HP of Vietnam Statistics Office, https://www.gso.gov.vn/default_en.aspx?tabid=776"

In Table 19, the numbers of enterprises in Ving Long Province and Can Tho City increased steadily from 2010 to 2017 by 14% and 46%, respectively.

Table 19: Trend in Numbers of Enterprises in Operation (Manufacturing Sector)

Region \ Year	2010	2011	2012	2013	2014	2015	2016	2017
1.Ving Long Province*1	295	321	314	306	305	307	314	335
2.Can Tho City*2	665	n.a.	721	678	723	764	865	973

*1. Source: Ving Long Province Statistical Yearbook 2015, 2018

*2. Source: Can Tho City Statistical Yearbook 2016, 2018

In Table 20, the income of residents (average monthly salary per capita) increased in Ving Long Province by about 90% and in Can Tho City by about 120% from 2010 to 2016. However, these growth ratios are similar to those of the Mekong Delta region and the entire Vietnam.

Table 20: Trend in Average Monthly Salary per Capita
(Unit: Thousand Vietnamese Dong)

region \ year	2010	2012	2014	2016	2018*
1.Ving Long Province	1,239	1,744	2,205	2,378	3,089
2.Can Tho City	1,540	2,325	2,673	3,365	4,371
3.Mekong Delta	1,247	1,797	2,327	2,778	3,588
4.Entire Vietnam	1,387	2,000	2,637	3,098	n.a.

Source: Website of Vietnam Statistics Office, https://www.gso.gov.vn/default_en.aspx?tabid=776"
*Note: Tentative figures

Land prices also increased in the vicinity of the project site according to field research (interviews with real estate companies and research of related websites on the Internet), as shown in Table 21 (We adopted the average figures of plural information data).

Table 21: Trend in Land Prices

Indicator	Baseline (Actual at 2008)	Target (2012, 2 years after the completion)	Actual (2012, 2 years after the completion)	Actual (2019, 9 years after the completion)
Index of increase of the price of land in vicinity (the figure of 2006 as 100)	165	450	333 (Urban area, Can Tho), 338 (Urban area, Ving Long)	1,333 (Urban area, Can Tho), 1,500 (Urban area, Ving Long)

At the point of two years after project completion, the average land price increased 3.3 times the figure of 2006, which is slightly lower than the forecast of 4.5 times. However, the land price increased drastically in the years after 2012.

3) Qualitative impact (Contribution to socio-economic development by improving the living environment)

1. Impact of establishing the bridge and roads (Interviews with local government and residents)

The results of interviews with the chairpersons of the People's Committees in Ving Long and Can Tho, the sites of the bridge and roads, are shown below. Regarding the benefit from the project, both representatives mention strong benefit such as reduction of passing time, convenience (that is, travelers are not constrained by factors such as departure times of the ferry service), decrease of influence of bad weather, improved traffic access to many places, and more benefits to commercial establishments near the project site. Further, they state that materials can be brought in from and taken to farther regions. They also mention no negative influences.

Regarding local residents, three households close to the project site and two households living 1–1.5 km away from both sides of the bridge (Ving Long and Can Tho) were also interviewed as samples. The summary of interviews is as follows:

- All ten respondents from the ten households mention high benefits such as reduction of passing time, convenience, less influence of bad weather, and improved traffic access to many places. Nine households obtained opportunities of new employment and business as a result of the project.
- Most opinions were "no particular change" regarding the influence on the environment at both sides of the bridge, but there were minor opinions that the quality of air and noise worsened[10].

[10] The executing agency did not hear any particular complaints from local residents either during the completion or after.

- Eight out of ten households replied that the AIDS prevention program was effective.
- All households were satisfied with the operation and maintenance of roads.
- Regarding the total project evaluation of five grades[11], five households responded "Excellent" and another five households responded "Good" (There was no difference between the two sides).

2. Impact of establishment of the bridge and roads (Interviews with enterprises)

Regarding enterprises, we interviewed three operating in the industrial estates near the project site and four near the project site.

- All seven enterprises mentioned high benefits such as reduction of passing time, convenience, reduction of influence of bad weather, and improved traffic access to many places.
- All enterprises reported increasing trends of sales and stable profits in their business performance. One enterprise (Japanese) in an industrial estate mentioned that it decided to operate there because of the project and that their business is fully dependent on the Can Tho Bridge.
- Regarding the total project evaluation of five grades same as above, six enterprises responded "Excellent" and one enterprise responded "Good."

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Natural Environment

This project belongs to Category A, as it is a road sector project according to "JBIC Guideline for the purpose of environment consideration in ODA Loans" (issued in October 1999).

From 2005 to 2011, the executing agency conducted monthly environment monitoring. The items of monitoring are quality of air, quality of water, noise, and vibration. Table 22 presents the monitoring method and results.

Table 22: Environment Monitoring Method and Results

Item	Method	Results
Air quality	To collect 3 samples at one place per day (Total 3 days at 3 places)	Parameters of dust, CH and SO^2 were over the limit of Vietnamese Standard in 2005 and 2006 but had lessened to the level within the national standard.
Water quality	Underground water: to collect one sample at one place River water: to collect two samples at a place (total 6 places)	Underground water was not particularly affected by the construction works. Impact on the river water (of the Hau River) was also subtle (As at December 2019, there was not much change from the baseline and majority items out of 14 satisfied national standard).
Noise	Measurement of 24 times per place (total 3 places)	Figures slightly increased after construction works but they are not at the level affecting people.
Vibration	Measurement of 24 times per place (total 3 places)	Figures slightly increased after construction works but they are not at the level affecting people.

Considering the above results, no special countermeasures for environment conservation were taken. With regard to any change in the environment as a whole, the director of the health management center (clinic) in charge of the district, including the project site, also recognizes no problematic change. She states that she has received no health complaints from residents. Regarding noise and vibration, the evaluator believes they are not at serious levels, based on his stay at the project site on several days for total several hours.

[11] *5: Excellent, 4: Good, 3: Medium, 2: Poor, 1: Very poor

2) Resettlement and Land Acquisition
The evaluator visited the headquarters of the executing agency and two district people's committees (of Ving Long and Can Tho) that were in charge of the resettlement of residents. The evaluator confirms the following content about the outline of the resettlement and land acquisition, as reported in the appraisal document *Can Tho bridge Cuu Long (Can Tho) Bridge Construction Project II* issued on March 5, 2010.[12]

"About 210 ha of land acquisition was conducted with the resettlement of 1,574 households. Procedure on land acquisition and compensation was realized in line with domestic law of Vietnam."

The results of the interviews on resettlement of residents are shown below. Two district people's committees (Can Tho and Ving Long) in charge of the resettlement adopted the following comprehensive compensation measures according to the governmental decrees.[13]

1. Compensation for land that is acquired for the project (For residential land: compensation by provision of alternative land or monetary compensation; for agricultural land: monetary compensation)
2. Monetary compensation for removed properties including houses and structures
3. Tentative support for living, monetary support of an equivalent to 30 kg of rice
4. Support for expenditure in training to find work in a non-agriculture field

In addition, two committees established basic infrastructure (water, electricity, and roads) at the site of resettlement.

Interviews at three places introduced by the executing agency show that most relocated residents had already moved, with only a few households remaining at the site (There is no list of relocated residents). Consequently, the evaluator was able to conduct interviews with ten households. The results are summarized as follows.

- The interviewees are not satisfied with the monetary compensation for resettlement.
- The standard of living of most interviewees decreased because they cannot practice agriculture and their continuous source of income was lost.
- Life infrastructure such as water, electricity, and roads of some places was not well established in the beginning (at the Can Tho side).

According to the staff of the people's committees who were in charge of resettlement and still remain in the committees, the amount of monetary compensation was to be sufficient enough to purchase new land for agriculture after resettlement. However, the site visit to Can Tho gave reason to believe that the problem of life infrastructure was a fact. For example, the roads and drainage in parts of the resettlement sites were not well established at the time of the site visit.

3) Other impacts
(HIV/AIDS prevention program)
According to the report of Mid-Term Review conducted during project implementation (issued in June 2006), the executing agency held the HIV/AIDS prevention program for two years from February 2006 to January 2008 with the support of Care International, an NGO.

[12] There was no resettlement of residents related to the countermeasures taken against land settlement at the approach span bridge of the north side.
[13] 1) Decree of Government No. 22/1998/ND-CP dated April 24, 1998 on compensations for damage when the state recovers land for use in purposes of national defense, security, national interests and public interests and 2) Decree of Government No. 197/2004/ND-CP dated December 3, 2004 on compensation, support and resettlement when land is recovered by the State

The content included workshops, education, and publicity activities for about 800 laborers and residents of the community near the project site. The evaluator was unable to confirm more details with the executing agency because more than 10 years had passed. The executing agency did state that the program was effective, especially because construction laborers tend to have low awareness of HIV/AIDS.

We visited the health management center in charge of the district, including the project site in Can Tho City, for an interview. The head of the center stated that, although it is difficult to verify the effect of the program scientifically, the number of HIV-infected people would have increased had the program not been implemented.

(Other considerations to the people affected by the project)

- The people who made a living through commercial services, including venders, to ferry passengers may have moved to another ferry port.
- Of the 300 employees of the ferry company, 200 were employed by the O&M company of the bridge and 100 were recruited by another ferry company after project completion.
- Because the Can Tho Bridge and approach roads became a part of the highway, pedestrians and bicycles cannot pass the bridge. Accordingly, a new ferry service for the local residents was introduced at a point 4 km away from the Can Tho Bridge, in line with their demands.

In conclusion, this project has achieved its objectives, indicating high effectiveness and impact.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

In March 2010, the O&M company, also called the Can Tho Bridge Joint Stock Company, was established as a state company by the Ministry of Transport (MOT) of Vietnam. The main task of the company is to operate and maintain the main bridge at Can Tho and the National Highway No. 1 approach roads. It has 89 staff members. The company became a subsidiary of the executing agency, CUU LONG CIPM (CUU LONG Corporation for Investment, Development and Project Management of Transportation Infrastructure) in July 2011. CUU LONG CIPM had been a department of the MOT (PMUMT), but became a state company under the MOT in 2011.

The O&M company conducted the operation and maintenance of the Can Tho Bridge from 2010 to 2015 under a consignment contract (negotiated contract) with the fourth local road management unit in VRA (Vietnam Road Administration), MOT. From 2015 to 2019, the company continued operation and maintenance after winning a competitive bidding. Therefore, the operation and maintenance of the project facilities are not necessarily undertaken by the same company, indicating the weak stability of the company in charge; the operation and maintenance under such arrangement may be slightly less stable than one under a fixed government agency. However, the main organization in charge is VRA; owing to its routine monitoring, there is no concern regarding operation and maintenance.

Under the board of directors, the O&M company consists of five departments: planning and technical department, equipment and supply department, quality control department, labor safety department, and operation and maintenance department. The operation and maintenance department consists of the Main Bridge Maintenance Team, Approach Road & Bridge Maintenance Team, and Electricity & Landscape Maintenance Team, with 20, 21, and 12 staff members, respectively. The number of staff members is sufficient and there is no problem in conducting tasks. The turnover ratio is small, except for mandatory retirement; overall, the staff structure is stable.

In summary, there is no problem of institutional or organizational sustainability.

3.4.2 Technical Aspect of Operation and Maintenance

The following operation and maintenance tasks are conducted.

Table 23: Operation and Maintenance of Project Facilities

Facilities	Responsible organization	Operation and maintenance activities
1.Main bridge	Main Bridge Maintenance Team	- Repair of physical damage and defect of the bridge - Structure health monitoring - Monitoring by patrol (Attention to fire and traffic accidents)
2.Approach roads	Approach Road & Bridge Maintenance Team	- Repair of physical damage and defect of the roads
3.Electricity system	Electricity & Landscape Maintenance Team	- Monitoring of function of power generation facility and fire prevention facilities

The following three manuals are used in conducting operations:

1. The Manual for Maintenance Works (made by the Can Tho bridge contractor)
2. The Manual for Monitoring System for Health of The Bridge Structure (made by NTT Data corporation)
3. The Manual on Management, Operation & Maintenance of Can Tho Bridge issued under the decision No. 1467/QD-BGTVT (made by MOT)

According to the executing agency, there is no technical problem in the operation and maintenance of the bridge or roads under this project, or in the staff's technical level. The road engineer, as the national expert supporting the external evaluator, conducted interviews with core staff in charge of operation and maintenance. The engineer confirms the staff's high technical level and knowledge.[14] In fact, these staff members are supervised by team leaders with professional experience of 25–30 years; the assigned staff members are all experienced and certified engineers (Bachelor of engineering). In addition, the O&M company conducts training in subjects such as "Management of O&M and construction," "Supervising for O&M," and "Occupational Health and Safety" using the teaching materials provided by the government.

In summary, there is no problem in technical sustainability.

3.4.3 Financial Aspect of Operation and Maintenance

In 2012, the Government of Vietnam established a Road Maintenance Fund. The fees for operation and maintenance of roads are collected annually for all motorized vehicles in order to finance the fund. All vehicle holders are required to annually pay these fees at the time of car registration (e.g., 1,560,000 Vietnam dong, or 7,400 yen, per unit for a passenger vehicle). This also meant that the tolls for highways constructed by government funds were abolished. Thus, the toll booth of the Can Tho Bridge stopped its operation on February 3, 2013. Table 24 shows the results of the toll collection.

Table 24: Results of Toll Collection

Fiscal year	Collected amount (Vietnamese Dong)
2010 (Sept. – Dec.)	23,301,825,000
2011	78,576,484,000
2012	80,614,135,000
2013 (until Feb.)	6,886,222,834

[14] The engineer asked about the understanding about the project, knowledge of operation and maintenance, current situation of structures, recording of maintenance activities, recognition about the necessity of training and capacity development.

