

Kingdom of Cambodia

FY2024 Ex-Post Evaluation Report of Japanese Grant Aid Project

“The Project for Flood Protection and Drainage Improvement
in the Phnom Penh Capital City (Phase IV)”

External Evaluator: Keiko Asato

Foundation for Advanced Studies on International Development

0. Summary

This project was implemented with the objective to efficiently drain rainwater and to minimize inundation damage by internal water¹ via the development of drainage facilities and the functional improvement of existing drainage pumping stations in the northern part of the central area of Phnom Penh Capital City², thereby contributing to the urban environment’s improvement in the target area.

This objective was consistent with Cambodia’s development plan and development needs at the time of planning and at the time of the ex-post evaluation, and it was relevant with Japan’s ODA Policy and JICA’s development cooperation policy at the time of planning. On the other hand, at the time of planning, no projects were confirmed, which were implemented by JICA, other Japanese organizations or other donors with the intention of generating synergetic effects with this project through coordination or collaboration. Therefore, its relevance and coherence are high. Inundation depth and inundation duration decreased as planned, and inundation area was also estimated to have decreased. The inundation situation of residences and shops, as well as the sanitary situation, has improved, and movement within the area has become easier. Therefore, the objective of minimizing damage from internal water inundations has mostly been achieved. In addition, positive effects were recognized in terms of inundation damage, disease incidence, and economic, traffic, and educational aspects, contributing to the urban environment’s improvement. Therefore, the effectiveness and impacts of the project are high. Although the project period exceeded the plan, the project cost was within the plan; therefore, efficiency of the project is high. Regarding the operation and maintenance of this project, mostly no major problems are observed in terms of policy/system, institutional/organization, technical and environmental and social aspects. However, some issues have been observed in terms of the financial aspect even though some improvement can be seen. They are not highly expected to be improved/resolved. Therefore, sustainability of the project effects is moderately low.

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

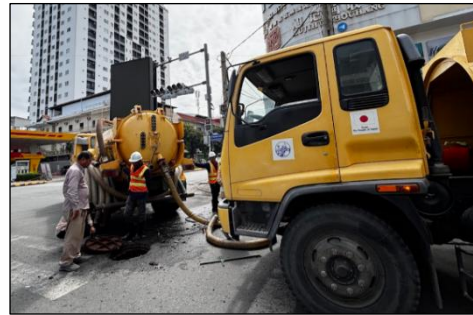
¹ “Internal water” refers to water accumulated in areas inside levees protected by levees, whereas “external water” refers to the flowing water of the main river channel (Ministry of Land, Infrastructure, Transport and Tourism, Kinki Regional Development Bureau, “Glossary of River-related Terms”).
https://www.kkr.mlit.go.jp/yamato/keikaku/glossary/sougou/sougou04.html#h3_0_3
Accessed on October 7, 2025.

² This project was implemented with the target area of Wat Phnom Northern area and Tuol Kork area in the northern part of Phnom Penh Capital.

1. Project Description



Project Location



Workers cleaning with the equipment provided (source: Taken by the evaluator)

1.1 Background

Phnom Penh, the capital of the Kingdom of Cambodia (hereinafter referred to as “Cambodia”), is at high risk of flooding due to its geographical features. The city has been protected from flood disasters by outer ring dikes surrounding the urban district against flooding caused by river overflow, as well as by discharging the rain that falls within the urban area (internal water) through drainage facilities. Many of these flood-protection and drainage facilities were constructed from the French colonial period through the 1960s and therefore are severely deteriorated; in addition, their functions have declined due to the civil war in the 1970s-1980s. Consequently, flood damage and poor drainage have not only hindered citizens’ daily life through the inundation of houses and submergence of roads but also become a cause of traffic congestion and sanitary problems.

In this situation, in 1999, the JICA implemented the Development Study type technical cooperation “The Study on Drainage Improvement and Flood Control in the Municipality of Phnom Penh (1998-1999)” and formulated a master plan concerning urban drainage and flood control measures.

In line with this master plan, the Grant Aid project “The Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City” was implemented from Phase I to Phase III in order to support embankment reinforcement, rehabilitation and new installation of main drainage channels in the city, and renewal of pump drainage facilities. On the other hand, along with population increase and urbanization in Phnom Penh Capital, illegal waste dumping into drainage channels increased, flowing into the drainage pumping station near the city center constructed by Japan, which made manual removal of waste difficult.

1.2 Project Outline

The objective of this project is to efficiently drain rainwater and to minimize inundation damage by internal water, by improvement of drainage facilities and the functional improvement of the existing drainage pumping station in the northern part of Phnom Penh Capital (Wat Phnom Northern area and Tuol Kork area), thereby contributing to the urban environment’s improvement in Phnom Penh Capital City.

<Grant Aid Project>

Grant Limit / Actual Grant Amount	Detailed Design	109 million yen/109 million yen
	Main Works	3,948 million yen/3,681 million yen
Exchange of Notes Date/ Grant Agreement Date	Detailed Design	March 2017/March 2017
	Main Works	August 2017/October 2017
Executing Agency		Department of Public Works and Transportation (hereinafter referred to as “DPWT”) of Phnom Penh Capital City
Project Completion		December 2021
Target Area		Northern part of the city center of Phnom Penh Capital City (Wat Phnom (hereinafter referred to as “WP”) North and the Toul Kork (hereinafter referred to as “TK”) District)
Main Contractor(s)		Toa Corporation
Main Consultant(s)		CTI Engineering International Co., Ltd.
Procurement Agency		None.
Preparatory survey		March 2016 -December 2016
Related Projects		【Technical Cooperation Projects】 “The Study on Drainage and Sewerage Improvement Project in Phnom Penh Metropolitan Area” (2014-2016). “The Project for Improvement of Public Bus Operation in Phnom Penh” (2017-2020).
		【Grant Aid Projects】 “The Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City” (August 2002) “The Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City (Phase II)” (June 2007) “The Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City (Phase III)” (March 2011) “The Project for Sewerage System Development in Phnom Penh Capital City” (November 2019) “The Project for Improvement of Transportation Capacity of Public Bus in Phnom Penh” (November 2016).

2. Outline of the Evaluation Study

2.1 External Evaluator

Keiko Asato, Foundation for Advanced Studies on International Development

2.2 Duration of Evaluation Study

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

Duration of the Study: October 2024-February 2026

Duration of the Field Study: February 16-March 1, 2025 and July 1-4, 2025

3. Results of the Evaluation (Overall Rating: B³)

3.1 Relevance/Coherence (Rating: ③⁴)

3.1.1. Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Cambodia

At the time of planning, under the *Rectangular Strategy Phase III (2013-2018)*, one of the main strategies, “The Development of Physical Infrastructure,” listed “Management of Water Resources and Irrigation System Management” as a priority strategy, and flood management and protection through drainage infrastructure, flood-protection dams, and rainwater reservoirs was considered a priority policy. The *National Strategic Development Plan (2014-2018) of Cambodia* (hereinafter referred to as “the NSDP”), which was formulated to implement the said Rectangular Strategy, included in its action plan the reduction of natural disasters caused by flooding through the development of flood control and drainage systems.

At the time of the ex-post evaluation, the *Rectangular Strategy Phase III (2013-2018)* evolved into the *Pentagonal Strategy Phase I (2024-2028)*. The tactic “Economic Diversification and Competitiveness Enhancement” stated in the said Pentagonal Strategy the necessity of infrastructure development such as flood and drainage systems was proclaimed for achieving “resilient, sustainable and inclusive development.” In “Economic Diversification,” positioned as a high-priority policy in *NSDP (2019-2023)*, “Improving the Logistics Systems and Enhancing Transportation, Energy, and Digital Connectivity” were emphasized, and continuous investment in flood-protection systems and drainage pipelines together with donors and private companies was stated.⁵

Therefore, at both the time of planning and the ex-post evaluation, this project was consistent with the partner country’s development plan.

3.1.1.2 Consistency with the Development Needs of Cambodia

At the time of planning, “The Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City (2002-2004),” “The Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City (Phase II) (2007-2010),” and “The Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City (Phase III) (2011-2015)” had been implemented in accordance with the master plan concerning urban drainage and flood control, formulated based on “The Study on Drainage Improvement and Flood Control in the Municipality of Phnom Penh (1998-1999).” Among the target areas of the said master plan, the northern part of the city center of Phnom Penh Capital City (north of WP and the TK District) still suffered from serious flood damage, and the development of drainage facilities was anticipated.

³ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

⁴ ④: Very High, ③: High, ②: Moderately Low, ①: Low

⁵ At the time of the ex-post evaluation, *NSDP (2024-2028)* was formulated but not officially approved; therefore, *NSDP (2019-2023)* was regarded as an effective development plan and as a basis for evaluation judgement.

In addition, along with population growth and urbanization in Phnom Penh Capital City, illegal waste dumping also increased. At the pumping station co-managed under “The Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City (Phase II) (2007-2010),” it had become difficult to manually remove wastes flowing into the pumping station.

The population of Phnom Penh Capital increased from 1,148 thousand in 2000 to 2,211 thousand in 2022, almost doubling in size, and its share of the total population of Cambodia rose from 9.2% in 2000 to 12.9% in 2022. Even at the time of the ex-post evaluation, the concentration of people in the capital region had progressed,⁶ and the drainage pipeline network was also expanding. On the other hand, although drainage improvement projects had been implemented in nine out of 14 districts of Phnom Penh Capital City (including the target area of this project), such projects had not yet been implemented in the remaining five districts, and further drainage improvement was still required.