The O&M company furnishes the operation and maintenance budget based on the actual needs and the instructions in the Manual on Management, Operation & Maintenance of Can Tho Bridge issued under decision No. 1467/QD-BGTVT. The budget is appraised by the fourth local road management unit in VRA and, thereafter, approved by VRA. This way, the required amount to operate and maintain the bridge and approach roads is secured. The budget is furnished for three financial years at once, with annual adjustments for inflation. Table 25 reports the budget for and after 2010 (The actual expenses seem to be close to the budget according to the executing agency).

Table 25: Operation and Maintenance Budget

Fiscal year	Operation and maintenance budget (Vietnamese Dong)
2010	7,381,818,182
2011	18,000,000,000
2012	19,797,681,747
2013	19,771,548,446
2014	19,978,000,019
2015	18,003,564,118
2016	18,866,388,918
2017	19,800,939,272
2018	19,157,012,531

In summary, the project's financial sustainability is stable.

3.4.4 Status of Operation and Maintenance

Major parts of the facilities inspected are as follows.

The main span: The foundation part cannot be observed as it is underground. However, there are no defects in the main pylons, bridge girders, bridge deck, and parapet. The lighting system is in good condition and traffic signs are properly equipped.

Approach spans: The foundation cannot be observed. However, according to the executing agency, the project required additional piling in 2013 to strengthen the piers. Then, monitoring of the settlement of piers was conducted as a security measure to the end of the warranty period (one year after the end of construction completion). However, there is no abnormity, and the settlement seems to have stopped. There is no deterioration of abutments and piers, and no defect in the bridge deck and parapet. The lighting system is in good condition and traffic signs are properly equipped.

Approach roads: Deterioration of some road surfaces was observed (e.g., cracking and pothole), but this defect was reportedly fixed after the first site field survey.

Bridge monitoring system (structure health monitoring): In this system, any abnormity in data of three kinds on the following is monitored 24 hours a day: displacement of structure; rainfall, air temperature, and temperature of structure; and situation of road traffic of bridge and approach roads (monitored by cameras). Regarding the displacement of structure, there was a defect in the software to process the received data and it was not in operation at the time of the site visit. As stated above, the conditions of the facilities are good in general, except for the bridge monitoring system; there is no problem obtaining spare parts either.

In conclusion, no major problems have been observed in the institutional/organizational, technical, and financial sustainability of the project. The current status of the operation and maintenance system is also sound. Therefore, the overall sustainability is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aims to improve the efficiency of logistics in the Mekong Delta region by constructing the Cuu Long (Can Tho) Bridge crossing the Hau River, a tributary of Mekong River and related approach roads in the South Vietnam.

Its implementation fully matches the Vietnamese government's development plan, needs and Japan's ODA policy to Vietnam, indicating the project's high relevance. The project budget was revised because of the global rise in prices of construction materials after the first appraisal and the changes in the extent and design of the construction in line with the site condition (soft ground). Further, the tentative piers of the bridge collapsed. Nevertheless, the bridge was constructed successfully and the number of vehicles that pass the bridge significantly increased after the completion of the project. In addition, local residents are not required to wait for ferry departure times anymore and the bridge offers many concrete benefits such as reduced travel time, decreased influence of bad weather, and improved traffic access to many places. Furthermore, socio-economic statistics seem to indicate the realization of an impact brought by the project. Accordingly, we find that both effectiveness and impacts have reached the originally expected level. However, the project's efficiency is low, because the project cost could not be confirmed for a lack of information, and the actual project duration exceeded the planned one significantly. The operation and maintenance of this project has no particular problem in its institutional/organizational, technical, and financial aspects. The sustainability of the project's 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

Improvement of the bridge monitoring system: There exists a facility to conduct 24-hours-a-day monitoring at the Can Tho side. At the time of the site visit, there was a defect in the software that processes received data on displacement of the structure observed within the monitoring system. This problem has been unsolved for several months. Owing to the monitoring's critical nature in maintaining bridge functions, VRA should either fix or replace the software promptly.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

Monitoring of the structure during construction: Although the accident was not foreseeable, the collapse of the tentative piers led to many casualties. As proposed in the "Proposals to prevent the repetition of the accidents and points of improvement of project supervision of ODA Loans[15]" made by the Ministry of Foreign Affairs' Special Committee for the prevention of repetition of accidents of Can Tho bridge, we recommend monitoring the quality of both tentative and final structures to prevent similar accidents in the future. The Vietnamese government and MOT have already issued notifications[16] to this effect. Corresponding to the above proposal, JICA formulated the "Guidance on security control of ODA construction works," summarizing basic policies of safety management and concrete technical instructions related to safe construction works for the purpose of prevention of labor accidents and public damage in ODA construction works of public facilities.

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[15] https://www.mofa.go.jp/mofaj/area/vietnam/canto.html, https://www.mofa.go.jp/ICSFiles/afieldfile/2008/07/15/att2.pdf

[16] the Decree No. 46/2015 / ND-CP on 12/05/2015 on quality management and maintenance of construction works、（by central government）, Circular 26/2016 / TT-BXD. dated October 26, 2016 and Circular 04/2019 / TT-BXD dated August 16, 2019 (by MOT)

JICA is also expected to assist implementing such measures (monitoring the quality of both tentative and final structures) for similar ODA Loan projects to be conducted in Vietnam in future.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
Cuu Long (Can Tho) Bridge Construction Project	Hybrid (Steel and Prestressed Concrete) Cable bridge - Center span arrangement: 550 m - Length: 1,090 m - Foundation Type: Cast in place RC Pile of 100 m depth	Hybrid (Steel and Prestressed Concrete) Cable bridge - Center span arrangement: 550 m - Length: 1,010 m - Foundation Type: Cast in place RC Pile of depth of 92 m (north) and 94 m (south on water)
	Approach span Bridge Vinh Long side (Connected PC-I Girder, length: 480 m)	Approach span Bridge Vinh Long side (Connected PC-I Girder, length: 520 m)
	Approach span Bridge Can Tho side (Connected PC-I Girder, Connected PC Box-Girder, length: 1,180 m	Approach span Bridge Can Tho side (Connected PC-I Girder, Connected PC Box-Girder, length: 1,220 m
	Inspection and maintenance vehicle: 1	Inspection and maintenance vehicle: 1
		Countermeasure for settlement at Approach span Bridge, Vinh Long side, Structure Health Monitoring System, Additional countermeasure (piling) for settlement in north side Approach span Bridge, Vinh Long side
National Highway No. 1 Bypass Road Construction Project 1. Ving Long side	Length: 5,410 m	Length: 5,410 m
	Minor bridges: 3	Minor bridges: 4
	Interchange: -Semi-Y Type (NH.1) -Diamond Type (NH.54)	Interchange: -Semi-Y Type (NH.1) -Diamond Type (NH.54)
	Service area: 21,000 m^2	Service area: 21,000 m^2
2. Can Tho side	Length: 7,690 m	Length: 7,690 m
	Minor bridges: 7	Minor bridges: 9
	Interchange: -T-type Grade Intersection (NH.1), -Diamond Type (NH 91)	Interchange: -T-type Grade Intersection (NH.1), -Diamond Type (NH 91)
		Flyover at interchange
	Service area: 21,000 m^2	Service area: 21,000 m^2
	Toll gate: 1	Toll gate: 1 (installed once but removed later because of suspension of toll collection)
Consulting services	・Review of Detailed Design (D/D) ・Support for bidding and making contract ・Construction management ・Technical guidance ・Environmental countermeasures	・Review of Detailed Design (D/D) ・Support for bidding and making contract ・Construction management ・Technical guidance ・Environmental countermeasures
2. Project Period	March 2001 – December 2006 (70 months)	March 2001 – March 2010 (109 months)
3. Project Cost Amount Paid in Foreign Currency Amount Paid in Local Currency Total ODA Loan Portion Exchange Rate	27,912 million yen 11,194 million yen (1,461,358 million Vietnamese Dong) 39,106 million yen 33,240 million yen 1Vietnamese Dong = 0.00766 yen (As of October 2000)	21,978 million yen 20,410 million yen (3,586,995 million Vietnamese Dong) 42,388 million yen 40,604million yen 1 Vietnamese Dong = 0.00569 yen (IFS average between 2003 and 2017)

4. Final Disbursement	National Highway No. 1 Bypass Road Construction Project: March 2012 National Highway No. 1 Bypass Road Construction Project (II): February 2018 Cuu Long (Can Tho) Bridge Construction Project: March 2012 Cuu Long (Can Tho) Bridge Construction Project (II): February 2018

Socialist Republic of Vietnam

FY2019 Ex-Post Evaluation of Japanese ODA Loan

"Second Hanoi Drainage Project for Environmental Improvement (I) (II)"

External Evaluator: Mariko Homma, IC Net Limited

0. Summary

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, wastewater treatment system was established at some drainage sub-catchment areas, which are the foundation for wastewater treatment work 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.

1. Project Description

Project Location

An upgraded canal and road

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 (1) (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)	- 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)	- 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) - 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)	

	(ODA Loans) - 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) (JICA Partnership Program) - 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)

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: B[1])

3.1 Relevance (Rating: ③[2])

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) International Experts Vietnamese Experts Supporting Staff		FS 51.0/50.8	Detail Design 138.5/138.3 50.0/50.0 236.0/235.9	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 km^2 catchment area surrounding Bay Mau Lake. Using the standard activated sludge method, it is capable of treating 13,300 m^3 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 km^2 basin of the To Lich River. First, nine vertical shaft centrifugal pumps (5 m^3/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 Program[3] (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

	Plan[*1]					Actual			
Items	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 Impacts[4] (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%

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 (38,000m^3/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 m^3/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 m^3/day, while the target is 19,300 m^3/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 evaluation[5] 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)	• 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)	<Along box culverts> • Areas improved: Improvement in offensive odors as a result of covering canal, improved convenience as a result of road infrastructure. <Along canal> • 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)	• 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.

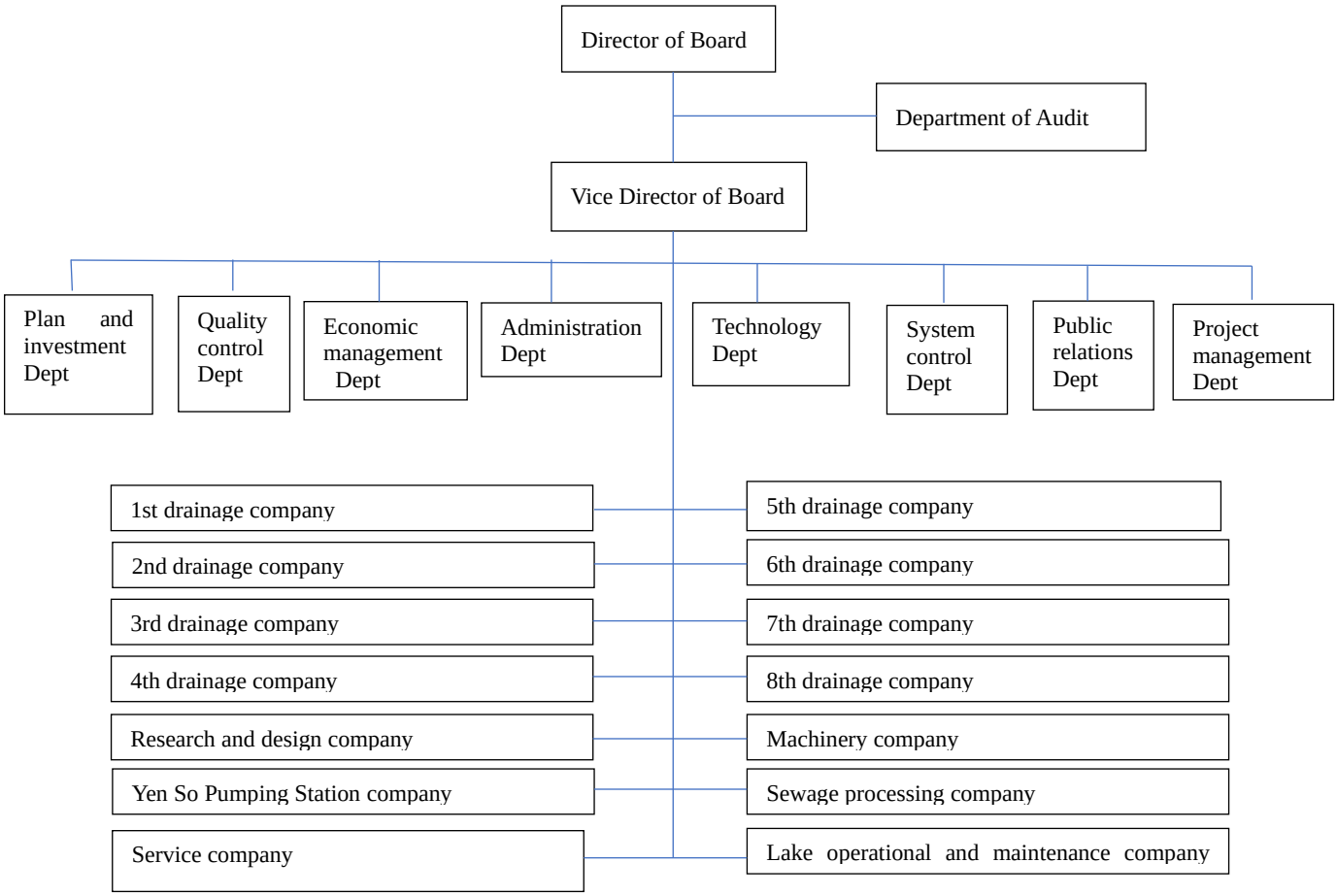
Thus, capacity building for HSDC has had the indirect impact of strengthening maintenance of facilities established or improved in the project and local residents' awareness of the environment.