Therefore, both at the time of planning and at the time of ex-post evaluation, this project was consistent with the partner country’s developmental needs.

3.1.1.3 Appropriateness of the Project Plan and Approach

In the “Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City (2002–2004)” and the “Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City (Phase II) (2007-2010),” the necessity of capacity development related to the formulation of drainage pipe cleaning plans was identified as a lesson learned. In the “Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City (Phase III),” based on this lesson, the technical guidance on methods for formulating drainage pipe cleaning plans was provided to the Department of Public Works and Transportation (DPWT) and the Drainage and Sewage Office (hereinafter referred to as “the DSO”). However, planned and regular cleaning activities as preventive measures were not sufficiently established, and the implementation was limited to symptomatic cleaning activities conducted after problems occurred. In addition, it was necessary to restrain residents’ illegal waste dumping. In this project, in addition to providing guidance to the DPWT and the DSO on the formulation and implementation of preventive cleaning plans (cleaning plans for drainage pipelines organized on yearly, monthly, and weekly bases), awareness-raising activities to prevent illegal waste dumping, which often clogs drainage pipes in and around markets where illegal dumping frequently occurred, were conducted for citizens. It can be said that the project was planned while utilizing the lessons learned from similar projects.

In this project, regions with severe inundation damage (where inundation occurred more than four times per year, inundation depth reached above the shin, and inundation lasted for two to

⁶ World Development Indicators, <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=KH> (Accessed on July 28, 2025).

three hours or more) were selected as project sites, and the project was planned to fairly benefit residents in the target areas, including the poor.⁷

This project was listed as one of the eight prioritized projects⁸ in the master plan formulated based on “The Study on Drainage Improvement and Flood Control in the Municipality of Phnom Penh (1998-1999).” After this formulation of master plan, already a long time has passed and the areas requiring drainage and flood control projects might have changed, the priority of this project was confirmed through the technical cooperation project “The Study on Drainage and Sewerage Improvement Project in Phnom Penh Metropolitan Area (2014-2016).” In the project mentioned, the 25 drainage districts in Phnom Penh Capital City were grouped into four areas, and the Economic Internal Rate of Return (hereinafter referred to as “EIRR”) was confirmed.⁹ It was found that the target area of this project belonged to the area with the highest economic benefit, having an EIRR of 15% or more. In the central area of Phnom Penh Capital City, with National Road No. 4 as the boundary, both the southern and northern sides decrease in elevation of land (see p.19, Figure 4). The flood and drainage conditions on the southern side of the central area have been improved by the first through the third phases of “The Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City.” The approach of selecting the project was appropriate because the target was regarded as having high priority in the master plan formulated in 1999 and was also identified as high priority among multiple options in the technical cooperation project implemented from 2014 to 2016.

Regarding the generation of this project’s outcomes, there was no significant difference between the plan and the actual results, and the logic of this project at the planning stage could be considered appropriate.

From the above, the project plan and its approach can be judged as appropriate.

3.1.2 Coherence (Rating: ②)

3.1.2.1 Consistency with Japan’s ODA Policy

At the time of planning, in the *Country Assistance Policy for the Kingdom of Cambodia (2012)*, the promotion of cooperation for flood protection and drainage was mentioned in the priority goal, “Promotion of Social Development.” In addition, the *JICA Country Analysis Paper for Kingdom of Cambodia (2014)* also pointed out the necessity of improving the damage caused by the inundation and submergence of roads due to poor rainwater drainage in Phnom Penh Capital City.

From the above, at the time of planning, this project was consistent with Japan’s assistance

⁷ The water tariff in Phnom Penh Capital is exempted from the VAT based on the concept of Basic Human Needs. The unit rates are set separately for domestic, public, and commercial uses; however, for all categories of use, the unit rates for large-volume users are set higher, and the tariff structure is mainly designed to suppress water consumption rather than to give consideration to the poor.

⁸ CTI Engineering International Co., Ltd. Nippon Koei Co., Ltd. (August 1999). “The Study on Drainage Improvement and Flood Control in the Municipality of Phnom Penh” Final Report, Summary (p.45).

⁹ The judgment was done by dividing target area into four groups with EIRR 15% or more, 10-15%, 5-10%, and less than 5%.

policy.

3.1.2.2 Internal Coherence

At the time of planning, no projects were confirmed, which were implemented by JICA or other Japanese organizations with the intention of generating synergetic effects with this project through coordination or collaboration.¹⁰

3.1.2.3 External Coherence

At the time of planning, no projects were confirmed, which were implemented by other donors with the intention of generating synergetic effects with this project through coordination or collaboration.

Regarding relevance, this project was consistent with Cambodia's development plan and development needs at both the time of planning and of ex-post evaluation, and the project plan and the selection of approach were also appropriate. Regarding coherence, this project was consistent with the assistance policy of Japan and JICA at the time of planning. On the other hand, at the time of planning, no projects were confirmed, which were implemented by JICA, other Japanese organizations or other donors with the intention of generating synergetic effects with this project through coordination or collaboration.

Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

The achievement of this project's outputs are as follows. Differences arose in the lengths of drainage pipes in the WP North area and in the TK District, as well as in the number of overseas missions and the contents of activities for the technical guidance under the technical guidance.

¹⁰ This project was implemented after confirming its priority by "Project for Improvement of Drainage and Sewerage System in Phnom Penh Capital City" (2014-2016). However, there was no intention to generate the effect of collaborating with this project.

Table 1: Output Plan and Actual Results

		Area	Component	Project contents	Plan	Actual
Civil works and Procurement of equipment	Facilities	WP North	Installation of drainage pipes	Box culvert Drainage pipes	0.48 km 2.28 km	0.48 km 2.49 km
			Installation of interceptor pipes	Drainage pipes Manhole pump	1.62 km 1 site	1.62 km 1 site
			Pumping station	Pumping station Underground reservoir Mechanical screen	1 site (1.4 m³/second) 1 site(6,500 m³) 1 site	1 site (1.4 m³/second) 1 site(6,500 m³) 1 site
			TK District	Installation of drainage pipes	Box culvert Drainage pipes	1.49 km 6.65 km
		Mechanical screen at Trabek district	Installation of mechanical screen	Mechanical screen	4 sites	4 sites
	Equip ment	Vehicle-mounted drainage pumps	Vehicle-mounted drainage pumps	2 units	2 units	
	Capacity building program		Technical guidance on cleaning activities of drainage pipes and use and maintenance of equipment		5 travels	2 travels
Awareness raising to reduce illegal waste dumping			Event-based awareness raising activities for gathering people	Consultation with stakeholders and distribution of awareness raising materials and others		
Consulting Service					Detailed design, Supervision of procurement and construction	As planned

(Source: Elaborated by evaluator from document provided by JICA)

The differences between the plan and the actual results regarding the outputs in both districts occurred because of responses according to site conditions after the commencement of construction and as a result of measures taken in response to the COVID-19 pandemic.

Regarding the drainage pipeline development in the WP North area, concerns were expressed by the DPWT, the Embassy of Japan, and the JICA Cambodia Office about the worsening of traffic congestion caused by this project's implementation. In response, the construction method was changed from the open cut to the shield method, which served as a measure to minimize negative social impacts such as traffic congestion during construction. In addition, modifications were made according to local conditions based on the detailed design study, resulting in changes in the length of drainage pipes.

In the TK District, after completion of the detailed design study and before commencement of construction, it was found that a Cambodian private developer had installed drainage pipelines at the same location as the plan. Therefore, installation of drainage pipes in the overlapping section was canceled. As a result, the extension length and burial depth of the drainage pipes prearranged to be connected to those pipes in this project were modified. Furthermore, because it was also found that the removal of manholes and drainage pipes prearranged to be connected, as well as the parallel installation of underground transmission lines at the same depth was necessary,

the design was changed, resulting in differences in drainage pipe length.

The procurement and installation of mechanical screens at the pumping stations and vehicle-mounted drainage pumps were executed as planned.

As for the capacity building program, the number of overseas missions was changed from five to two due to the COVID-19 pandemic. The implementation method of awareness-raising activities for reducing waste dumping was also altered, due to the lockdown of Phnom Penh Capital City during the COVID-19, from people gathering type activities, such as facility tours and cleanup events, to activities such as consultations with stakeholders at the target three markets (Central Market, Kandal Market, and Old Market), the installation of garbage bins, explanations to residents around the markets about the relationship between garbage and drainage, and the display of pamphlets and posters. Guidance to the DSO on the method of formulating drainage pipe cleaning plans and on cleaning activities, as well as guidance on the use and maintenance of mechanical screens and vehicle-mounted drainage pump trucks, was implemented as planned.

According to the DPWT, although there were changes in the outputs (civil engineering works, equipment procurement, and capacity building program) in the WP North area and the TK District, those changes did not affect the generation of outcomes such as reduction in inundation area, inundation depth, and inundation duration. It was also stated that all changes were based on requests from the DPWT and that the change process was appropriate.¹¹

Therefore, the outputs were generated as planned.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned and actual project costs are as follows. The actual project cost was 38.31 million yen, and it was within the plan (93% compared with the plan).

Table 2: Planned and Actual Cost of Project

(unit: million Japanese yen)

	Plan	Actual	Difference
Japan	40.57	37.90	(2.67)
Cambodia	0.42	0.41	(0.01)
Total	40.99	38.31	(2.68)

(Source: Documents provided by JICA)

The difference between the planned and actual project costs was due to changes in the outputs. In both countries, the project cost increased due to changes in the WP North area, whereas it decreased due to changes in the TK District. Regarding the capacity building program, the cost

¹¹ The COVID-19 pandemic was unpredictable and beyond the contractor's scope of responsibility. Therefore, the JICA also agreed to this change. In addition, Phnom Penh Capital City was under lockdown, and it was realistically difficult to conduct the technical guidance to restrain residents from waste dumping by gathering stakeholders. Therefore, the DPWT also acknowledged that the above changes were unavoidable.

incurred on the Japanese side decreased, whereas there was no significant change on the Cambodian side.

As a result of the above, the total amount became lower than the planned cost.

3.2.2.2 Project Period

The planned and actual project periods are as follows. The plan was from March 2017 to November 2020, whereas the actual period was from March 2017 to December 2021 (129% compared with the plan), which exceeded the plan.

In addition to the time required for the approval by the Government of Cambodia of the Resettlement Action Plan (hereinafter referred to as “the RAP”), the land to be acquired for permanent involuntary resettlement was changed from that identified at the time of the preparatory survey as a result of the detailed design study. Therefore, it was necessary to provide additional explanations to the affected residents, and it took time to obtain their consent. As a result, the period for the detailed design study, including the bidding period, was extended from eight months to eighteen months.

Table 3: Planned and Actual Project Period

Phase	Plan	Actual
G/A signing	March 2017	March 2017
Detailed design study /Bidding	April 2017-November 2017 (8 months)	May 2017-October 2018 (18 months)
Construction	December 2017-November 2020 (36 months)	October 2018-October 2021 (37 months)
Project completion	November 2020	December 2021
Entire period of project	45 months	58 months

(Source : Documents provided by JICA)

Although the project period exceeded the plan, the project cost was within the planned amount. Therefore, efficiency of the project is high.

3.3 Effectiveness and Impacts¹² (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The achievement of this project’s indicators is as follows. Although information on the inundation area was not obtained, the operational indicators for inundation depth and inundation duration were achieved.

The inundation area, both in terms of the baseline and the target values, was calculated by

¹² When providing the sub-rating, Effectiveness and Impacts are to be considered together.

simulation using the hydrological analysis model¹³ at the time of the preparatory survey. Because the DPWT does not have a system capable of running this model, it was not possible to measure the change of inundation area in the same manner. Moreover, monitoring the inundation area without using this model would require additional workload beyond their regular duties, therefore they have not monitored the inundation area. Regarding inundation depth and inundation duration, the situation was grasped through oral reports from twenty workers engaged in cleaning the drainage pipes.

Table 4: Quantitative Effects (Achievement of Operation Indicators)

	Target area	Baseline value	Target value	Actual value (at the time of ex-post evaluation)			
		2015	2023	2021	2022	2023	2024
			3 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
Inundation area (m ²)	WP North	111,600	49,500 (44%)	No data	No data	No data	No data
	TK District	460,800	169,200 (37%)	No data	No data	No data	No data
Inundation depth (cm)	Both areas mentioned above	Max.50	Max.20	Max.20	Max.20	Max.20	Max.20
Inundation duration (hour)	Both areas mentioned above	Max.9	Max.2	Max.2	Max.2	Max.2	Max.2

(Source: Answer by DPWT to questionnaire)

Note 1) The above target values correspond to rainfall of a two-year return period (rainfall of a scale that occurs once every two years on average).

The intensity of rainfall of a two-year return period is 44.8 mm/hour and 87.8 mm/day.

Note 2) The inundation area refers to the area where the duration of inundation continues for ten minutes or longer.

In this evaluation study, resident interviews were conducted to supplement the understanding of achievement of the three indicators.

For the selection of residents for interviews, with regard to the inundation area, based on the preparatory survey, areas that had been flooded before project implementation but were simulated to “become not flooded after project implementation (in which the duration of one inundation is less than ten minutes or the inundation depth is less than 20 cm)” were selected: 13 locations in the WP North area and 16 in the TK District. Interviews were conducted with residents in these areas, and from the ratio of respondents who answered, “no flooding,” the “probability” of the simulation results was evaluated.

As for inundation depth and inundation duration, based on the preparatory survey, areas where the flooding situation was expected to improve through project implementation were selected: 16

¹³ It is calculated by simulation using a runoff model, a pipeline model, and an inundation model based on information on the existing drainage pipe network, topographic survey, manhole survey, and flood damage survey (Preparatory Survey Report, pp. 3, 15–17).

locations in the WP North area (seven residential sites and nine shops) and 14 locations in the TK District (10 residential sites and four shops).¹⁴ At the time of the ex-post evaluation, interviews were conducted concerning the inundation depth and inundation duration at the time of flooding. The locations of the interview sites are shown in Figures 1 and 2.

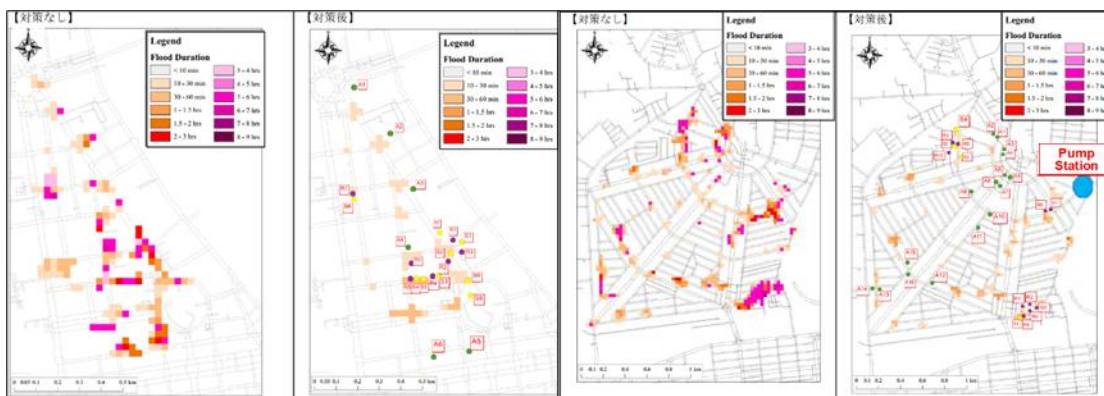


Figure 1: Interview area at WP North

Figure 2: Interview area at TK District

(For each area, the left figure shows the inundation conditions before the implementation of the project, and the right shows those after the implementation of the project based on the simulation.)

(Source: Elaborated by evaluator based on the preparatory survey report)

The results of the resident interviews are shown in Table 5. Regarding the inundation area, the proportion of respondents who answered “no flooding” was 85% in the WP North area and 75% in the TK District. From the high ratio of respondents who answered, “no flooding,” it is considered highly probable that the sites that were simulated as “becoming not flooded” through project implementation were actually not flooded at the time of the ex-post evaluation.

Table 5: Result of the Interview with Residents Regarding the Operation Indicator

Indicators	Target areas	Baseline value	Target value	Actual value (at the time of ex-post evaluation) (2025) (4 years after completion)		
		2015	2023 (3 years after completion)	Indicators	Target areas	Result of interview
Inundation area (m ²)	WP North	111,600	49,500 (44%)	Rate of the locations with “no flooding” answer	WP North	11/13 locations (85%)
	TK District	460,800	169,200 (37%)		TK District	12/16 locations (75%)
Inundation depth (cm)	WP North	Max. 50	Max. 20	Average value of inundation depth of interviewees (cm)	WP North	14.8
	TK District				TK District	23.8
Inundation duration (hrs)	WP North	Max. 9	Max. 2	Average value of inundation duration of interviewees (hrs)	WP North	0.7
	TK District				TK District	1.2

(Source: Baseline value and target value are from documents provided by JICA, Actual value at the time of ex-post evaluation is collected during field survey. Elaborated by evaluator)

Regarding inundation duration, the indicator was achieved according to the results of the resident interviews in both districts, and together with the responses from the DPWT, it is

¹⁴ The northern side of WP was an area with many small shops, other than residences; therefore, many shops were interviewed in the northern side of WP.

considered that the indicator was achieved.

As for inundation depth, in the WP North area, the indicator was achieved according to both the responses from the DPWT and the results of the resident interviews. On the other hand, in the TK District, although the indicator was achieved according to the responses from the DPWT, it was not achieved according to the results of the resident interviews. Among the 14 interview sites, flooding that reached the thigh level occurred at two sites, which was the cause. The failure to achieve the indicator at these sites is considered to have been caused by several factors: the five pumps at the pumping station (marked with blue circles in Figure 2 on the previous page) for discharging water from the TK District to outside the district were not operating at full capacity;¹⁵ heavier rainfall was recorded than was expected;¹⁶ and the drainage pipes were not being cleaned as planned.

In summary, although the achievement of indicator on the inundation area cannot be determined, it is assumed that the area has decreased. The indicators for inundation depth and inundation duration have been achieved. From these results, it can be judged that the efficient drainage of stormwater, which was the intended outcome, was mostly achieved.

3.3.1.2 Qualitative Effects (Other Effects)

To confirm qualitative effects on the residence, sanitation and transportation from this project's implementation, interviews were conducted not only with the abovementioned residents and shops but also with medical institutions in the WP North area and the TK District (one at each district), the City Bus Authority (hereinafter referred to as "CBA"), which operates bus services covering both districts, seven motorcycle taxi (including tuk-tuk) drivers,¹⁷ and the managers of the three markets targeted under the technical guidance (one manager for each market).