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 organization[17] 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 packages[18] 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] International Experts Vietnamese Experts Supporting Staff	FS 51.0/50.8	Detail Design 138.5/138.3 50.0/50.0 236.0/235.9	Construction Supervision 375.3/375.1 1,783.9/1,701.9 658.7/657.6
2. Project Period	March 2006–September 2011 (66 months)	March 2006–December 2016 (129 months)
3. Project Cost Amount Paid in Foreign Currency Amount Paid in Local Currency	JPY 7,600 million JPY 34,709 million (VND 5,180,448 million)	JPY 5,855 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

The Kingdom of Morocco

FY 2019 Ex-Post Evaluation Report

Japanese ODA Loan Project "Sewage System Development Project"

External Evaluator: Noriaki Suzuki, IC Net Limited

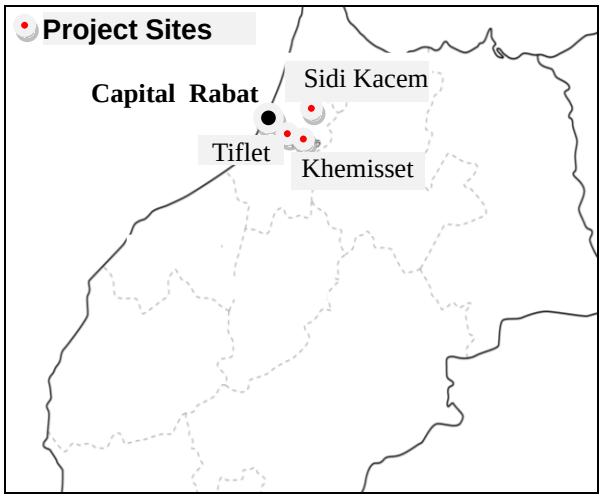
0. Summary

This project was implemented to establish and expand sewerage systems in three cities (Khemisset, Sidi Kacem, and Tiflet) near Rabat, and improve the sanitary environment in the cities, thereby contributing to improvement in living standards in the areas.

The target areas were core cities and communes in regions in which the need for sanitation or sewerage improvement was the highest among those specified in the *National Sanitation Master Plan* (formulated in December 1997, and hereinafter referred to as "SDNAL"), a sector development policy of the Moroccan government. In addition, this project has been highly consistent with Japan's ODA policy; thus, its relevance is high. The project period of ten years was significantly longer than the planned period (four years) because the project required a considerable amount of labor and time to acquire land for sewage treatment plants. Meanwhile, the project cost was within the plan, at 92% against the recalculated budget plan. Therefore, the efficiency of the project is fair. In Khemisset and Sidi Kacem, the sewerage systems were established almost as planned, excluding some sections, thereby improving the sanitation environments in the cities. On the other hand, in Tiflet, although the trunk sewer and sewage collection network were improved as planned, and the sanitation environment in the city was improved, the establishment of a sewage treatment plant remains incomplete. This led to the fact that sewage in the city has been untreated and discharged into the river. According to an interview survey, local residents are satisfied with this project, and positive impacts on the natural environment, public health, and economy in the cities have been confirmed. Although the improvement in living standards in the target cities has been achieved, consideration for the natural environment and measures for water quality monitoring are insufficient. To summarize the above, the effectiveness and impacts of the project are fair. For the systems for maintenance in this project, implementation systems by the headquarters, regional and provincial offices, and city service offices have functioned. With regard to technical aspects, the National Office of Electricity and Drinking Water (Office National de l'Electricite et de l'Eau Potable [ONEE]) has a good track record in maintenance and sufficient technical capabilities. In addition to the soundness of its financial condition, the balance of payments combined with water supply and electric power has been active every year, and no major problems have been observed. Therefore, the sustainability of the project effects is high.

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

1. Project Description



Project Location

The sewage treatment plant installed by the project (Khemisset)

1.1 Background

In infrastructure improvement in Morocco, sewerage improvement is one of the fields in which delay is still conspicuous. It is a priority issue that must be resolved immediately from the perspectives of the sanitation environment and recycling of scarce water resources. In large cities including Casablanca and Rabat, sewerage has been developed by local governments (municipalities) or private companies and operated and managed by public corporations such as ONEE or private companies. On the other hand, in smaller cities, local governments have been in charge of sewerage improvement, but the progress has been slow because of rapid urbanization and acute fund shortage in local governments.

In 1997, the Moroccan government formulated SDNAL, and positioned ONEE providing water supply service as the main implementing body of sewerage projects. Based on the institutional framework, ONEE formulated the *National Sanitation Program* (PNA) (2003-2017), in which top priority projects to be implemented in 2003-2017 were selected.

To promote balanced economic growth through improvement of economic and social infrastructure including sewerage systems, ONEE requested, through the Moroccan government, the Japanese government to provide an ODA loan for establishment and improvement of sewerage systems by local governments, which is the component with the highest priority in PNA, and the request was approved.

1.2 Project Outline

This project was implemented to establish and expand sewerage systems in three cities near Rabat, and improve the sanitary environment in the cities, thereby contributing to improvement in living standards in the areas.

Loan Approved Amount/ Disbursed Amount	4,203 million JPY	/	2,919 million JPY
Exchange of Notes Date/ Loan Agreement Signing Date	November 29, 2005	/	November 30, 2005
Terms and Conditions	Interest Rate		0.75%

	Repayment Period (Grace Period)	40 years (10 years)
	Conditions for Procurement	General Untied
Borrower / Executing Agency	National Office of Electricity and Drinking Water (Office National de l'Electricite et de l'Eau Potable: ONEE)	
Project Completion	May, 2016	
Main Contractors	No contractor exceeds 1 billion JPY	
Main Consultants	Consultant 1: Nippon Koei Co., Ltd. (Japan) / TEAM MAROC,S.A. (Morocco) / NOVEC S.A. (Morocco) Consultant 2: Nippon Koei Co., Ltd. (Japan) / TEAM MAROC, S.A. (Morocco) / SCET-SCOM S.A. A DIRECTOIRE ET A CONSEIL DE SURVEILLANCE (Morocco)	
Related Studies	Special Assistance for Project Formation (SAPROF) for Sewerage System Development Project in Four Communes (2004)	
Related Projects	**[Technical Cooperation]** - JICA Expert dispatch / Technical Assistance to the Water Conservation Agency (2001 - 2004 / 2004 - 2006) - JICA Expert dispatch / Support on planning for local drinking water supply (2004 - 2007) **[Japanese ODA Loan]** - Rural Water Supply Project (I) (II) (L/A: 2000, 2000 - 2004) (I) 4,513 million JPY, (II) 2,236 million JPY - Urban Environment Improvement Project (L/A: 2007, 2007‐2014) 7,383 million JPY **[Japanese Grant Aid]** - Southern Provinces Drinking Water Supply Plan (2000) - Benslimane District Drinking Water Plan (2003) **[Other International Organizations, Aid Agencies, etc.]** German Reconstruction Finance Corporation (KfW) - 20 ONEE projects on National Sanitation Master Plan, Islamic Development Bank (IsDB) - 9 loan projects with ONEE on National Sanitation Master Plan	

2. Outline of the Evaluation Study

2.1 External Evaluator

Noriaki Suzuki, 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 7 - 27, 2019

2.3 Constraints during the Evaluation Study

The second field survey scheduled for 2020 was canceled because of the impact of novel coronavirus infection (COVID-19), and the evaluator could not travel to Morocco. However, the evaluator communicated in writing with the executing agency and the JICA Morocco Office. In addition, the supporting researchers (local consultants) conducted supplementary surveys by telephone or email. Thus, minimum necessary information was obtained.

3. Results of the Evaluation (Overall Rating: B[1])

3.1 Relevance (Rating: ③[2])

3.1.1 Consistency with the Development Plan of Morocco

(1) Development plan of Morocco at the time of the appraisal

SDNAL provides that ONEE becomes the main implementing body of sewerage projects, and specifies the importance of ONEE's undertaking sewerage projects in core cities and their surrounding communes. Based on SDNAL, ONEE formulated the *National Sanitation Program* (PNA) (Target: 278 communes; Total cost: About 180 billion yen; Beneficiary population: About 4.50 million), aiming to improve sewerage systems in 15 years in all the jurisdictions to which ONEE supplies water. It was decided that projects with the highest priority from perspectives of 1) pollution risk of water supply sources, 2) population size, and 3) progress in necessary surveys for project implementation (Target: 90 communes; Total cost: About 50.8 billion yen; Beneficiary population: About 3.40 million) in PNA would be implemented in the first five years (2003-2007). Meanwhile, in the *National Economic and Social Development Plan* (2000-2004), which is Morocco's long-term development plan approved in the country's Parliament in September 2000, environment improvement in core cities through sewerage improvement was positioned as one of the top priority issues at the time of the appraisal. Thus, as the project is part of the investment plan for PNA, its relevance is high.

(2) Development plan of Morocco at the time of the ex-post evaluation

SDNAL was revised once after its formulation in December 1997, and the plan period was extended to 2022. In the quarterly reports of SDNAL projects, the importance of ONEE's undertaking sewerage projects in core cities and their surrounding communes is specified. In addition, PNA, formulated based on SDNAL, has been reviewed every five years; and now as PNA for 2018-2022, the same contents have been continued. As of July 2019, 181 sanitation projects have been implemented in approximately 156 core cities or communes, and an amount of 12,807 million MDH or 155 billion yen (Exchange rate: 12.1 yen/MDH) has been invested. Although the periods became longer than the initial plans and the costs became more than planned, in order to cover the initially planned 278 core cities and communes, sanitation or sewerage improvement has been promoted (Progress as of July 2019: 56%). Thus, even at the time of the ex-post evaluation, the direction of the development plan for national sanitation remained unchanged. Therefore, this project is consistent with the development plan of Morocco also at the time of the ex-post evaluation.

3.1.2 Consistency with the Development Needs of Morocco

Each of the three target cities in this project, Khemisset, Sidi Kacem, and Tiflet, is a core city relatively near the capital. In PNA, based on SDNAL, 278 core cities and communes were stipulated as priority areas for sanitation or sewerage improvement. Ninety areas out of those were designated as areas in which a sanitation project should be implemented in 2003-07. Each of the target cities in

[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[2] ③: High, ②: Fair, ①: Low

this project was designated as one of these priority areas. In the priority ranking, Khemisset is ranked 1st, Sidi Kacem 3rd, and Tiflet 15th. Each of them is a core city and commune with higher priority among the priority areas. Although ranked 15th, Tiflet is a city in Khemisset Province with Khemisset as the core city, and near the capital Rabat; thus, a future population increase is expected. Therefore, its selection is of relevance. From this, the relevance of selecting Sidi Kacem, Khemisset, and Tiflet as the target cities in this project is high. Incidentally, other cities with high priority were to be aided with fund schemes by other donors and private banks.

Moreover, PNA stipulates sanitation or sewerage improvement in smaller regional cities as an urgent task, and recommends increasing the sewerage connection rates to 80% and the sewage treatment rates to 60% by 2020. The sewerage connection rates in Sidi Kacem and Tiflet were low among such cities, and the sewage treatment rate in each of the three cities was 0%. Through this project, the connection rates have been significantly higher than the target, over 95%, and the sewage treatment rates in Sidi Kacem and Khemisset have become over 90%, satisfying the development needs of Morocco. Currently in Khemisset and Tiflet near Rabat, urban development as a commutable area or commuter town to the capital Rabat has been put on a fast track. A future significant increase in the number of households is expected. Therefore, the importance of sanitation or sewerage improvement in both cities is continuously high after the ex-post evaluation.

3.1.3 Consistency with Japan's ODA Policy

In Japan's *Country Assistance Policy for the Kingdom of Morocco* in 2006, the environment was taken as one of the six priority areas. JICA's (former JBIC's) *Implementation Policy for Overseas Economic Cooperation Operations* (2002-2004) defined "projects for environment conservation" and "support for economic infrastructure improvement to reduce income and regional disparities, the social sector, and poverty programs" as priority support areas in light of deterioration of the living environment accompanying urbanization, and conspicuous wealth and regional disparities. The *Implementation Policy for Overseas Economic Cooperation Operations* (2005-2007) continuously focused on efforts toward poverty reduction with the necessity of contribution to achievement of the Millennium Development Goals (Goal 1-Goal 6) in mind. In association with this project, emphasis was placed on support to "continuously improve economic and social infrastructure with high needs in developing countries (transportation and physical distribution, irrigation, water and sewer services, etc.) and promote sustainable growth." In addition, since 2005, JICA has promoted reduction of regional and social disparities, as well as a policy for support contributing to sustainable economic growth and reduction of social and regional disparities in order to contribute to stabilization of regional parts and balanced development of the Moroccan economy. This project aimed to promote sewerage projects in regional parts and solve the water quality problems in rivers, lakes, dams, and similar. From this perspective as well, this project was consistent with Japan's ODA policy.

3.1.4 Appropriateness of the Project Plan and Approach

The objectives, indicators, and activities set at the time of the appraisal are logically connected and feasible with no major problems. In Tiflet, the sewage treatment plant could not be constructed because of unexpected circumstances that could not be controlled by the executing agency, such as the price of land to acquire that became several times the original estimate and significantly exceeded the city's budget for land acquisition. However, this is far from inadequate project plan or approach. In the other two cities, the plants were constructed as planned, which resulted in production of expected results.

As described above, this project has been sufficiently consistent with the country's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

Table 1 shows the comparison between planned and actual outputs (sewerage systems) of this project.