1) Existence of Above-Floor Inundation

As shown in Table 6, there were still houses and shops in both districts that experienced above-floor inundations at the time of the ex-post evaluation; however, its number had decreased compared to that before project implementation, and the number of above-floor inundation cases significantly declined.

¹⁵ This was to avoid worsening inundation in the downstream areas where water is discharged from the pumping station; however, an expansion project of the drainage canal (Ou Veng Canal), used at the time of the ex-post evaluation, was planned. So, once it is completed, the pumps will be able to operate at full capacity, and the situation is expected to improve (DPWT interview).

¹⁶ The indicators set the rainfall intensity conditions as "44.8 mm/hr and 87.8 mm/day" (see Footnote 1 for the indicators); however, according to the rain gauges measured by the DPWT in the city (Chakto Mukh, Boeng Trabaek, Boeng Tumpun, and Toul Kork 1), rainfall exceeding 100 mm/day was recorded in October 2024, indicating that rainfall beyond the assumed conditions had occurred (source provided by CP).

¹⁷ Motorcycle taxis include various types, ranging from tuk-tuks that pick-up customers on the street, to services such as PassApp, which dispatch vehicles through smartphone applications.

Table 6: Change of Existence of Above-Floor Inundation

(unit: residents: person, shops: establishment)

Target area		WP North				TK District			
Interviewees		Residents (7)		Shops (9)		Residents (10)		Shops (4)	
Before or after the project		before	after	before	after	before	after	before	after
Existence of above-floor inundation	Yes	7	2	6	0	10	5	4	0
	No	0	5	3	9	0	5	0	4
Frequency of above-floor inundation	Increased		0		0		0		0
	Decreased		7		9		9		4
	No change		0		0		1		0

(Source: Interview with residents and shops)

Among the three markets targeted under the technical guidance, at Central Market and Kandal Market, there had been cases in which inundation reached inside the markets before project implementation; however, at the time of the ex-post evaluation, the number of inundations decreased, and the inundation duration also become shorter.¹⁸ Because Kandal Market is located in a low-lying area, water tends to accumulate, and even at the time of the ex-post evaluation, there were cases in which inundation reached the waist level; however, the time required for the water to recede were shortened from two hours before project implementation to about 30 minutes at the time of the ex-post evaluation.¹⁹

Regarding the medical institutions, those in the TK District showed a remarkable improvement in the inundation situation.

2) Improvement in sanitation

Regarding improvement in sanitation, interviews were conducted from the perspective of the existence of foul odor, the scattering of sludge, the scattering of waste, the reproducing of rats, and the occurrence of mosquitoes.

Table 7: Opinion of Residents and Shops Regarding the Improvement of Sanitary Aspect

(unit: residents: person, shops: establishment)

Target area		WP North		TK Districts	
Interviewees		Residents (7)	Shops (9)	Residents (10)	Shops (4)
Improved		6	9	9	3
Worsened		0	0	0	0
No change		0	0	0	0
Details of change (multiple choices)					
Decrease in bad odor		5	4	5	2
Decrease in sludge scattered		1	3	1	0
Decrease in waste scattered		4	2	6	2
Decrease in mouse reproduction		1	2	2	0
Decrease in mosquito occurrence		0	0	1	0

(Source: Interview with residents and shops)

¹⁸ At the Old Market, even before implementing the project, the inside of the market was hardly ever inundated. The main reason is that it is located on high ground (Interview with Manager of Old Market).

¹⁹ Interview with Manager of Kandal Market.

In both the WP North area and the TK District, the improvement points most frequently mentioned were those related to foul odor and the scattering of waste. According to the officer of the district environmental office of the WP North area, the reasons for the decrease in the scattering of waste were, in addition to the reduction of waste that accumulated due to the improvement of inundation, the orders issued to the local authorities under the laws and regulations concerning the proper disposal of waste, the efforts made by the Phnom Penh Capital Authority (hereinafter referred to as “the PPCA”) and each district to properly collect waste, and the issuance of penalty notices by the PPCA to violators of the laws and regulations.

3) Improvement of Transportation

The main means of transportation for residents are motorcycles, tuk-tuks, automobiles, and walking;²⁰ however, an interview was also conducted with the CBA in order to grasp the project effects from a broader perspective in addition to residents.²¹

Table 8: Easiness to Move in the Target Area

(unit: person)			
Target area	WP North	TK District	Both districts at WP North and TK District
Interviewees	Residents (7)	Residents (10)	Motorbike taxi drivers (7)
Improved	6	9	7
Worsened	0	0	0
No change	1	1	0

(Source: Interview with residents and Motorbike taxi drivers)

Many residents feel that inundation depth and inundation duration become shorter, making it easier to move around. The motorcycle taxi drivers also feel that the time spent taking detours to seek out roads with shallow inundation depth has decreased and that the traffic congestion that had occurred due to cars and motorcycles concentrating on roads with shallow inundation depth has also decreased, resulting in shorter travel time. According to the CBA, improvement in the inundation situation has eliminated the need for detours, and the reduction in the need to slow down due to inundation has reduced the delays, making it possible to ensure smooth operation according to the schedule. It was reported that the improvement was particularly remarkable in the WP North area.

Meanwhile, residents’ perception toward traffic congestion has not improved compared with the situation before project implementation. This is because traffic congestion is not caused solely by inundations but is also affected by traffic volume and by the flow of vehicles resulting from urban development. Although the above effects were observed, it did not lead to a reduction in

²⁰ JICA, Oriental Consultants Global Co., Ltd., International Development Center of Japan, Mets Research & Planning Inc. (February 2023). Kingdom of Cambodia Data Collection Survey on Urban Transportation in Phnom Penh Capital City Final Report. (p.126)

²¹ Of the 13 routes operating in Phnom Penh Capital City, six were operating in the project area.

traffic congestion.²²

3.3.2 Impacts

3.3.2.1 Intended Impacts²³

1) Damage by the above-floor inundation

The impact of this project on the damage of above-floor inundation is as follows.

Table 9: Change of Damage by Above-Floor Inundation

(unit: residents: person, shops: establishment)

Target area	WP North		TK District	
Interviewees	Residents (7)	Shops (9)	Residents (10)	Shops (4)
Improved	7	9	9	3
Worsened	0	0	0	0
No change	0	0	1	1

(Source: Interview with residents and shops)

Among the residents and shops in the WP North area and the TK District, except for one shop in the TK District, all respondents answered that the damage caused by above-floor inundation had improved. As a result, expenditures related to inundation responses such as repair costs for damaged floors and walls, repair costs for damaged household goods, costs for floor-raising works, costs for purchasing drainage pumps, and expenses for replacing floors have decreased.

2) Incidence of Diseases

Table 10: Incidence of Disease

(unit: person)

Target area	WP North (7)	TK Districts (10)
Improved	4	2
Worsened	0	0
No change	3	8

(Source: Interview with residents)

In both districts, about half of the interviewees answered that the disease incidence status had improved. As for the content of the improvement, many stated that they no longer suffered from skin diseases (two persons in the WP North area and four in the TK District).

3) Impact on the Economic Aspect

The economic impacts on residents, shops, and motorcycle taxi drivers are shown in Table 11.

²² In Phnom Penh Capital City, over the 10-year period from 2013 to 2023, the motorcycle ownership rate per household has remained unchanged at about 90%, whereas the car ownership rate has increased from 15% to 25%, and this is considered one of the causes of traffic congestion. (Source: National Institute of Statistics, Ministry of Planning. (2013, 2014). Report of Cambodia Socio-Economic Survey. (p.34)., National Institute of Statistics, Ministry of Planning. (2023, 2024). Report of Cambodia Socio-Economic Survey. (p.141).)

²³ The interviewees were the same in the section of effectiveness, as 7 residents and 9 shops of WP North and 10 residents and 4 shops in the TK district, as well as 7 motorcycle taxi drivers covering both areas.

The situation of each stakeholder is described below.

Table 11: Economic Impact on Residents and Shops

(unit: residents: person, shops: establishment)

Target area		WP North		TK District		Motorbike taxi drivers (7)
Interviewees		Residents (7)	Shops (9)	Residents (10)	Shops (4)	
Number of days unable to work / unable to operate due to inundation	Increased	0	0	0	0	0
	Decreased	1	2	5	2	5
	No change	6	7	5	2	2
Number of customers attributed to inundation	Increased		6		3	4
	Decreased		0		0	1
	No change		3		1	2
Income attributed to inundation	Increased	0	5	0	3	4
	Decreased	2	0	3	0	1
	No change	4	4	5	1	2
	I don't know	1	0	2	0	0
Expense attributed to inundation	Increased	0	0	0	0	0
	Decreased	2	6	5	3	6
	No change	5	3	4	1	1
	I don't know	0	0	1	0	0
Number of customers (throughout the year)	Increased		3		2	3
	Decreased		4		1	1
	No change		2		1	3
Income (throughout the year)	Increased	0	2	0	0	2
	Decreased	2	5	5	2	1
	No change	5	2	4	2	4
	I don't know	0	0	1	0	0

(Source: Interview with residents, shops and motorbike taxi drivers)

(1) Impact on the Residents and Shops

Before project implementation, residents went to work and shops remained open even during the rainy season; therefore, no major changes were observed in the number of working days or business days because of this project. On the other hand, due to improvement in the inundation situation, some cases were observed that customers have returned to the shops, which had once declined during the rainy season, thereby bringing income increase. In addition, many shops reduced expenditure that were necessary due to inundation (such as floor replacement).

On the other hand, not many people were reporting improvement in the number of customers and income throughout the year. Competition for customers with similar shops nearby²⁴ and the

²⁴ The shops interviewed included pharmacies, roadside stalls, and daily goods stores, among others. Because they handled products that were difficult to differentiate, the number of customers did not increase due to competition for customers among shops. In addition, in Cambodia, the real estate downturn has been prolonged, and an economic slowdown due to the withdrawal of Chinese merchants from Phnom Penh has been pointed out (The World Bank. (June 2025). Navigating Uncertainty, Strengthening Revenues for Cambodia's Future.). Some interviewees pointed out a decline in the willingness to consume due to such factors (from resident interviews).

closure of factories nearby were cited as reasons for this situation.

An increase in the number of customers and income throughout the year could not be confirmed due to the influence of various factors; however, due to improvement in inundation, economic effects, such as an increase in the number of customers and income, and a decrease in expenditure were recognized in rainy season.

(2) Impact on the Motorcycle Taxi Drivers

From motorcycle taxi drivers, notable positive effects were observed regarding changes in the number of customers, income, and expenditures attributed to improvement in the situation of the inundation.

Overall, costs have decreased, including a reduction in gasoline consumption due to elimination of the need for detours and a reduction in engine troubles and repair costs caused by water. In addition, before project implementation, during inundation events, they had suspended operations because it was unclear when the water would recede; however, at the time of the ex-post evaluation, because the inundation duration could be anticipated, they waited for the water to recede and then resumed operations. Due to improvement in the inundation situation, more people went out even during the rainy season, making it easier for motorcycle tax drivers to obtain customers; moreover, inundation depth became shallower, making safe operation possible. Many cases were heard in which operating hours became stable, income increased, and costs decreased.²⁵

(3) Impact on the Tourism Industry

In 2000, the number of tourists to Cambodia, which had been steadily increasing up to that time, dropped sharply due to the COVID-19 pandemic. Thereafter the total number of tourists has been recovering. However, according to souvenir shops and tourist photo service providers around Wat Phnom, the number of tourists has not returned to the same level as before the COVID-19 pandemic. Nevertheless, before project implementation, the number of tourists during the rainy season had decreased compared with those during the dry season due to inundation around Wat Phnom; however, at the time of the ex-post evaluation, the number of tourists during the rainy season had increased, and it was said there was no longer a significant difference in the number of tourists to Wat Phnom between the dry season and the rainy season.

²⁵ Although motorcycle taxis showed remarkably positive effects, the manifestation of the effects differed depending on the types of motorcycle. Customers avoided tuk-tuks pulled by bicycles for the reason of safety. In addition, the motorbike taxi which arrives on call by application PassApp is preferred, because it is convenient and safe. The impacts on the number of customers and income were also influenced by factors other than the improvement of inundation.

On the other hand, for tourists from overseas, popular tourist destinations in Phnom Penh include the Tuol Sleng Museum, the Killing Fields, and the Royal Palace, and there are not many tourists who come to Wat Phnom for tourism purposes. Rather, Wat Phnom is said to have high value as a departure and arrival point for long-distance buses heading to provincial tourist destinations (such as Siem Reap, Sihanoukville, and Battambang).²⁶ As the area around Wat Phnom no longer experiences inundation, services that previously had to be suspended due to inundation during the rainy season are now able to operate normally even during the rainy season, which makes stable income foreseeable. In addition, as the completion of this project (December 2021) coincided with the COVID-19 pandemic period, the operation of long-distance buses has increased after the end of the COVID-19 pandemic. Improvement in the inundation situation caused by this project at the departure and arrival point has produced positive effects on the tourism industry.²⁷

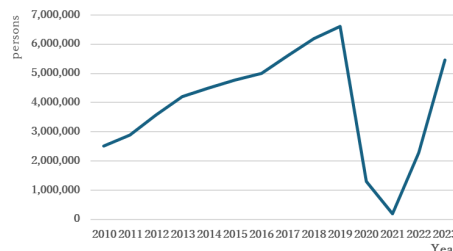


Figure 3: Transition of number of overseas tourists to Cambodia
(Source: *Tourism Statistics Report*, Ministry of Tourism)

4) Impact of Improvement in Traffic Condition

Due to the easiness of movement brought about by improvement in inundation, impacts in various other aspects are seen as follows.

(1) Impact on the Resident's Daily Life

According to resident interviews in both districts (seven persons in the WP North area and ten persons in the TK District), interviewees stated that it became easier for them to go out for nonessential purposes, such as shopping and going out with family members (three persons in the WP North area and four persons in the TK District). In addition, the time required to take children to school became shorter (two persons in the WP North area and two in the TK District), and because inundation depth became shallower, residents became able to let their children commute to school alone with peace of mind (two persons in the WP North area and three persons in the TK District).

(2) Impact on the Transportation Organization

At the CBA, because inundation depth became shallower, safety in bus operations improved,

²⁶ Interview with travel agency.

²⁷ According to interviews with two travel agencies, every day, six to nine late-night services and 16 daytime services to Siem Reap, one late-night service and 12 daytime services to Sihanoukville, and one late-night service and seven daytime services to Battambang departed from Wat Phnom. Before this project, there were five to seven late-night services and 11 to 12 daytime services to Siem Reap, as well as no late-night services and seven to eight daytime services to Sihanoukville, and for Battambang, only one company was operating, with only four daytime services.

and due to reduced delays and smoother operations, trust in bus services among citizens increased, leading to an increase in passengers and contributing to improved sales. The increase in opportunities for residents to go out during the rainy season, who had previously refrained from going out, is also one factor contributing to the increase in passengers. In addition, due to reductions in inundation depth and inundation duration, engine troubles decreased, and improvements in financial conditions, such as reductions in repair costs, were also observed.

Meanwhile, the reasons for the increase in bus passengers are not limited to improvement in the inundation situation but are also mostly attributed to the technical cooperation project “The Project for Improvement of Public Bus Operation in Phnom Penh (2017–2020)” and the Grant Aid project “The Project for Improvement of Transportation Capacity of Public Bus in Phnom Penh (November 2016).” In the technical cooperation project, improvements in drivers’ driving skills, development of bus routes, capacity enhancement in bus service operation management, and development of bus stops and bus terminals were carried out, whereas in the Grant Aid project, bus maintenance equipment and other items were provided.

Improvement in the inundation situation served as a supporting foundation that enabled the CBA, whose technical and equipment-related capacities had been strengthened, to realize these effects.

5) Impact on education²⁸

In schools in both districts, teachers’ commuting time during the rainy season has been shortened, and student tardiness has also decreased. This is because detours by motorcycle and stoppages due to engine trouble have decreased, resulting in shorter commuting and school travel times. In addition, improvements in the educational environment were particularly remarkable at a junior high school in the TK District. At this school, before project implementation, inundation reached inside the school buildings more than 15 times per year, and the school was sometimes closed. Upon reopening, teachers and students were mobilized to clean the inside of the school buildings and the schoolyard; however, at the time of the ex-post evaluation, inundation no longer reached inside the school buildings. During inundation of the schoolyard occurring two or three times per year, it has become sufficient to spend about half a day cleaning mud and waste from the schoolyard.

At a junior high school in the WP North area, inundation in the schoolyard was still occurring at the time of the ex-post evaluation. However, compared with the situation before the project, inundation duration became shorter, and because the amount of mud and waste decreased, the time required for teachers and students to carry out cleaning was also shortened.

²⁸ Interviews were conducted with stakeholders of educational institutions (WP North side: a secondary school (one principal, two teachers (one male and one female), and 10 students (six boys and four girls)); TK area: a secondary school (one principal, two teachers (one male and one female), and 13 students (seven boys and six girls)).

At all schools, educational effects were confirmed, such as an increase in the time that could be devoted to subject teaching and a decrease in student tardiness, making it easier to provide classes at a uniform pace.

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Environment

This project does not fall under the sectors and characteristics that are likely to have impacts, or the areas that are vulnerable to the effects, as set forth in the “JICA Guidelines for the Confirmation of Environmental and Social Consideration (April 2010), and since the adverse impacts on the environment are judged not to be significant, it was classified as Category B.

On June 15, 2018, the Initial Environmental Impact Assessment Report was approved, and this project was started to implement. During project implementation period, environmental monitoring was conducted, and noise, air pollution and water quality levels did not exceed the standards. Environmental monitoring should be conducted by the implementing agency even



Photo1: Tenant at market (Red circle in left is waste bag) (taken by evaluator)

after the completion of the project; however, the DPWT answered that such monitoring has not been carried out because no issues were identified during the construction period.²⁹

At the time of the ex-post evaluation, interviews with residents and shops indicated that appropriate considerations were taken, such as advance notification of the construction period, securing access routes to allow customers to enter shops, installation of fences to prevent construction-related hazards, and the display of “under construction” signs by traffic police. Although noise and air pollution were present during project implementation, these were within an acceptable range. Moreover, after the project’s completion, residents recognized that some effects of inundation improvement far exceeded the inconvenience experienced during the construction period. Stakeholders, including the DPWT, residents, shops, schools, and hospitals, reported no negative impacts.

In addition, as a result of conducting awareness-raising activities to discourage illegal waste dumping (including the posting of posters, installation of waste bins, distribution of pamphlets, among others) for the three markets under the technical guidance, tenants understood that “littering waste is not only an issue of hygiene and beautification, but also a cause of inundation. Proper waste disposal is important also for flood prevention,”³⁰ and, for the convenience of their

²⁹ Interview with the DPWT.