Table 1: Project Outputs (Plan / Actual)

Items	Plan (2005)	Actual (2016)	
Khemisset			
Sewage Treatment Plant	Pretreatment + anaerobic pond + aerated lagoon	As planned	
Sewage Treatment Volume per Day (m^3 /day)	11,008	12,152	The Treatment Volume was slightly increased in consideration of future population growth.
Cleaning of Sewer Lines (km)	3.6	0	None
Rehabilitation of Sewer Lines (km)	0.3	0	None
Sewer trunk line / Sewage collection network / interceptor (km)	23.5	15.5	Some of the existing sewers were sufficient to be reused. As a result, the new trunk sewer, sewage collection network, and interceptor could be kept to a minimum.
Drainage Ditch	6.1	6.1	It was integrated with newly installed sewer collection network by confluence system. Khemisset city office has implemented it.
Pumping Station	2	1	The sewage pumping stations were reduced from two to one by optimizing the sewer network.
Sidi Kacem			
Sewage Treatment Plant	Pretreatment + anaerobic pond + facultative pond	As planned	
Sewage Treatment Volume per Day (m^3 /day)	11,120	7,600	It is about 70% of the planned value. The designed sewage treatment volume was reduced by 30% according to actual population.[3]
Cleaning of Sewer Lines (km)	42.5	0	None
Rehabilitation of Sewer Lines (km)	2	10.7	The number of sewer lines that can be repaired was more than expected, and it was reused.
Sewer trunk line / Sewage collection network / interceptor (km)	33.5	30.9	There was a part that could be repaired. The part of interceptor pipes was increased by reviewing the sewer network. In addition, a part (4.5 km) of the sewer trunk lines remain uncompleted.
Drainage Ditch	22.2	22.2	Integrated with newly installed sewer collection network by confluence system. Sidi Kacem city office has implemented it.
Pumping Station	1	2	Since there are many areas with a larger longitudinal gradient than expected, one pump station was added.

[3] The planned value was calculated by using the population estimate for the year following project completion expected at the time of the ex-ante evaluation of this project (scheduled for 2010), which is 138,000. However, the population estimate for the year following the actual project completion (2017) was 93,255, which resulted in a divergence of as much as 32% between the planned and actual.

Tiflet			
Sewage Treatment Plant	Pretreatment + anaerobic pond +facultative pond	None	
Sewage Treatment Volume per Day (m^3 /day)	4,850	0	No sewage treatment
Cleaning of Sewer Lines (km)	4.6	0	None
Rehabilitation of Sewer Lines (km)	0.2	0.2	As planned
Sewer trunk line / Sewage collection network / interceptor (km)	20.1	21.6	The distribution of trunk pipes, collection pipe networks, and interceptor pipes was changed by reviewing the sewer network. The sewer network was covered as planned.
Drainage Ditch	3.6	0	It was integrated with newly installed sewer collection network by confluence system.
Pumping Station	3	3	As planned

Source: Documents provided by JICA, and by ONEE

Project outputs were basically produced as planned. The outputs produced as planned, including installation of trunk sewers, sewage collection networks, interceptors, and relay pumping stations in the three target cities in this project, contributed to production of project effects.

Some components had differences between planned and actual outputs. The components having particularly significant differences are shown in the table below.

Table 2: Major differences between planned and actual outputs of this project, and the reasons

Major difference between planned and actual outputs	Reason
1) Failure to establish a sewage treatment plant in Tiflet[4]	Because the land acquisition price increased to an amount that was several times the expected one, the Tiflet City government could not take budgetary measures for land acquisition. Thus, land could not be acquired.
2) Incomplete part of the trunk sewer in Sidi Kacem	While the trunk sewer was constructed, the outsourcing contractor could not cover the construction costs. Thus, the planned construction work was discontinued. Then, another contractor took measures, but there was some point at which the trunk sewer must pass under a railway in its course, and the construction permission could not be obtained. In this situation, this project ended and part of the trunk sewer was left incomplete.[5]
3) Unimplemented cleaning of sewer lines	ONEE has taken measures within its normal operation and maintenance services, and the cleaning has not been implemented in the project scope.
4) Regarding the trunk sewer, sewage collection network, and interceptor in Khemisset City, the difference between the planned and actual results was 34%, which was about 66% of the planned achievement level.	At the time of the detailed planning of this project, sewers in Khemisset were reviewed, aiming to use and optimize the existing sewers. As a result, the sewage pumping stations were reduced from two to one, and the existing system was reused. Therefore, the new trunk sewer, sewage collection network, and interceptor could be kept to a minimum.

As for 1), the incomplete applicable scope has affected production of project effects. The executing agency held negotiations for land acquisition for a sewage treatment plant in Tiflet together with the Tiflet city office, but they met opposition of farmers around the site in the first negotiations for land acquisition. At the time of the second negotiations for land acquisition, the increased purchasing price of land significantly exceeded the budget estimated by the city office. Numerous unexpected

[4] After the project start, land acquisition for a sewage treatment plant was attempted in Tiflet, but farmers around the planned site for establishment of a sewage treatment plant opposed it. Thus, its establishment in Tiflet was given up. After that, the procedures for land acquisition were proceeded in 2013 in Tiflet as in the other cities, but then the landowner demanded a price increase. The increased land price could not be covered by the budget approved by the Tiflet city government, so price negotiations for land acquisition were given up. At the time of an interview in the ex-post evaluation, we confirmed that the land price had increased to about five times as much as the amount calculated at the time of the ex-ante evaluation. After that, another site was sought but not found, so the project ended with the completion of the sewage treatment plants in the two other cities. As a result, establishment of a sewage treatment plant in Tiflet remains undone. The reasons for the rise in land price are: 1) rapid progress in urban development in Tiflet since around 2013, and land price increase in Tiflet and neighboring cities, 2) land price increase by the landowner who heard that the local governments had disbursed a large amount of funds for land acquisition for establishment of a sewage treatment plant in the other cities, and intended to sell land at a price as high as possible, etc.

[5] After project completion, a subcontractor for construction of the incomplete part was selected. This work is to be funded by parties other than JICA.

problems arose, and land acquisition for a sewage treatment plant was given up. This caused the failure to establish a sewage plant. Sewage in Tiflet has been untreated and discharged into rivers as it was before. Improvement of the natural environment in the river near the city has not been achieved. However, all sewage in the city came to be collected and discharged at points distant from residential areas in the city; thus, no negative impacts on the sanitation environment in the city have been produced. As for 2), because part of the trunk sewer in Sidi Kacem is incomplete, sewage from households in areas connected with the incomplete trunk sewer has not been treated. Construction of the trunk sewer connected to the sewage treatment plant is incomplete, but sewage has been collected,[6] and the percentage of sewered population has been higher than the target (Achievement ratio: 131%). Moreover, the amount of treated sewage has accounted for 95% of the target readjusted by using the actual population. Therefore, the incompletion has not particularly affected achievement of the project objective. As for 3), we confirmed that the cleaning has been within the range of ONEE's normal operation and maintenance services, having no impacts on achievement of the project purpose, and its implementation in the project scope has been unnecessary. As for 4), at the time of the detailed planning of the project, the planned sewer lines were reviewed and optimized; thus, the planned project scope has been kept to a minimum, which has contributed to a reduction in the project cost. Part of the sewage collection network in Khemisset has been being constructed by the Khemisset city office as a substitute. No major impacts of the difference in 4) have been observed on the project's purpose.

Table 3: Consulting service output (Plan / Actual)

Items	Plan (2005)	Actual (2016)	
(a) Review of Detailed Design, Preparation for bidding	O	O	As planned
(b) Supervision on the Constructions	O	O	As planned
(c) Environmental Monitoring	O	X	None (because it was no longer needed)
(d) Training and OJT on sewage treatment systems for O&M support	O	O	As planned
	Feb. 2007 - Feb. 2013	Apr. 2007 - May 2016	
International consultant (M/M)	59 M/M	96.5 M/M	Increased by 64%. Construction management and monitoring operations were increased due to extension of construction period
Local consultant (M/M)	197 M/M	201 M/M	Almost as planned

Source: Documents provided by JICA, and by ONEE

Consulting services were basically provided as planned. As part of the consulting services, training in the sewerage field and technical support for maintenance were provided. ONEE personnel for the regions, provinces, and service offices of the three target cities in this project were very satisfied with the technical support. The consulting services in this project can be assessed as very beneficial for improving the sustainability of the project. Training or support in environmental monitoring was not provided, because ONEE already possessed a necessary technology and implementation system for environmental monitoring focusing on water quality monitoring.

[6] Additionally, in areas unconnected to the sewage treatment plant, sewage collecting pipes were constructed and sewage has been collected. The sewage collected in these areas has been discharged into rivers along the way. The discharge points are distant from residential areas; thus, negative impacts have not been produced on the natural environment in the city. Construction of the trunk sewer in the areas has already started, and the trunk sewer is scheduled to be completed in 2020.

3.2.2 Project Inputs

3.2.2.1 Project Cost

First, for efficiency analysis of the project cost, it is necessary to adjust the incomplete parts in this project. The reason why establishment of a sewage treatment plant in Tiflet was not realized was inability to take budgetary measures for land acquisition. The incomplete part of the trunk sewer in Sidi Kacem was caused by the contractor's inability to take financial measures to continue the construction. In efficiency evaluation of the project cost, we judged it appropriate to subtract the budget calculated for these incomplete parts from the total budget (costs of public works and land acquisition) to evaluate the project cost with regard to efficiency. Similarly, for the sewer lines cleaning not implemented in this project's scope, the total budget was modified by subtracting the initial budget allocated to cleaning of sewer lines. The next issue is what to do with the land acquisition cost. Land was acquired in Sidi Kacem City and Khemisset City, but the executing agency has not grasped the actual land acquisition costs accurately. Thus, it is decided to assume that, in both cities, the planned and actual land acquisition costs are the same. Based on the above, for more appropriate efficiency evaluation, the planned land acquisition cost will be modified to the minimum possible extent, and the actual land acquisition cost is revised as follows.

(Revision of budget amounts)

(1) The construction cost of the incomplete portions above will be subtracted from the initial budget.

(2) The land acquisition cost remains the same for Sidi Kacem City and Khemisset City where land acquisition was done. However, for Tiflet City that implemented no land acquisition, the acquisition cost will be subtracted from the initial budget.

(3) Taxes accounted for in the initial budget were estimated on the basis of the following rates: 14% for public works and land acquisition; and 20% for materials, equipment, consulting services, and contingency. However, the tax amounts in the initial budget will be revised because the changes in (1) and (2) above will affect the tax calculation process.

Table 4: Details of the Revision of the Planned Budget

(1) Reduction of the public works cost	**784**
Incomplete sewage treatment plant in Tiflet	638
Incomplete part of sewer network in Sidi Kacem	111
Unimplemented pipeline cleaning	35
(2) Reduction of the land acquisition cost	**42**
Tiflet City	42[*1]
(3) Changes in taxes, etc., after the budget revision above	**673[*2]**
Public works + land acquisition[3]	526[*2]
Equipment, consulting services, and contingency (as initially planned)	148[*2]

*1: The land acquisition budget of Tiflet City is calculated as follows: percentage of each city in the land acquisition costs (Sidi Kacem City: 48%, Khemisset City: 21%, Tiflet City 30%) at the time of the preliminary survey is multiplied by 139 million yen, which is the sum of the land acquisition budgets of the three cities.

*2: The total amount is rounded off and differs from the sum (674 million yen) of rounded-off items.

*3: Multiplying by 14% the figure for "public works + land acquisition" upon reduction cited in (1) and (2) above.

(Revision of the actual cost)

(1) Regarding public works, Sidi Kacem City and Khemisset City implemented alternative construction for part of the project scope. However, because the executing agency has not grasped the actual cost

of the alternative construction accurately, it is assumed that the actual cost is the same as the planned one.

(2) As mentioned above, the executing agency has not grasped accurately the actual costs of land acquisition in Sidi Kacem City and Khemisset City. Thus, for convenience, it is assumed the actual costs are the same as the planned ones.

The following are the initial budget, revised budget, and actual costs that summarize the above.

Table 5: Breakdown of the Planned Initial Budget, Revised Budget, and Actual Cost at the Time of the Ex-Post Evaluation

Item	Planned initial budget (million JPY)			Revised budget (million JPY)			Actual cost (million JPY)		
	JICA	ONEE	Total	JICA	ONEE	JICA	JICA	ONEE	Total
Public works	3,553	889	**4,442**	2,769	889	**3,658**	2,174	1,159*1	**3,333**
Equipment procurement	86	0	**86**	86	0	**86**	102	0	**102**
Consulting service	427	0	**427**	427	0	**427**	643	0	**643**
Contingency	137	89	**226**	137	89	**226**	0	0	**0**
Land acquisition	0	139	**139**	0	97	**97**	0	97*2	**97**
Taxes and duties	0	684	**684**	0	673	**673**	0	629	**629**
Total	4,203	1,801	**6,004**	3,027	1,583	**5,167**	2,919	1,328	**4,804**

Source: Documents provided by JICA and ONEE

* The following exchange rates are used: 12.1 yen/MDH (Moroccan dirham) (September 2004) at the time of the appraisal; and 11.7 yen/MDH (2007-2016 average) at the time of the ex-post evaluation.

* All public works deductions are from the JICA budget, and the land acquisition deductions are from the ONEE budget.

*1: The actual cost of alternative construction by the municipalities for the drainage ditch in Sidi Kacem City and Khemisset City is the same amount as the planned initial budget for it.

*2: Regarding the actual cost of the land acquisition in Sidi Kacem City and Khemisset City, the budget amount at the time of planning is applied as it is.

The revised total budget was 5,167 million yen. The actual project cost was 4,804 million yen, within the planned budget after recalculation (93%).

The consulting services cost increased (the reason is to be described later), while optimization of sewage collection networks as well as repair and reuse of the existing collection networks made it possible to significantly reduce the cost to construct sewage collection networks. In addition, contract lots of public works were subdivided to create an environment where, widely, many building/construction companies can tender for contracts, thereby encouraging competition among companies participating in the tenders, which resulted in reduction in the project cost as a whole. Moreover, the executing agency ONEE properly implemented construction supervision of the many contractors and monitoring of progress in the public works together with the consultants, and ONEE's project implementation system functioned at the regional, provincial, and city levels. This seems to have contributed to the project implementation within the planned budget.