³⁰ Refrain from illegal waste dumping has the effect of promoting rainwater to flow into drainage pipes without clogging.

own businesses and daily lives,³¹ they had come to voluntarily dispose of waste properly (Photo 1).

Colum

Possibility of Sustaining the Effects through the Implementation of Technical Guidance
in line with the Partner Country's Important Policies

In this project, awareness-raising activities were conducted to encourage market stakeholders to refrain from illegal waste dumping and prevent clogging of drainage pipes through the technical guidance. On the other hand, the government of Cambodia has also prioritized proper waste management as a national policy, enacting laws and regulations on waste and solid waste management and obligating local authorities to take measures to discourage illegal waste dumping. In 2023, the PPCA strengthened its implementation by issuing notices to mandate fines for violators of said laws and regulations.

The technical guidance did not involve large inputs, such as consultations with each market, distribution of posters and pamphlets, and placement of waste bins. However, because it was in line with the policies strongly promoted by the PPCA, market stakeholders decided to continue implementing the instructions provided under the technical guidance, even after the completion of the project, also from the viewpoint of compliance with laws and regulations, which led to the continuation of the project's effects.

It can also be considered that a true understanding of the significance of waste management obtained by the technical guidance promoted compliance with laws and regulations among market stakeholders and contributed to the implementation of the policies of PPCA.

In this project, extrinsic motivation for compliance with laws and regulations, as well as intrinsic motivation fostered through the technical guidance, created a synergistic effect. This approach became a good example that led to the continuation of the project's effects and the promotion of policies.

2) Resettlement and Land Acquisition

In this project, one case of temporary relocation and one case of permanent resettlement occurred. At the time of planning, one vacant shop and one case of temporary relocation were expected to occur; however, due to a change in the drainage pipe installation location identified through the detailed design study, a case of permanent resettlement of household, instead of vacant shop, occurred. As a result, the RAP was revised, and after acquiring 63 m² of land and obtaining the consent of the relocation-affected household, this project was commenced.³² The costs for land, buildings, and livelihood-related compensation for both temporary relocation and

³¹ The posters displayed at the entrances of the markets had been replaced by those for COVID-19 measures at the time of the ex-post evaluation.

³² Interview with the DPWT.

permanent resettlement were estimated in accordance with domestic procedures in Cambodia. Compensation was paid to the temporary relocated house by the Inter-Ministerial Resettlement Committee. For the permanently resettled household a title deed for the compensation-eligible land was granted, and since the household sold the land using that title deed and resettled, no compensation amount was paid.³³ All of these were implemented in accordance with domestic procedures in Cambodia and the JICA guidelines.

3) Gender Equality

According to resident interviews, no reports were heard that the burden of cleaning up, caused by inundation damage, was biased toward girls, which affected their school attendance. Moreover, no differences in opportunities for schooling due to gender were heard from teachers and students themselves at educational institutions.

4) Marginalized People

In the target area of this project, there were no areas where poor people were living in groups, and no situation was confirmed in which people could not obtain project benefits because they were poor, based on the method used to select the project area.³⁴

5) Social Systems and Norms, People's Well-being and Human Rights

Due to improvement in the inundation situation, residents have been provided with safe, secure, and sanitary living conditions. Children have become able to commute to school safely, and residents have gained more free time during the rainy season, as the burden of cleaning after inundation has been reduced, with a smaller number of occurrences of above-floor inundation. As movement during the rainy season has become easier, families have also become able to go out more easily and freely, and motorcycle taxi drivers have also become able to operate with peace of mind.

6) Unintended Positive / Negative Impacts

In Phnom Penh Capital City, various forms of cooperation related to flood protection and drainage improvement had been implemented, such as the four successive “Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City,” the formulation of a master plan through the “Study on Drainage and Sewerage Improvement Project in Phnom Penh Metropolitan Area (2014-2016),” and the implementation of the “The Project for Sewerage System Development in Phnom Penh Capital City (2019-2024)” based on that master plan. With

³³ Interview with the DPWT and DPWT. (July 2018). *Updated Resettlement Action Plan*, Phnom Penh City.

³⁴ From the viewpoints of inundation frequency, inundation depth, and inundation duration, areas with severe damage by inundation were selected as the project sites, which enabled for even the poor to get benefit without being excluded (see p. 6).

National Road No. 4 as the boundary, on its southern side, the “Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City” was implemented in the first three phases, in coordination with one another, targeting three adjacent districts, and were highly effective projects.³⁵ This project was implemented in the area adjacent to the north side of National Road No. 4; this area serves as the starting point of National Road No. 5 (toward Battambang) and National Road No. 6 (toward Siem Reap), heading to northwestern Cambodia. Effects were also observed in facilitating travel to provincial areas.

In the “Study on Drainage and Sewerage Improvement Project in Phnom Penh Metropolitan Area,” the priority of the “Project for Flood Protection and Drainage Improvement (phase IV)” was confirmed as high, and the “Project for Sewerage System Development in Phnom Penh Capital City” was proposed. The project involved the construction of a sewage treatment facility at an area adjacent to the southern side of the areas (Choeung Aek Lake) targeted by the “Project for Flood Protection and Drainage Improvement in Phnom Penh” from phases I to III. This played a role in appropriately treating the sewage flowing in from the target areas of the project, from phases I to III, and reducing environmental burdens. This series of projects was mutually related and constituted a group of projects that generated a large ripple effect in many aspects, not only improving the drainage situation in the central area of Phnom Penh Capital City (Figure 4).

Regarding the changes in the inundation area brought about by this project, although the degree of the indicator’s achievement could not be confirmed, it was estimated that the inundation area had decreased based on the results of the field survey. Inundation depth and inundation duration decreased as planned. Qualitative effects, such as improvements in the inundation situation, sanitary conditions, and facilitation of movement within the area, were also confirmed. The project objective of efficiently draining rainwater and minimizing damage from inundation by internal water was mostly achieved. Positive effects were confirmed in terms of above-floor inundation, disease incidence, and economic, traffic, and educational aspects. No negative environmental impacts were confirmed, and no differences in benefits by gender were observed. Residents in the target area received benefits from this project in an equitable manner. It can also

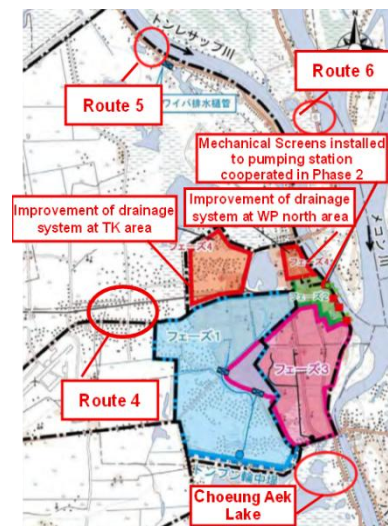


Figure 4: Groups of projects related to drainage sector implemented in Phnom Penh capital (Source: Elaborated by evaluator from the report. JICA, CTI Engineering International Co., Ltd. 2017. Preparatory Survey Report on the Project for Flood Protection and Drainage Improvement in Phnom Penh Capital City (Phase IV) in the Kingdom of Cambodia

³⁵ Interview with PPCA.

be said that this project contributed to the expected improvement of the urban environment.

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

3.4 Sustainability (Rating: ②)

3.4.1 Policy and System

In the *First Pentagonal Strategy (2024-2028)*, to realize the strategy of “economic diversification and strengthening competitiveness” to achieve the *Cambodia Vision 2050*, the necessity of infrastructure development, including flood and drainage systems, is emphasized. In the *NSDP (2019-2023)* as well, it is emphasized to continue investment in drainage systems (such as flood protection systems and drainage pipelines) together with donors and private companies.

From the above, the necessary policies and systems required to sustain the project’s effects have been established.

3.4.2 Institutional/Organizational Aspect

According to the DPWT, although the total number of officers has decreased, the main factor is the reduction in the number of officers in departments other than drainage pipe cleaning and maintenance, with no impact on the performance of duties related to drainage pipe cleaning and maintenance. On the other hand, in the case of the DSO, whereas drainage-related facilities are expanding, the number of its officers is decreasing. Although officers’ allocation is insufficient, requests are being made for the officer’s assignment with expertise in engineering, machinery, civil engineering, and other fields. The DSO is managing multiple assignments for each officer and contracts with retired officers.³⁶ With this effort, the DSO is fulfilling its duties without major problems.

The District Public Works Division handles drainage pipes with a diameter of less than one meter, and the number of district officers is also insufficient. To supplement the lack of institutional capacity, private contractors began to take responsibility for the work in 2021. Since 2021, the PPCA has contracted with two or three private contractors annually. According to the DPWT, at the time of the ex-post evaluation, about 40% of the drainage pipe network was being cleaned by private contractors. The PPCA places emphasis on infrastructure development, including drainage facilities, and it is assumed that the role of private companies will increase in the future.³⁷

As described above, although it cannot be said to be sufficient, an institutional setting for the continuation of effects, in addition to the DPWT and DSO, has been established, along with

³⁶ In Cambodia, there is a system under which retired civil servants can be contracted at 80% of their salary at the time of retirement. By utilizing this system, retired staff are engaged in operations. Retired staff have rich experience of duties and are making up for the shortage in the number of personnel.

³⁷ Interview with PPCA.

private contractors and the District Public Works Division. Thus, it is considered that no major hindrance will arise in the performance of duties in the future as well.

Table 12: Number of Allocated Officers to DPWT and DSO

(unit: person)

Organization / Responsible group (G)	At the time of ex-ante evaluation (2015)		At the time of ex-post evaluation (2024)	
	proper	contract	proper	contract
DPWT				
Sub-total	301	580	203	508
Total		881		711
DSO				
Administration	5	0	5	0
Management	6	0	3	1
Technical	8	0	3	1
Construction	6	0	0	14
Pipe cleaning and OM	1	45	2	29
Pumping station	2	56	2	72
Pipe construction and repair	0	50	1	34
Operator	0	20	0	0
Sub-total	28	171	16	151
Total		199		167

(Source: Answer by DPWT to questionnaire)

3.4.3 Technical Aspect

At the DPWT, some officers graduated from university engineering faculties, whereas at the DSO, qualified proper officers with the necessary expertise for their duties (engineering, machinery, electrical engineering, civil engineering, management, etc.) are assigned. Except for the mechanical screens, there is no equipment that requires new technologies, and there are no problems in the routine operation and maintenance by the DSO. Manuals for the mechanical screens and the vehicle-mounted drainage pump vehicles have also been distributed (manuals in Khmer have also been distributed for the vehicle-mounted drainage pump vehicles), and no problems were confirmed in the operation of the machines.

When troubles arise, the officers address the issues through consultation among themselves and advice from experienced contract officers who have retired. Additionally, as necessary, officers obtain advice from the DPWT officers and the construction consultant of this project.³⁸

Regarding the procurement of parts, general items are sourced within Phnom Penh, whereas special items are procured through agents of Japanese manufacturers located in Phnom Penh. If

³⁸ The consultant for this project had been implementing multiple projects in Phnom Penh other than this project, which has established a good relationship with the executing agency. Even after the completion of the project, continuous advice had been provided by the consultant for this project after returning to Japan and by other consultants of the same company engaged in other projects in Phnom Penh.

items are not in stock, it is necessary to import them from Japan, which may take time.

Concerning the annual cleaning plan, the preventive cleaning plan, subdivided into monthly and weekly bases, which was instructed through the technical guidance, has not been prepared. The formulation of such a subdivided preventive cleaning plan was intended to accurately estimate the budget required for its implementation; however, because the necessary amount is not allocated, even if a budget is calculated, the preventive cleaning plan has not been prepared. Instead, a plan listing pipeline lines to be cleaned in order of priority has been prepared and used as the annual plan. On the other hand, regarding the prevention of illegal waste dumping, in accordance with national and PPCA policies, measures have been implemented around the three target markets, resulting in a decrease in the volume of waste.

Private contractors often lack opportunities for technical training, do not possess the necessary equipment and materials for cleaning, and do not have high technical capacity.³⁹ Therefore, the pipe cleaning conditions at the areas private contractors are responsible for are monitored by the DSO, which serves as a mechanism to ensure quality.⁴⁰ The areas cleaned by the District Public Works Division are also similarly monitored by the DSO.

Thus, there are no problems with the technical capacity of the DPWT and DSO. Regarding cleaning by the District Public Works Division and private contractors, a mechanism to ensure quality has been established through monitoring by the DSO, and it is considered that there are no technical problems with the continuation of the effects from a technical perspective.

3.4.4 Financial Aspect

The planned amount for operation and maintenance set at the time of the preparatory survey was intended to cover only the facilities and equipment of this project; however, it was challenging to calculate the budget and actual amounts limited to those of this project. Therefore, information was collected on the budget and expenditure amounts for the operation and maintenance of all drainage-related facilities and equipment under the responsibility of the DSO.

³⁹ Interview with the DPWT.

⁴⁰ The payment to private contractors is conditional upon passing inspection by the DSO.

Table 13: Request of Budget and Actual Allocation and Expenditure of DSO

(unit: USD)

		Drainage Pipes (a)	Pumping Station, Underground Reservoir and Mechanical Screens (b)	Vehicle-Mounted Drainage Pump (c)	Manhole Pump (d)	Total (e)
Plan						
Budget necessary for OM of facilities and equipment by this project		15,300	35,500	8,800	12,800	72,400
Actual						
Budget (A)						
2024	Request	782,393	62,247	20,195	Included in (b)	864,835
	Allocation	443,143	62,247	16,207		521,417
2023	Request	782,393	62,247	30,195		864,835
	Allocation	372,365	62,247	16,027		450,640
2022	Request	801,321	62,247	20,195		883,763
	Allocation	333,780	62,247	16,027		412,954
Expenditure (B)						
2024		443,143	62,247	16,207	Included in (b)	521,417
2023		372,365	62,247	16,027		450,640
2022		333,780	62,247	16,027		412,954
Reference of Expenditure (C)						
2017		82,500	81,898	0	Included in (b)	164,398
2015		97,250	119,250	0		216,500
2014		131,148	284,486	0		437,634
2013		186,068	108,000	0		294,067

(Source: Data for Plan and 2013-2014: Preparatory Survey, data for 2022-2024: Answer by DPWT of questionnaire, data for 2015 and 2017: Ex-post evaluation report of the "Project for Flood Protection and Drainage Improvement in Phnom Penh (Phase III). Elaborated by evaluator)

The ratio of the allocated amount to the requested amount has been increasing year by year, reaching 47% in 2022, 52% in 2023, and 60% in 2024. Additionally, the amount allocated has also increased compared with the period from 2013 to 2017. However, it is not sufficient for the implementation of the planned activities, and they are coping by prioritizing the areas to be cleaned. At the time of the ex-post evaluation, although the inundation situation in the project target area had improved as planned, some cases were also reported in the target areas of past projects where inundation had occurred again because those areas had been assigned a low priority and had low cleaning frequency.⁴¹

To the District Public Works Division, a standard amount of 5 billion riel is allocated. Although some districts also receive 3 billion riel on an application basis, this is a budget to cover all the activities and personnel expenses for infrastructure projects, including the drainage sector. It is not sufficient to clean the drainage pipes as planned, and it is also challenging to respond

⁴¹ Interview with the DPWT.

effectively to large-scale repairs.⁴²

Furthermore, the overall amount of PPCA's drainage-related expenditure has been increasing, as shown below. Although expenditures for the operation and maintenance of existing drainage facilities, excluding new construction and pipe repairs, have also been increasing, the growth rate of expenditures related to the operation and maintenance of existing drainage facilities is lower compared with the overall growth rate of drainage-related expenditures. Although the PPCA is securing budgets to respond to the expanding drainage demand in Phnom Penh, the emphasis is placed on new construction and repair of drainage pipes, and sufficient budgets are not allocated for the cleaning of existing facilities, resulting in situations where inundation occurs in areas with low priority for pipe cleaning.

Table 14: Expenditure of PPCA on Drainage Work

	(unit: thousand USD)						
	2013	2014	2017	2021	2022	2023	2024
Entire expenditure on drainage work (a)	3,335	3,258	14,185	29,060	37,050	47,460	28,430
Pipes cleaning and OM expenditure, excluding Pipe Repair & New Construction Expenses (b)	2,640	2,463	3,478	5,554	18,196	16,601	9,447
b/a	79%	76%	25%	19%	49%	35%	33%

(Source: Data for 2013-2014: Preparatory Survey, data for 2017: Ex-post evaluation report of the "Project for Flood Protection and Drainage Improvement in Phnom Penh (Phase III)" and data for 2021-2024: document provided by PPCA. Elaborated by evaluator.)

From the above, although the allocated budget amount has been increasing annually, it is not sufficient to implement the planned cleaning activities. DSO are coping with this situation by setting priorities, but challenges were observed in the financial aspect.

3.4.5 Environmental and Social Aspect

The issues assumed to have an impact during the operation of this project do not include the issues that require environmental consideration. No issues were observed that could have a negative impact on the sustainability of the project.

3.4.6 Preventative Measures to Risks

At the time of the ex-post evaluation, neither the occurrence of risks that would affect the continuation of the project effects nor the possibility of their future occurrence could be confirmed.

3.4.7 Status of Operation and Maintenance

1) Drainage Pipes and Interceptor Pipes

Among the stakeholders responsible for cleaning drainage pipes and interceptor pipes, the

⁴² Interview with District Public Works Division.

DSO has the highest technical capacity and possesses the necessary equipment for cleaning. The DSO is responsible for the main drainage pipelines, whereas the District Public Works Division and private contractors handle the other areas. Cleaning activities are mainly carried out during the dry season; however, they are occasionally conducted during the rainy season when residents complain about inundation.

For pipes with a diameter of 60 centimeters or more, workers enter the pipes to carry out cleaning. For the safety of the workers, it is instructed that the manhole should be open for approximately 20 minutes to release the air inside before starting the work (Photo 2).

The length of drainage pipelines cleaned was 20% of the planned length in 2020 but had increased to 50% in fiscal year 2024. Although it is only half of the plan, it has shown improvement. The inundation situation had improved as planned in the target area of this project as well.