The project cost was 93% against the plan, within 100% of the budget. Therefore, the project cost evaluation falls under ③.

3.2.2.2 Project Period

The planned project period was from November 2005 to October 2009 (48 months), while the actual project period was from the start of this project to May 2016 (127 months), 265% against the plan and significantly longer than planned.

Table 6: Project Period (Plan / Actual)

Work Contents	At the time of Preliminary Evaluation (2005)	At the time of the Project Completion (2016)
Sewage facilities construction in Khemisset	Oct. 2006 - Oct. 2009	Feb. 2009 - Mar. 2016
Sewage facilities construction in Sidi Kacem	Nov. 2005 - Oct. 2009	Feb. 2007 - Apr. 2016
Sewage facilities construction in Tiflet (Excluding the sewage treatment plant)	Dec. 2005 - Oct. 2009	Feb. 2007 - Apr. 2016
Equipment Procurement	Nov. 2005 - Oct. 2007	Jul. 2006 - Jan. 2007 Apr. 2014 - Apr. 2015
Training, Technical Assistant Service	Oct. 2006 - Oct. 2009	Feb. 2007 - Feb. 2013 Aug. 2013 - May 2016
Project Completion	**Oct. 2009**	**May 2016**

Source: Documents provided by JICA, and by ONEE
Note: The bidding and contract for the main construction starts from the preliminary qualification examination (P/Q)

The biggest cause of the project period being over ten years was the unexpectedly slow progress in land acquisition. In all the three target cities in this project, land acquisition required much time. Particularly in Tiflet, land acquisition for a sewage treatment plant required more time than in the two other cities, and the construction period was also extended. Moreover, in this project, many contractors entered into agreements with ONEE, and each contractor was in charge of a different process of construction processes for the same facility. Therefore, in any of the three cities, when a contractor's process fell behind schedule, work of the contractor in charge of the next process was also delayed, and the delay affected the subsequent processes. This work procedure in which many contractors worked as a collective was also a major cause of delay.

Meanwhile, the significant extension of the project period caused an increase in the cost for consulting services and a decrease in cost efficiency.

The project period was significantly longer than planned, increasing to 265% of the planned period. Therefore, the project period evaluation falls under ①.

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

Financial Internal Rate of Return (FIRR)

Terms and conditions for FIRR calculation and FIRR at the time of the appraisal and at the time of the ex-post evaluation are organized below. Benefits are sewerage charge receipts and sewer connection charge. The sewer connection charge is paid by beneficiaries. The project life is 40 years, but 40 years from the L/A year was defined as the period for FIRR calculation at the time of the appraisal and at the time of the ex-post evaluation.

Factors	Project life: 40 years Expenses: Construction costs and Maintenance costs related to the project, excluding the land acquisition costs Benefits: Revenue from Sewerage service charges and Sewer connection fee (Beneficiary's Contribution)		
At the time of appraisal:	**(2005 - 2044) 2.9%** Khemisset: 2.25% Sidi Kacem: 4.61% Tiflet: 1.93%	At the time of ex-post evaluation:	**(2005 - 2044) -5.95%** Khemisset: -14.93% Sidi Kacem: -6.57% Tiflet: -0.24%

At the time of the ex-post evaluation, FIRR was a negative value in each of the cities, and FIRR in the project as a whole was -5.95%. This was caused by a decrease in the actual sewerage charge receipts by about 30% from the amount estimated at the time of the ex-ante evaluation. In Khemisset, FIRR was nearly -15%, showing the largest divergence from the time of the appraisal. This can be attributed mainly to the treatment method of aerated lagoon at the sewage treatment plant in Khemisset, and increase in equipment cost and subcontract cost for this method. On the other hand, in Tiflet, although a negative value, FIRR was nearly 0%. In this city, the sewage treatment plant has not been established. This caused a decrease in construction cost and pushed up FIRR.

Economic Internal Rate of Return (EIRR)

Terms and conditions for EIRR calculation and EIRR at the time of the appraisal and at the time of the ex-post evaluation are organized below. Benefits are, similarly to the time of the appraisal, improvement in production of agricultural products,[7] decrease in medical cost for diseases,[8] reduction in water treatment cost (only in Khemisset),[9] and rise in land value.[10]

Factors	Project life: 40 years Expenses: Construction costs and Maintenance costs related to the project, excluding the land acquisition costs Benefits: Improvement of the productivity of agricultural products, reduction in medical cost related to diseases, reduction of water treatment cost (Khemisset only), increase of land value		
At the time of appraisal:	**(2005 - 2044) 18.7%** Khemisset: 15.1% Sidi Kacem: 24.8% Tiflet: 12.9%	At the time of ex-post evaluation:	**(2005 – 2044) 11.9%** Khemisset: 7.4% Sidi Kacem: 16.8% Tiflet: 7.8%

[7] It is expected that the water quality of rivers serving as water sources for irrigation and the productivity of agricultural products will improve through sewage treatment. Similarly to the time of the appraisal, the benefit effect was estimated at 20% of the production before the project start (in 2004), by using the cases of sewerage projects in other developing countries as references. In Tiflet, collected sewage has not been treated, so the benefit was defined as none.

[8] It is expected that improvement of the living environment by preventing sewage mixed with sewage from flooding into the city will cause a decrease in the number of sufferers from waterborne diseases including cholera, typhoid fever, hepatitis, and diarrhea, as well as a reduction in medical cost. Through this project, the living environments were improved as planned in all the cities. Therefore, all the reductions estimated at the time of the ex-ante evaluation were considered a benefit.

[9] The Kansera Dam, the water source for Khemisset and Tiflet, is located in the lower reaches of the river into which sewage in Khemisset is discharged. To prevent water pollution at the Dam from progressing with the untreated sewage discharged at that time, the water had been purified, but the water purifying cost became unnecessary after sewage came to be treated through this project. Therefore, the reduction in water purifying cost estimated at the time of the ex-ante evaluation was considered a benefit.

[10] A rise in land value caused by improvement of the living environment through installation of a sewerage system is generally estimated at 5-20%. At the time of the appraisal, a rise rate of 7% was applied to Khemisset and Sidi Kacem, and a rise rate of 10% was applied to Tiflet, whose living improvement effect was seen as the greatest. Meanwhile, the land value rise rate in Kenitra near the three target cities in this project, in which a sewerage project was implemented in the same manner at the same time, was 41%. When contributions of the sewerage project are taken into account, this rate could fall within or beyond the range of 5-20%, general rise rates caused by a sewerage project. In EIRR calculation for this project, low rise rates were multiplied: a rise rate of 7% was applied to Tiflet, which had the highest population growth rate compared to before the project start, a rise rate of 6% was applied to Khemisset, and the lowest general rise rate of 5% was applied to Sidi Kacem, which had the lowest population growth rate. The rises in land price were considered a benefit.

As described above, EIRR of the project as a whole was 11.9%, decreasing by 6.8% from the time of the appraisal. This was caused by a decrease in the total amount of benefits during the project life by about 22%, although benefits were produced almost as planned. Moreover, in Khemisset, the operation and maintenance cost for the sewage treatment plant adopting the method of aerated lagoon increased by 23% from the initial budget; and in Sidi Kacem, the land value rise rate estimate was lowered from 7% to 5%. This pushed down EIRR more in both cities (a decrease by about 8% from the time of the appraisal). On the other hand, in Tiflet, decrease in the project cost, caused by incomplete establishment of a sewage treatment plant, pushed up EIRR, and absence of benefit in improvement in the productivity of agricultural products pushed down EIRR. As a result, EIRR decreased by about 5% from the time of the appraisal, but the rate of decrease is lower than in the two other cities.

Although the project cost was within the plan after the readjustment by taking into account the undone or incomplete projects and the part not implemented, the project period significantly exceeded the plan. Therefore, efficiency evaluation of the project falls under ② according to the rating criteria in the ex-post evaluation.

3.3 Effectiveness and Impacts[11] (Rating: ②)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

The three indicators used to evaluate the quantitative effects of effectiveness were the sewage treatment volume per day (m^3/day),[12] the sewerage connection ratio, and the BOD concentration of treated water (mg/L). At the time of the appraisal, the target year of the project was 2010, but at the time of the ex-post evaluation, the quantitative evaluations of effectiveness were compared with the results of indicators in 2017, the year following project completion, because the project was actually completed in 2016. On the other hand, as the project targeted the three provincial cities of Khemisset, Sidi Kacem, and Tiflet, and the cities operated their sewage businesses independently, the degree of achievement for the above-mentioned indicators in each city was calculated to evaluate effectiveness, and the overall degree of achievement was computed by weighting the degree of achievement for each city according to the city's population when evaluating the overall quantitative effects of effectiveness.

(1) Sewage Treatment Volume per Day (operation indicator)

At the time of the appraisal, the target sewage treatment volume per day[13] was 9,350 m^3/day for Khemisset, 7,780 m^3/day for Sidi Kacem, and 3,880 m^3/day for Tiflet. These targets were calculated based on each city's population that was projected for one year after the completion of the project

[11] Effectiveness is rated by adding impacts when judging it.
[12] Sewerage uses the confluence system with rainwater flowing into sewers in the rainy season. In addition, if the amount of rain increases, rainwater mixed with sewage is discharged halfway through the interceptor at the dam of the storm overflow chamber. In this project, the sewage treatment volume is sought by measuring the volume of sewage that flows into sewage treatment plants.
[13] The sewage treatment volume per day is obtained by dividing the annual sewage treatment volume for sewage treatment plants in each city by 365 days.

expected at the time of the appraisal (2010). However, the estimated population for one year after the completion of the project (2017) decreased to 140.7 thousand people in Khemisset (-14%) and 93.3 thousand people in Sidi Kacem (-32%) and increased to 92.6 thousand people in Tiflet (+16%). In particular, the estimated population for Sidi Kacem was reduced by 32% compared to the one estimated at the time of the appraisal. This is because the population for 2010 was estimated based on the population census of 2000 while the one for 2017 was estimated based on the population census of 2014. The ex-post evaluation used the population estimated for 2017 based on the population census of 2014, which shows an estimated population that is closer to the actual one, to readjust the target sewage treatment volume per day. Table 7 indicates the targets set at the time of the appraisal, targets after readjustments, results, and the degree of achievement.

Table 7: Sewage Treatment Volume per Day (m^3/day)

Cities (Actual project completion year)	Baseline (2005)	Target (2010)	Readjusted Target (2017)	Actual (2016)	Actual (2017)	Degree of Achievement
Khemisset (2016)	N.A.	9,350	8,045	N.A.	6,771	84%
Sidi Kacem (2016)	N.A.	7,780	5,257	N.A.	5,000	95%
Tiflet (2016)	N.A.	3,880	4,491	N.A.	N.A.	0%

Source: Documents provided by JICA, and by ONEE

One year after the completion of the project, the actual sewage treatment volumes per day for Khemisset and Sidi Kacem respectively exceeded 80% of the post-readjustment target. The degree of achievement for the daily sewage treatment volume was 84% for Khemisset and 95% for Sidi Kacem. Located in a mountainous region, Sidi Kacem has more precipitation in the rainy season than Khemisset. In Sidi Kacem, it is estimated that more rainwater flowed into sewage when the latter was treated, making the overall amount of sewage treated larger than the actual one. Meanwhile, Tiflet did not see the completion of its sewage treatment plant, leaving the degree of achievement at zero.

(2) Sewerage Penetration Rate

At the time of the appraisal, the sewerage penetration rate represented the percentage of households connected to ONEE's sewage services to the total number of households in ONEE's sewerage connection service area in each city in 2005. Table 8 shows the targets set at the time of the appraisal, results, and the degree of achievement.

Table 8: Sewerage Penetration Rate (%)

Cities (Actual project completion year)	Baseline (2005)	Target (2017)	Actual (2016)	Actual (2017)	Degree of Achievement *1
Khemisset (2016)	85.0%	85.0%	99.0%	99.0%	100% (116%)
Sidi Kacem (2016)	72.0%	75.0%	97.0%	98.0%	100% (131%)
Tiflet (2016)	75.0%	80.0%	89.0%	96.0%	100% (120%)

Source: Documents provided by JICA, and by ONEE

*1: The degree of achievement is evaluated as 100% even if it exceeds 100%. Figures in parentheses indicate the actual degree of achievement obtained by comparing targets and results. In these cases, the degree of achievement is counted as 100%.

As shown by the base figures, a certain percentage of households in each city were connected to ONEE's sewage service even before the start of the project. Through the implementation of the project, the goal of increasing the sewerage penetration rate in small and medium-sized provincial cities to 80% or more by 2020 was achieved as part of PNA. The degree of achievement for each city exceeded 100%, and it is judged that sufficient effects were obtained through the implementation of the project.

(3) BOD Concentration of Treated Water

The BOD concentration of treated water[14] represents the BOD concentration of treated sewage which is released from the sewage treatment plants developed in this project. At the time of the appraisal, the standard BOD concentration for treated water released from the sewage treatment plant was set at 70 mg/L or less, but in those days, Morocco did not have any standard for discharged sewage. In 2006, the year after the start of the project, the government stipulated national wastewater standards, providing that the BOD concentration should be 120 mg/L or less. Therefore, in this project, it was considered appropriate to evaluate the degree of achievement by comparing results with the national wastewater standards rather than the targets set at the time of the appraisal. Table 9 indicates the targets set at the time of the appraisal, results, and the degree of achievement.

Table 9: BOD Concentration of Treated Water (mg/l)

City (Actual project completion year)	Indicator item	Baseline (2005)	Target (2010)	National standard value[15] (2006)	Actual (2016)	Actual (2017)	Degree of achievement
		Appraisal year	1 year after the project completion		Project completion year	1 year after project completion	
Khemisset (2016)	Water flowing into treatment plant	N.A.	380	300	N.A.	290	103%
	Water discharged from treatment plant	N.A.	70 or less	120	N.A.	120	100%
Sidi Kacem (2016)	Water flowing into treatment plant	N.A.	480	300	N.A.	1,750	17%
	Water discharged from treatment plant	N.A.	70 or less	120	N.A.	320	38%
Tiflet (2016)	Water flowing into treatment plant	N.A.	400	300	N.A.	N.A.	0%
	Water discharged from treatment plant	N.A.	70 or less	120	N.A.	N.A.	0%

Source: Documents provided by JICA and ONEE

[14] BOD stands for biochemical oxygen demand. It refers to the amount of oxygen consumed by aerobic microorganisms when a sufficient amount of dissolved oxygen (DO) is available and organic matter in water is decomposed by such microorganisms. It is determined from the amount of oxygen consumed when a sample is cultivated at 20℃ for five days in a dark place.

[15] The national standards are based on "Bulletin Officiel n" 5448 du Jeudi 17 Août 2006." The highest permissible BOD concentration for sewage that flows into a sewage treatment plant is set at 300 mg/L, and this is equal to the upper limit of the BOD concentration of sewage discharged from households. In fact, the BOD concentration sometimes exceeds 300 mg/L because household sewage is mixed with other types of filthy water in the drainage ditches to sewage treatment plants. On the other hand, the upper limit to the standard BOD concentration of treated water released from sewage treatment plants is 120 mg/L.

The sewage treatment plant in Khemisset meets the national wastewater standards, and there is no problem with the quality of treated water. On the other hand, the plant in Sidi Kacem far exceeds the national wastewater standards with the result nearly three times as high as the standards. This is because the BOD concentration of sewage that flows into the plant is extremely high, at 1,750 mg/L, and the high BOD concentration was affected by the disposal by olive growers of large amounts of agricultural waste from olive oil refining operations into drainage ditches during the sampling period (December 2017). Incidentally, in May 2018, when ONEE measured the BOD concentration of inflow/effluent water at the sewage treatment plants in both cities, the BOD concentration at each sewage treatment plant was within the national wastewater standards,[16] indicating that the BOD concentration improved further.

Tiflet does not have a sewage treatment plant. Its sewage is collected at three pump stations, and then released into a nearby river without being treated. BOD concentrations cannot be confirmed, as the monitoring of water quality in Tiflet is not conducted, and the quality of sewage discharged is estimated to far exceed the national standards. Prior to the completion of the project, sewage was released at 11 locations in the city, and some of the locations, which were in close proximity to residential areas and school-commuting roads, always smelled of sewage. When it rained and rainwater mixed with sewage overflowed from the drainage ditch, the school-commuting road close to the location of release was closed, causing problems such as preventing students from going to school. The project concentrated the locations of release, enabling sewage to be released from locations far away from residential areas; afterwards, rainwater mixed with sewage no longer overflowed, and the smell of sewage was removed from the former locations of release. Thus, the sanitary environment in the city improved remarkably, and it is fair to say that this is a positive effect of the project.

(4) Summary of Quantitative Effects Evaluated

In evaluating quantitative effects, the degree of achievement for the three operation and effect indicators mentioned above was calculated for each city, and the calculated degree of achievement was weighted according to the cities' populations; thus, the overall quantitative effects of the project's effectiveness was evaluated. Shown below are the results of evaluation of quantitative effects of effectiveness and the breakdown thereof.

Table 10: Evaluation Results of Quantitative Effectiveness

City	City population (thousand)	Weight (%)	Achievement of three indicators for effectiveness evaluation (%)			Effectiveness achievement level of each city	Degree of achievement of each city after multiplied by weight
			Sewage treatment volume per day	Sewerage penetration rate	BOD concentration (at the time of release)		
Khemisset	140.7	43.1%	84%	100%	100%	94.7%	40.8%
Sidi Kacem	93.3	28.5%	95%	100%	38%	77.5%	22.1%
Tiflet	92.6	28.4%	0%	100%	0%	33.3%	9.5%
Total	326.6	100.0%					**72.4%**

Source: Documents provided by JICA and ONEE, and the achievement results of the effectiveness evaluation indicators used in the ex-post evaluation of the project

[16] In Khemisset, the BOD concentration value at inflow was 230 mg/l, and the BOD concentration value of treated sewage at discharge was 36 mg/l, indicating that the BOD was reduced by 84%. In Sidi Kacem, it was 420 mg/l and 100 mg/l, respectively; thus, the BOD was reduced by 76%.

The degree of achievement for the indicator of quantitative evaluation of effectiveness in the entire project area was 72.4%. The greatest reason for failure to achieve 80% or more was that the degree of achievement for the daily sewage treatment volume and the BOD concentration of sewage released was 0% for Tiflet because the installation of a sewage treatment plant in the city was not completed.

3.3.2 Qualitative Effects (Other Effects)

This ex-post evaluation covers the monitoring of water quality in the project as well as qualitative operation and effect indicators related to consulting services.

(1) Periodic monitoring of the quality of water released from treatment plants

In Morocco, the quality of water released from sewage treatment plants is monitored in summer (June) and winter (December), and such monitoring is conducted at the treatment plants, the points where treated sewage is released, and the upper and lower courses of rivers into which treated sewage is released. In addition, if there are major riverheads (dams) or agricultural land nearby, the quality of water is monitored at these locations.[17] However, the monitoring of water quality is carried out only for cities that have sewage treatment plants (only Khemisset and Sidi Kacem in this project), and cities without such plants (such as Tiflet) are not covered by the monitoring. It cannot be said that the monitoring of water quality by ONEE is satisfactory; nor is full attention paid to the natural environment around rivers into which sewage is released.

(2) Technology Transfer through Consulting Services and Its Effects

In this project, environmental monitoring through consulting services was not conducted. The reason for this was that it was judged that the necessity of environmental monitoring was low because the Environmental Monitoring Department at the ONEE headquarters already had a system and technology to conduct such monitoring. On the other hand, training in sewage treatment systems as well as administration and guidance was provided, but partly because ONEE, which had experience in the sewage treatment technology applied under this project in other cities, already possessed a sufficiently high level of technology, the effects of consulting services peculiar to the project were not particularly confirmed.

As described above, the effects of this project are high, but one result is that in aspects such as consideration to the natural environment, some issues were left unaddressed. Efforts to make this project more effective are hoped for.

[17] In Khemisset, there is the Kansera Dam, the source of water supply for the capital area, in the lower course of a river into which treated sewage is released, and the monitoring of water quality is conducted at the dam. In Sidi Kacem, the sewage treatment plant is located adjacent to agricultural land, and sewage from the plant is likely to leak into the underground, affecting neighboring agricultural land. For this reason, the quality of groundwater or similar outside the sewage treatment plant is also monitored.

3.4 Impacts

3.4.1 Intended Impacts

(1) Quantitative Assessment for Intended Impacts

The impacts that are expected in this project are to improve the environment and the sanitation of local residents with the aim of making the living standards better in the areas covered by the project. The project places emphasis on the natural environment as well as health and sanitation. To assess quantitative impacts on the natural environment as well as health and sanitation, indicators of quantitative impacts before and after the installation of sewage facilities are compiled in Table 11. The impact indicators listed in Table 11 were not set at the time of the ex-ante evaluation but were newly set at the ex-post evaluation to measure impacts in quantitative terms.

Table 11: Quantitative Impact of the Project

Cities	Indicator items		Water quality sampling results before installation of the sewage facilities (2008 - 2011)	Actual (2018) 2 Years after the project completion
Khemisset	Water quality in the river into which treated sewage is released	Lower course BOD (mg/l)	Upper course: 120 - 290 Lower course: 13 - 110	Upper course: 365 Lower course: 61
		Lower course SS concentration (mg/l)	Upper course: 98 - 430 Lower course: 20 - 400	Upper course: 295 Lower course: 98
		Changes in the number of Colon Bacilli (number/100 mL)	Upper course: $1.1*10^3$ - $1.6*10^8$ Lower course: $5.0*10^5$ - $1.1*10^7$	Upper course: $1.1*10^5$ Lower course: $4.6*10^4$
	Number of people contracted waterborne Infectious Diseases (person)*1		N.A.	0 (Dec. 2019)
	Water quality of the Kansera dam (dyke) into which the treated sewage from Khemisset is flowed: COD concentration (mg/L)		Dam surface: 1.0 - 2.5 Dam bottom: 1.4 - 2.0	Dam surface: < 0.6 - 2.2 Dam bottom: < 0.6 - 1.9
Sidi Kacem	Water quality in the river into which treated sewage is released	Lower course BOD (mg/l)	Lower course: 4 - 130	Lower course: 46.mg/L
		Lower course SS concentration (mg/l)	Lower course: 6 - 13,000	Lower course: 86 mg/L
		Changes in the number of Colon Bacilli (number/100 mL)	Lower course: $2.4*10^4$ - $2.4*10^7$	Lower course: $4.6*10^6$
	Number of people contracted waterborne Infectious Diseases (person)*1		N.A.	0 (Dec. 2019)
Tiflet	Water quality in the river into which treated sewage is released	Lower course BOD (mg/l)	Downstream: 170 - 900	N.A.
		Lower course SS concentration (mg/l)	Downstream: 220 - 820	N.A.
		Changes in the number of Colon Bacilli (number/100 mL)	Downstream: $3.0*10^5$ - $9.0*10^7$	N.A.
	Number of people contracted waterborne Infectious Diseases (person)*1		N.A.	0 (Dec. 2019)

*1: At the time of the ex-post evaluation (December 2019), the interview survey results for 10 households in each of the 3 cities were collected.

Quality of water in the river into which treated sewage is released

From 2008 to 2011, the period prior to the installation of sewage facilities, and in 2017 and 2018, the years after their installation, ONEE conducted the monitoring of water quality in the rivers in the three project cities into which treated sewage was released and in the Kansera Dam located in the lower course of the river into which treated sewage was released by the sewage treatment plant in Khemisset. Table 11 compares the situations before and after the installation of sewage treatment plants using the results of water-quality sampling at the points covered by the monitoring. In Khemisset and Sidi Kacem, no clear improving trend in the water quality in the rivers was confirmed

on the basis of BOD concentrations, SS concentrations,[18] and the number of colon bacilli in the downstream part of the rivers into which treated sewage is released. The COD concentration for the Kansera Dam into which water released in Khemisset flows[19] has remained practically unchanged before and after the installation of sewage facilities, indicating that at least, effects such as improvement in the quality of water by the project are not felt.

In Tiflet, data were not obtained because the quality of water was not monitored in 2017 and 2018. Because collected sewage is released as it is in the city, the importance of conducting the monitoring of water quality is greater than in other cities, and it is necessary to monitor the quality of water in the river into which collected sewage is released and other sources of water supply at least twice a year (once in the rainy season and once in the dry season).

Number of People Who Contracted Waterborne Infectious Diseases

At the time of the ex-post evaluation, households in the three cities were asked in a fact-finding survey whether family members had contracted any waterborne infectious disease attributed to the overflow of sewage or filthy water before the installation of sewage facilities under this project and during the previous year. In the survey conducted in Tiflet, while some respondents said when asked about the period prior to the installation of sewage facilities, "In the period during which rainwater smelling of sewage overflowed in the city, I used to take my children to a hospital often," all households replied when asked about the previous year, "No one has contracted such a disease.[20] In the surveys carried out in the other two cities, similar replies were received.

(2) Qualitative Assessment for Intended Impacts

At the time of the ex-post evaluation, to confirm whether the living standards had improved, qualitative surveys were conducted to assess the qualitative impacts emerged from the project implementation. Fact-finding surveys were carried out for a wide range of people, including the people concerned with sewerage development and its beneficiaries (residents in the cities and people engaged in agriculture in the suburbs), in the three project cities, Khemisset, Sidi Kacem, and Tiflet. A total of 30 households as beneficiaries, 10 in each city, were interviewed. The result of the surveys showed that 91% of households replied that they were highly satisfied with the project. As one of the project's major contributions, respondents cited the fact that the city was no longer filled with water mixed with sewage or effluent and that the smell of sewage had been removed. In total, 82% of households replied that the living environment had improved, and it can be said that the project contributed greatly to the improvement of beneficiaries' living standards. Table 12 summarizes the results of the surveys that compared the qualitative impacts felt under the project before and after the implementation of the project, including the results of qualitative surveys.

[18] SS stands for suspended solids, and the SS concentration is an indicator of contamination with impurities contained in water.
[19] COD stands for chemical oxygen demand, and the COD concentration is an indicator of contamination with organic matter, which is used for lakes and lagoons.
[20] In the past, many children particularly developed symptoms of waterborne infectious disease attributed to the overflowing of sewage and filthy water. In the survey, it was also confirmed that residents had often taken their children to a clinic.

Table 12: Qualitative Survey Results of the Project (Based on the Indicators for Qualitative Surveys)

Indicators	Survey subjects	At the time of the ex-ante evaluation (2005)	Results (2019)
1. Improvement of the health of local residents	Residents living near the sewer pipes installed in the project (Around 10 households in each city, including two to three people engaged in agriculture in the suburbs of the city)	1. Many people contracted a waterborne infectious disease.	1. The qualitative survey confirmed whether people had contracted such a disease during the previous year (2019). Survey results indicated that nobody had replied that during the previous year, his/her household members had developed symptoms of a waterborne infectious disease attributed to the spread of sewage or filthy water when the city was submerged.
2. Reduction of contamination damage due to the overflowing of rainwater or sewage on the low ground		2. Rainwater mixed with sewage overflowed on the low ground, causing floods and filling the city with the smell of sewage. If it rained heavily, the amount of running sewage increased, raising the level of water in the river into which the sewage was released, and this caused damage such as sewage backflow. If that happened, residents suffered damage such as the smell of sewage spreading through their houses.	2. The three cities all use the rainwater/sewage confluence system, collecting sewage and at the same time letting rainwater flow into sewer pipes. However, in some areas of Sidi Kacem, separate drainpipes have been installed for rainwater. This has prevented the entire town from being inundated and rainwater from being mixed with sewage even if the former more or less stays, and the town no longer smells of sewage. One opinion of residents living near a pump station or similar where sewage is concentrated was that in summer, the station smelled of sewage as the amount of water decreased. Currently, ONEE is taking measures such as preventing the smell of sewage from leaking outside by planting tall trees around the pump stations.
3. Economic effects produced as the reuse of treated water for agricultural water progressed thanks to the improvement of water quality		3. Treated water had been reused for agricultural water, and it had not been confirmed whether crops produced using treated sewage actually caused damage, but it was estimated that the situation was extremely dangerous.	3. In Sidi Kacem and Khemisset, sewage was treated, and treated sewage was released into rivers whose water was used for agricultural water. In these two cities, untreated sewage is not used, and it is estimated that the effects of sewage on crops have been reduced. On the other hand, in Tiflet, where sewage is not treated, untreated sewage was formerly used, but today, rainwater, well water, or similar are used.
Improvement of the quality of water in the lower course of the river into which treated sewage is released, the preservation of the quality of water in the upper course of the river into which treated sewage is released (riverheads), etc.	Upper and lower course of the rivers in the three project cities into which treated sewage is released	N/A	In Sidi Kacem and Khemisset, where sewage was treated, fact-finding surveys for qualitative effects found that 60% of the 20 households surveyed replied that the quality of water (turbidity, odor, etc.) in the river had improved (The remaining 40% said that they did not know). In Tiflet, 70% of respondents said that the quality of water had not particularly changed.

The most important change in the indicators used for qualitative surveys before and after the implementation of the project was that the overflowing of filthy water, including sewage, which had frequently occurred on the low ground, no longer happened, improving the living environment in the city dramatically. Other changes included the improvement of the quality of water (turbidity, odor, etc.) in the river into which treated sewage was released, and 60% of the 20 households covered by the fact-finding survey for qualitative effects in Khemisset and Sidi Kacem, where sewage treatment

plants were built, recognized that the quality of river water had improved. On the other hand, some respondents expressed their negative opinions, complaining, for example, that in the dry season when the precipitation was low, the pump stations where sewage was concentrated gave out offensive smells. With respect to the offensive smells from the pump stations, however, it was confirmed with ONEE at the time of the ex-post evaluation that the National Office would take measures such as preventing such smells from leaking outside by planting tall trees around the stations.

3.4.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

This project is classified as Category B for the following reasons: under the "Japan Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Consideration" (established in April 2002), it is not a large-scale sector one, has no characteristic of such sector, and is not located in a sensitive area, and it is unlikely to have a significant adverse impact on the environment. The governments of the three project cities compiled reports on environmental impact assessments (EIA) in 2005, and these reports were already approved by the Ministère de l'Aménagement du Territoire, de l'Eau et de l'Environnement (MATEE). The environmental monitoring stipulated in the EIA was conducted before the project was completed (2008-2011) and after completion (2017-2018). The results of environmental monitoring for the river environment are as shown in Table 11, and there was no negative impact of the project on the rivers. In addition, sewage treatment plants and pump stations were installed far away from residential areas as part of the measures to reduce noise and offensive smells, and other measures included planting trees around sewage facilities; as a result, there have been no negative effects on the environment around residential areas. Nor have there been any other events that affected the domestic ecosystems, because the project area did not have nature reserves. However, in Tiflet, which has no sewage treatment plant installed, environmental monitoring for rivers into which sewage was released was not conducted after the completion of the project, and there is concern about the fact that the effects of such sewage on the natural environment are not recognized.

(2) Resettlement and Land Acquisition

Since the land required for the installation of sewage facilities consisted of agricultural land, residents were not relocated during the implementation of the project. In addition, no particular impact on the livelihood of farmers was confirmed in the sale of the land, and no complaint from the farmers on recovering their livelihood has been confirmed until now. The reason why the Tiflet city government eventually could not acquire land was that land prices soared due to the effects of urban development in the city. It took time to identify the final candidate for the site of sewage facilities in both Sidi Kacem and Khemisset and sweep away the concern about being chosen as the site of such facilities. A similar situation occurred in Tiflet, but land acquisition was given up because of soaring land prices.

In light of the above, certain effects were observed through the implementation of the project. Thus, the effectiveness and impacts of the project are fair.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional/Organizational Aspects of Operation and Maintenance

(1) Central Organizational Structure

The National Sewerage Plan calls for ONEE to enter into joint operation agreements with provincial core cities and communes and take the initiative in maintaining and managing sewerage in accordance with the agreements. For the past two decades, ONEE has worked with provincial core cities and communes to take responsibility for maintaining and managing regional sewerage operations. When prioritized core cities and communes are selected, ONEE works out plans to introduce sewage facilities and establish prefectural offices which are responsible for regional sewage projects. In the operation and maintenance of this project, the northern office of ONEE in the city of Kenitra (DR4), one of the ten ONEE regional offices under the control of ONEE's Bureau of Industry, was in charge of operating and maintaining sewage facilities under the project together with prefectural offices under its control (Khemisset and Sidi Kacem prefectural offices).

(2) Operation and Maintenance System for Sewerage Services

Sewerage services are operated and maintained based on municipal offices that belong to prefectural offices under DR4's control. In this project, engineers in Khemisset, Sidi Kacem, and Tiflet were incorporated into the personnel of ONEE municipal offices in the respective cities[21] in an effort to reinforce the operation and maintenance system for sewerage services. All offices in the three project cities belong to DR4, which has a total of 588 personnel (as of December 2019). DR4 has four prefectural offices, in Kenitra Prefecture, Khemisset Prefecture, Sidi Kacem Prefecture, and Tamesna Prefecture, respectively. The municipal offices in the three project cities belong to the Khemisset or Sidi Kacem prefectural offices, and each municipal office has tens of engineers as part of its personnel.

[21] The municipal offices in Khemisset, Tiflet, and Sidi Kacem received four, four, and two engineers, respectively. The engineers received from the respective city governments, who were familiar with the situation of the respective cities, contributed to the performance of construction work under the project by acting as intermediaries between ONEE and residents. Other engineers from the communes shared the geographical traits of the respective cities, candidates proposed for sewerage facilities to be installed, the characteristics of the ground at installation points, the existence of groundwater veins (such as groundwater), issues to address, and others with ONEE. Thus, they contributed mainly to detailed design of highly feasible facilities, and the smooth execution and management of construction work.

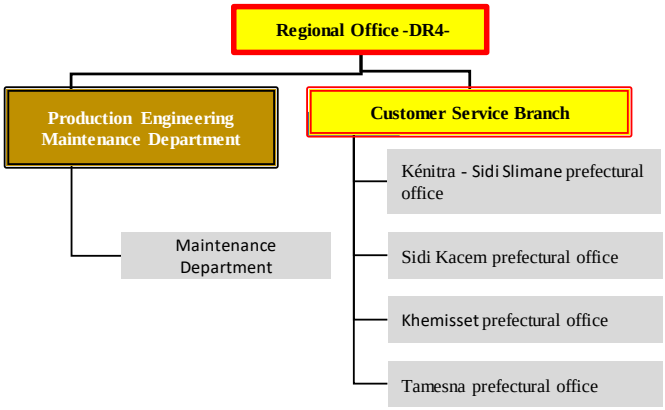


Figure 1: Implementation System Diagram of DR4

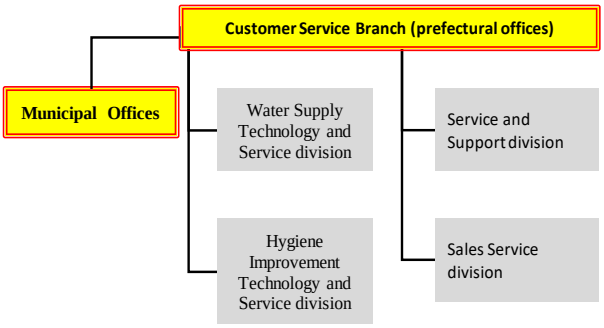


Figure 2: Implementation System Diagram of Local Offices in the Three Project Target Cities

Each municipal office is responsible for supervising the city's sewage treatment plants, trunk sewage canals, networks of sewage collection pipes, and sewage pump stations and operating and maintaining all sewage facilities of the city. A sufficient number of personnel are assigned to each municipal office to inspect these facilities periodically. All facilities to be inspected are periodically inspected, at a cycle of once a week, and around 30 minutes are spent on inspection at each facility.

(3) System to Conduct Environmental Monitoring for Water Quality

The Direction Contrôle Qualité des Eaux (DCE), which is under the control of the International Institute for Water and Sanitation at the ONEE headquarters, is in charge of environmental monitoring for water quality. Under this project, DCE personnel are seconded to DR4 and enrolled there for a certain period of time. Currently, they visit each sewage treatment plant each month to monitor the quality of water in the plant. Since the summer of 2019, two personnel have been assigned to the sewage treatment plant in Khemisset. Meanwhile, no personnel have been deployed in Sidi Kacem's treatment plant, with DCE personnel periodically sent to the plant for water-quality monitoring. There is no problem with the level of techniques and the maintenance of equipment required for environmental monitoring for water quality.

Under the control of ONEE's Bureau of Industry in the central government, which has authority for the operation and maintenance of sewage facilities built under the project, DR4 plays a central role in regular maintenance and management, emergency response when abnormalities are detected, repair and replacement, construction work for expansion, and monitoring of the quality of water in the sewage treatment plant by assigning personnel appropriately and putting implementation systems in place.

3.5.2 Technical Aspects of Operation and Maintenance

ONEE has a track record of operating and maintaining sewage facilities and possesses sufficient technological capabilities. It has many personnel with 20 years of experience or more, who account for half of ONEE's total employees. With over 62% of its personnel (as of December 2019) having completed related courses of study at university, ONEE has many personnel with technical

knowledge. Similarly, at DR4, which is responsible for operating and maintaining the sewage facilities installed under the project, more than half of engineers have 20 years of experience or more; with regard to academic backgrounds, 59% of personnel have a university degree or higher.

In addition, ONEE has the Technical Training Department (hereinafter referred to as "DIF"), which plans, implements, and monitors projects to develop technology for ONEE business. This department, which has necessary teaching materials, identifies the training needs of each department and reviews and revises the training curriculums. DIF instructors use these curriculums to train some 20 personnel in each training session. Together with this training, ONEE engineers receive practical training at the platform for sewage facilities, which is available at the headquarters for training. This enables ONEE engineers to acquire the technical abilities to solve failures and defects at sewage facilities by themselves. It was confirmed that there was no problem with the operation of sewage facilities, because engineers at DR4 regional offices, prefectural offices, and offices in the cities where sewage facilities had been installed had high-level knowledge of and know-how in on-the-spot surveys in their respective scopes of responsibility.

Both the headquarters and DR4 of ONEE have sufficient experience, abilities, and technological capabilities, therefore, the sustainability of operation and maintenance for sewage facilities in technical aspects is considered to be very high.

3.5.3 Financial Aspects of Operation and Maintenance

(1) Overall Revenue and Income and Operation/Maintenance Costs

It can be confirmed from the financial statements disclosed by ONEE that it has maintained a sound revenue and income structure over a long period of time. Table 13 summarizes changes in revenue and income during the period from 2016 to 2018.

Table 13: Changes in ONEE Income and Expenditures (2016–2018) (Unit: million MDH)

Income / Expenditure Items	2016	2017	2018
Total Revenue	**6,322**	**5,656**	**5,961**
Other incomes (subsidy and etc.)	887	1,329	1,077
Operation and Maintenance costs	1,182	1,244	1,297
Gross profit	**6,027**	**5,741**	**5,742**
Personnel expenses	1,386	1,435	1,476
Overhead, Operational allocation, other, tax	3,276	3,204	3,255
Operating income **Operating income ratio**	1,365 **18.9%**	1,101 **15.8%**	1,011 **14.4%**
Financial return (Financial income - Financial loss/expenditure)	-677	-413	-620
Ordinary profit	**688**	**688**	**391**
Income Tax	20	23	21
Net profit **Net profit margin**	667 **9.3%**	665 **9.5%**	370 **5.3%**

Source: based on the financial statements of the ONEE Annual Activity Report (2016-2018)
Note: Subsidies from local governments, national governments, and international organizations are calculated as part of the income.

Total revenue has increased and decreased, but the operating income ratio remained between 14% and 19%, indicating that the water supply/sewerage and electricity services earned a sufficient income. Financially, ONEE has run a deficit due to repayment for borrowings from the government and international organizations but is repaying each year without delay and posting net income steadily. Therefore, ONEE has no financial problems.

Table 14: Number of Households and Total Collected Amount by Water and Sewerage Services of ONEE as a Whole

	Number of households subscribing to sewerage service and total collected amount		Number of households subscribing to water supply service and total collected amount		Total collected amount by water and sewerage services (million MDH)
	Number of subscribing households (thousand)	Total amount collected (million MDH)	Number of subscribing households (thousand)	Total amount collected (million MDH)	
2014	865	180	1,807	1,274	1,454
2015	917	233	1,904	1,473	1,705
2016	1,047	259	1,997	1,505	1,764
2017	1,128	305	2,096	1,608	1,913
2018	1,212	310	2,183	1,572	1,882
2019	1,332	350	2,272	1,692	2,042

Source: Documents provided by the executing agency

(2) Operation and Maintenance Costs under the Project

According to interviews with ONEE officials, sufficient budgets were currently appropriated to operation and maintenance, and similar budgets were expected to continue in the future. It was confirmed from this that there was no problem with DR4's overall operation and maintenance costs, including those of the project. All expenses related to the installation of sewage facilities are borne by ONEE, with costs for land acquisition and some drainpipes paid by the communes. Because it earns revenue not only from sewerage business but also from water supply service, ONEE can sufficiently cover costs required for operation and maintenance. Table 15 shows the amounts it is estimated to collect for water supply and sewerage services in the three project cities and actual operation and maintenance costs. The actual operation and maintenance costs exceed the amounts estimated to be collected for sewerage services, indicating that the operation and maintenance costs for sewerage services cannot be fully covered by the amount collected for sewerage services alone. On the other hand, the amounts estimated to be collected for water supply more than double the amounts estimated to be collected for sewerage services, allowing part of the amounts collected for water supply to be appropriated to cover operation and maintenance costs for sewerage services. This can be confirmed in the table below.

Table 15: Estimated Collected Amounts by Water and Sewerage Services and Operation Budget and Actual Costs for the Three Target Cities (Unit: million MDH)

Year	Estimated collected amount by water and sewerage services from the estimated number of households covered by this project					Operation expenses for this project (Actual)	
	Number of households targeted for this project (thousand)	Overall ratio of this project (sewerage) (%)	Estimated total collected amount by sewerage services (million MDH)	Overall ratio of this project (Water) (%)	Estimated total collected amount by water services (million MDH)	Budget (million MDH)	Actual operation and maintenance cost (million MDH)
2014	86.3	10.0%	17.9	4.8%	60.8	31,0	29.5
2015	86.4	9.4%	21.9	4.5%	66.8	35.1	33.3
2016	88.1	8.4%	21.8	4.4%	66.4	36.1	42.1
2017	92.0	8.2%	24.9	4.4%	70.6	40.9	41.1
2018	93.6	7.7%	23.9	4.3%	67.4	39.4	41,0
2019	N.A.	N.A.	N.A.	N.A.	N.A.	40.2	39.5

Source: estimated and calculated by the evaluator on the basis of the responses from ONEE using the questionnaire at the time of the ex-post evaluation

(3) Sewerage Rate System for the Project

The systems and rules for sewerage rates were established based on the report compiled in 2000 (Service Public 2000).[22] Table 16 lists the fee for sewerage services in the project cities, which were later revised, in 2017.

Table 16: ONEE Sewerage Service Fee Structure (2017)

Fee Structure (2017)[23]	Khemisset, Tiflet (Group 3)	Sidi Kacem (Group 4)
a. General household use		
Fixed annual fee (MDH)	**36**	**36**
Monthly usage fee (MDH/m^3)		
Water use range 1: Monthly usage from 0 to 6 m^3	0.75	0.75
Water use range 2: Monthly usage from 6 to 20 m^3	3.51	3.51
Water use range 3: Monthly usage of 20 m^3or more	4.71	4.71
b. Use in public facilities and institutions		
Fixed annual fee (MDH)	**72**	**72**
Monthly usage fee (MDH/m^3)	4.21	4.21
c. Industrial use		
Fixed annual fee (MDH)	**144**	**144**
Monthly usage fee (MDH/m^3)	4.71	4.71

Source: responses from ONEE using the questionnaire at the time of the ex-post evaluation

Because the amount of sewage service used cannot be measured in quantitative terms, it is common to charge sewage service in proportion to the amount of tap water supplied, and sewage rates are charged to households covered by this project according to the amount of tap water supplied. According to Table 16, the fixed amount of 36 MDH is charged to each household annually with

[22] Service Public 2000 is a report on long-term charging policy, which was compiled by consultants hired in France. It includes the systems and rules established to revise sewage rates in order to ensure that ONEE will not fall into a financial crisis in the future.

[23] The sewage charging system divides cities into four groups. This system is based on the amounts set and charged for sewage services when, before 2000, each city operated and maintained its sewerage independently. In 2000, ONEE started to take responsibility for the operation and maintenance of sewerage and revised the amounts that had been set and charged by each city for sewage services in the past as operation and maintenance costs grew, and the result is the current categorization of charging, which does not take into consideration economic scales, the average income of households, and other factors. Of the project cities, Khemisset and Tiflet are included in Group 3 and Sidi Kacem in Group 4.

0.75 MDH per cubic meter added monthly if the amount of tap water used ranges from zero to 6 m^3 (Tap Water Use Range 1). If the monthly amount of tap water used ranges from 6 m^3 to 20 m^3, the amount charged per cubic meter rises sharply to 3.51 MDH (Tap Water Use Range 2). For subsequent ranges, rates are charged according to the amount of tap water used monthly based on this method. The average amount of water used by households ranges roughly from 11 m^3 to 14 m^3, and consideration is given to the charging system so that excessive sewage rates are not charged to average households. One of the reasons for this is that sewerage services are strongly intended to contribute to society and are easily affected by politics. Another is that, because it serves provincial core cities and communes, ONEE needs to pay full attention to actions it takes for the poor in particular. Because of such attention, ONEE can collect sewage rates smoothly, and this supports the sound financial condition of ONEE as described above. Currently, ONEE is proposing a plan to increase the rate per cubic meter by 0.1 MDH each year during the period from 2019 to 2023, and this has been approved in the process of discussions about the revision of water supply and sewage service rates. If the plan of increasing the rate by 0.1 MDH annually is realized, it will become possible to cover maintenance and management costs by revenue from sewerage services alone in 2023.[24]

It is possible to set water and sewage rates required to maintain both water supply and sewage services, and since full consideration is given to factors such as the living standards of residents and the economic situation, it can be said that the financial sustainability of ONEE's water supply and sewage services is extremely high.

As described above, ONEE has a stable financial structure, and there is no problem with the income and expenditure of water supply and sewage services provided by DR4, including the project. Therefore, there is no financial problem.

3.5.4 Status of Operation and Maintenance

In this ex-post evaluation and survey, the operation and maintenance of sewage facilities installed in this project were analyzed based on ONEE's quarterly project progress reports and replies to questionnaires, as well as on-the-spot surveys. All water supply and sewage facilities in the three cities are in operation without problems (Tiflet has only a sewage collection system and does not have treatment facilities). The table below shows the operation of each facility. The sewage treatment facilities used in this project are very basic, enabling all materials and spare parts to be procured within the country. In addition, they use the technology that has brought satisfactory results in the country, and there are many operators that support it.

[24] According to interviews with ONEE officials, sewerage services will become profitable if 1.0 MDH/m^3 can be charged per month.

Table 17: Current Status of Operation and Maintenance of Sewage Facilities in the Three Cities

Sewage Facilities	Status	Issues	Countermeasures
Sidi Kacem			
Sewage Treatment Plant	Good	Sludge treatment	Purchasing pump for sludge suction
Sewer pipe	Good	None	
Pumping Station	Good	There is a sewage odor when the water amount is small	Plant around the pumping station
Khemisset			
Sewage Treatment Plant	Good	Oxygen concentration sensor did not respond	Sewage dust adhered to the sensor. A maintenance company was asked to clean the sensor, and the problem has been dealt with.
Sewer pipe	Good	None	
Pumping Station	Good	There is a sewage odor when the water amount is small	Plant around the pumping station
Tiflet			
Sewage Treatment Plant			
Sewer pipe	Good	None	
Pumping Station	Good	None	

As described above, there is no problem with the project's operation and maintenance system, technology, finance, and overall situation, and the sustainability of effects brought by the project is high.

4. Conclusion, Lessons Learned, and Recommendations

4.1 Conclusion

This project was implemented to establish and expand sewerage systems in three cities (Khemisset, Sidi Kacem, and Tiflet) near Rabat by improving sewerage in the cities, thereby contributing to improvement in living standards in the areas.

The target areas were core cities and communes in regions in which the need for sanitation or sewerage improvement was the highest among those specified in the National Sanitation Master Plan (SDNAL), a sector development policy of the Moroccan government. In addition, this project has been highly consistent with Japan's ODA policy; thus, its relevance is high. The project period of ten years was significantly longer than the planned four years because the project required a considerable amount of labor and time to acquire land for sewage treatment plants. Meanwhile, the project cost was within the plan, at 92% against the recalculated budget plan. Therefore, the efficiency of the project is fair. In Khemisset and Sidi Kacem, the sewerage systems were established almost as planned, excluding some sections, thereby improving the sanitation environments in the cities. On the other hand, in Tiflet, although the trunk sewer and sewage collection network were improved as planned, and the sanitation environment in the city was improved, the establishment of a sewage treatment plant remains incomplete. This led to the fact that sewage in the city has been untreated and discharged into the river. According to an interview survey, local residents are satisfied with this project, and positive impacts on the natural environment, public health, and economy in the cities have been confirmed. Although the improvement in living standards in the target cities has been achieved, consideration for the natural environment and measures for water quality monitoring are insufficient. To summarize the above, the effectiveness and impacts of the project are fair. For the systems for maintenance in this

project, implementation systems by the headquarters, regional and provincial offices, and city service offices have functioned. With regard to technical aspects, ONEE has a good track record in maintenance and sufficient technical capabilities. In addition to the soundness of its financial condition, the balance of payments combined with water supply and electric power has been active every year, and no major problems have been observed. Therefore, the 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) It is desirable to take steps to acquire land for a sewage treatment plant in Tiflet, design the plant in detail and decide specifications for the plant, and start construction work as soon as possible. After these steps are taken, it is also desirable to start sewage treatment services by 2024.

(2) Because part of the construction work for drainpipes in Sidi Kacem has not been completed, it is desirable to conclude a construction contract for such a part quickly and complete the part of the work that is left uncompleted (At the time of the ex-post evaluation, according to interviews with the people concerned, the work is expected to be completed in 2020).

(3) The quality of water is not monitored in Tiflet. The quality of water at the three locations of the river where sewage is released as well as at the eight locations of the river where sewage was formerly released should be monitored to confirm whether sewage or similar is leaking.

4.2.2 Recommendations to JICA

Parts of the sewage facilities in the project cities are left uncompleted. It is necessary to continue monitoring Tiflet's sewage treatment plant, an uncompleted component of the project, and the portion of Sidi Kacem's drainpipes which is left uncompleted. It is desirable to seek a report on the progress in the construction of these uncompleted components from ONEE twice a year and continue monitoring until the components are completed.

4.3 Lessons Learned

(1) Add land acquisition to prior requirements in sewerage development by local governments

In this project, it took much time and labor to acquire land for sewage treatment plants. As a result, the installation of a sewage treatment plant in Tiflet was left uncompleted. If, as in the project, the authority and responsibility for land acquisition lies in the local government concerned, the requirements for prioritization of local governments covered by a sewerage development project, including the availability of land for sewage treatment plants in the project area, the conclusion of memorandums with landowners, budgets nailed down by the government in its annual plan to purchase the land, and so forth, enable the local government to strengthen its commitment for the sewerage development project.

Comparison of the Initial / Actual Scope

Item	Plan	Actual
(1) Project Outputs	**Khemisset** Sewage Treatment Plant: Anaerobic pond + aerated lagoon Total sewage treatment capacity: **11,008 m^3/day** Cleaning of Sewer Lines: **3.6 km** Rehabilitation of Sewer Lines: **0.3 km** Sewer trunk line / Sewage collection network / Interceptor: **23.5 km** Drainage Ditch: **6.1 km** Pumping Station: **2**	**Khemisset** Sewage Treatment Plant: Anaerobic pond + aerated lagoon Total sewage treatment capacity: **12,152 m^3/day** Cleaning of Sewer Lines: **0 km** Rehabilitation of Sewer Lines: **0 km** Sewer trunk line / Sewage collection network / Interceptor: **15.5 km** Drainage Ditch: **6.1 km** Pumping Station: **1**
	Sidi Kacem Sewage Treatment Plant: Anaerobic pond + facultative pond Total sewage treatment capacity: **11,120 m^3/day** Cleaning of Sewer Lines: **42.5 km** Rehabilitation of Sewer Lines: **2.0 km** Sewer trunk line / Sewage collection network / Interceptor: **33.5 km** Drainage Ditch: **22.2 km** Pumping Station: **1**	**Sidi Kacem** Sewage Treatment Plant: Anaerobic pond + facultative pond Total sewage treatment capacity: **7,600 m^3/day** Cleaning of Sewer Lines: **0 km** Rehabilitation of Sewer Lines: **10.7 km** Sewer trunk line / Sewage collection network / Interceptor: **30.9 km** Drainage Ditch:**22.2 km** Pumping Station: **2**
	Tiflet Sewage Treatment Plant: Anaerobic pond + facultative pond Total sewage treatment capacity: **4,850 m^3/day** Cleaning of Sewer Lines: **4.6 km** Rehabilitation of Sewer Lines: **0.2 km** Sewer trunk line / Sewage collection network / Interceptor: **20.1 km** Drainage Ditch: **3.6 km** Pumping Station: **3**	**Tiflet** Sewage Treatment Plant: **Not implemented** Total sewage treatment capacity: **0 m^3/day** Cleaning of Sewer Lines: **0 km** Rehabilitation of Sewer Lines: **0.2 km** Sewer trunk line / Sewage collection network / Interceptor: **21.6 km** Drainage Ditch: **0 km** Pumping Station: **3**
(2) Project Period	November 2005 - October 2009 (48 months)	November 2005 - May 2016 (127 months)
(3) Project Cost	At the time of Preliminary Evaluation:	At the time of the Ex-Post Evaluation:
Foreign currency	488 million JPY	N.A.
Local currency	5,516 million JPY	N.A.
Total	6,004 million JPY	4,804 million JPY
Japanese ODA loan portion Exchange rate	1 Moroccan Dirham = 12.1 JPY (As of September 2004)	1 Moroccan Dirham = 11.7 JPY (2007 - 2016 average)
(4) Final Disbursement	May 2016	