Photo 2: DSO officers cleaning pipes with sign board) (taken by evaluator)

However, due to budget constraints, it is difficult to clean all pipes listed in plans. So drainage pipes around major arterial roads that would have a significant impact in the event of inundation are cleaned once every three years, but in some other areas, the drainage pipes remain uncleaned for long periods, exceeding three years. In areas where cleaning has been given lower priority, inundation occurs. In response to complaints from residents about that inundation, unplanned emergency cleaning is carried out, resulting in a vicious cycle in which the original plans cannot be implemented.⁴³ Moreover, during cleaning, sludge is removed to ensure that the mud-retaining height in the manholes is 20 centimeters; however, due to budget, personnel, and time constraints, regular monitoring of sludge accumulation in manholes cannot be conducted. Even if sludge accumulates exceeding the criteria without being cleaned over long periods, because the situation cannot be known, the flow of drainage might be worsened, and inundation would be caused.

The districts are also in a situation similar to that of the DSO, and in addition, many of the equipment and materials lack the necessary functions for cleaning, which makes it difficult to remove sludge efficiently.

2) Pumping Station, Mechanical Screens and Underground Reservoir

(1) Pumping Station and Mechanical Screens

At the pumping station, two or three workers are stationed on a rotating basis around the clock. Daily operation and management are recorded based on a prescribed checklist and submitted to

⁴³ Interview with the DPWT.

the DSO. The DSO regularly monitors the working conditions, and no problems have been reported. During the rainy season, the mechanical screens are operated every day and collect a large amount of waste (Photo 3). Before the installation of the mechanical screens, workers collected waste by hand; however, they were unable to collect all of it, and the remaining waste hindered drainage. According to the DPWT, after the installation of these machines, such situations have been avoided, and efficient drainage has become possible.



Photo 3: Wastes collected by mechanical screen (taken by evaluator)

(2) Underground reservoir

The underground reservoir is cleaned once a year during the dry season. Because drainage is collected in the underground reservoir and discharged into the Sap River, if the cleaning of the underground reservoir is insufficient, serious inundation damage will occur. Therefore, cleaning the underground reservoir is regarded as the highest priority, and it is always cleaned annually to prevent sludge accumulation.⁴⁴

(3) Vehicle-mounted drainage pumps

In accordance with the prescribed monitoring sheet, the maintenance is carried out using pre-use checks (such as the condition of engine oil, drainage hoses, belts, and others) and post-use checks (such as the condition of drainage hoses and the removal status of waste and sludge suctioned during drainage, and others) are conducted.



Photo 4: Cleaning workers in operation (taken by evaluator)

(4) Security equipment

At the DSO, safety equipment such as masks, gloves, rubber boots, and uniforms is prepared, but it is not necessarily used. In addition to the fact that workers are accustomed to cleaning without using safety equipment and are reluctant to use it,⁴⁵ because the equipment is not fully available to all workers, they share the equipment among themselves, resulting in each person not being fully equipped. Furthermore, toxic gases may be generated inside sewer pipes, and workers are instructed to wait 20 minutes after opening a manhole, and to start to work inside the pipes; however, some cases of injury and illness have also been reported. Although the necessity of using safety equipment is recognized, its wearing has not been made mandatory (Photo 4).⁴⁶

⁴⁴ Interview with the DPWT.

⁴⁵ Interview with the DSO.

⁴⁶ Interview with the DSO.

Thus, no major problems are mostly observed in terms of policy/system, institutional/organization, technical and environmental and social aspects. However, some issues have been observed in terms of the financial aspect even though some improvement can be seen, and they are not highly expected to be improved/resolved. Therefore, sustainability of the project effects is moderately low.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented with the objective to efficiently drain rainwater and to minimize inundation damage by internal water via the development of drainage facilities and the functional improvement of existing drainage pumping stations in the northern part of the central area of Phnom Penh Capital City, thereby contributing to the urban environment's improvement in the target area.

This objective was consistent with Cambodia's development plan and development needs at the time of planning and at the time of the ex-post evaluation, and it was relevant with Japan's ODA Policy and JICA's development cooperation policy at the time of planning. On the other hand, at the time of planning, no projects were confirmed, which were implemented by JICA, other Japanese organizations or other donors with the intention of generating synergetic effects with this project through coordination or collaboration. Therefore, its relevance and coherence are high. Inundation depth and inundation duration decreased as planned, and inundation area was also estimated to have decreased. The inundation situation of residences and shops, as well as the sanitary situation, has improved, and movement within the area has become easier. Therefore, the objective of minimizing damage from internal water inundations has mostly been achieved. In addition, positive effects were recognized in terms of inundation damage, disease incidence, and economic, traffic, and educational aspects, contributing to the urban environment's improvement. Therefore, the effectiveness and impacts of the project are high. Although the project period exceeded the plan, the project cost was within the plan; therefore, efficiency of the project is high. Regarding the operation and maintenance of this project, mostly no major problems are observed in terms of policy/system, institutional/organization, technical and environmental and social aspects. However, some issues have been observed in terms of the financial aspect even though some improvement can be seen. They are not highly expected to be improved/resolved. Therefore, sustainability of the project effects is moderately low.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Establishment of a Regular Monitoring System for the Inundation Situation

At the DSO, although information on the inundation situation is collected irregularly and orally from workers, systematic monitoring to grasp the inundation situation is not being conducted. Even if cleaning is carried out by setting priorities under a limited budget, it is desirable to regularly monitor the actual conditions of the inundation and accumulated sludge so that preventive cleaning plans can be formulated, and cleaning activities can be implemented based on that, rather than prioritizing specific routes or responding after getting complaints from residents,. This will enable timely and effective cleaning activities through the efficient use of the budget.

Mandatory Use of Safety Equipment

Safety equipment such as masks, gloves, and rubber boots could not be made mandatory for workers because there was not a sufficient quantity for everyone to be fully equipped. In addition, because workers were not accustomed to using such equipment, they often performed cleaning activities without wearing safety equipment. It is desirable to procure safety equipment through a multiyear procurement plan, thereby reducing the single-year budget burden, so that everyone can be fully equipped and thoroughly enforce its mandatory use. This will ensure the safety of the workers' working environment.

Appropriate Waste Management in More Markets

At the three markets targeted by the technical guidance, waste is now being appropriately managed. However, at markets with a large volume of waste generation, such as the Doeum Kor and the Neak Meas wholesale market, waste continues to be scattered on the streets (Photos 5 and 6). As a result, at Mao Tse Toung Boulevard, which faces these markets, inundation damage remained serious at the time of the ex-post evaluation.⁴⁷ Although the improvement of inundation through appropriate waste management cannot be achieved overnight, the improvement at the three target markets, under the technical guidance of this project, is a successful case that can serve as a reference. It is desirable to implement similar initiatives in other markets to improve the situation of inundation.



Photo 5: Kandal market
(taken by evaluator)



Photo 6: Neak Meas market
(taken by evaluator)

4.2.2 Recommendations to PPCA

Although the amount of drainage-related expenditures secured by the PPCA has been

⁴⁷ Interview with the CBA and motorcycle taxi drivers.

increasing, its emphasis is placed on the new construction and repair of conduits, and the growth rate of the amount allocated for cleaning existing conduits and drainage channels is lower compared with that of the overall drainage-related expenditures. The DSO's budget is allocated from the said budget items for the cleaning of existing drainage-related facilities. Even though its amount has been increasing, only about 50% to 60% of the requested amount is allocated. Due to this budget shortage, the plans cannot be implemented even if they are formulated; therefore, the preventive cleaning plans have not been prepared. Although insufficient cleaning is not the only reason, inundation has recurred even in areas where cooperation was provided in the past, such as around the Royal Palace. From the perspective of sustaining the effects in areas where the inundation had once improved, it is desirable that the PPCA allocates budgets in a balanced manner between new facilities and existing facilities, and that the DPWT, DSO, and private contractors formulate and implement the preventive cleaning plans as much as possible.

4.2.3 Recommendations to JICA

None.

4.3 Lessons Learned

Setting of Necessary and Monitorable Indicators

Up to the previous phases of this project, inundation depth and inundation duration had been set as quantitative effect indicators. However, for this project, JICA requested that "indicators that can more clearly measure the project effects" be established. Based on a suggestion from the consultant for the preparatory survey, inundation area was added as a quantitative indicator. The baseline and target values of this indicator were calculated through simulations by a hydrological analysis model. However, since DSO does not have a system capable of running the same model, inundation area was not monitored. In this ex-post evaluation, with regard to the realization of effects related to inundation area, it was decided to confirm the proportion of locations that were actually "not inundated" among the locations that had been "assumed not to be inundated," and to infer, from the high probability thereof, the possibility that the simulation results were being realized at the time of the ex-post evaluation.⁴⁸

As a principle, the indicators for verifying project effects should be those for which data measurement and analysis are possible by the executing agency at the time of the preparatory survey. However, in fields such as the sewerage sector, where effects are difficult to visualize, in case that the indicators, that cannot be handled by the executing agency, are deliberately set for the purpose of effect measurement, it is necessary to consider, in advance, what kind of methods

⁴⁸ Of the 29 locations that were "assumed not to be inundated," 23 locations answered that they are "not inundated" at the time of the ex-post evaluation; therefore, it was inferred that the simulation results had materialized with a probability of about 80% (see p. 12).

will be used at the time of ex-post evaluation to collect data and verify the degree of achievement of the indicators, in addition to the method adopted in this ex-post evaluation. In the ex-ante evaluation, it is essential to reconfirm the appropriateness and availability of the operation and effect indicators, including these points.

Addition of Hydrogen Sulfide Concentration Measuring Devices to Safety Equipment

Hydrogen sulfide gas may be generated inside sewer pipes, and there is a risk that workers may suffer poisoning. In this project, workers were instructed to start to work after 20 minutes passed since opening the manhole. However, in order to mitigate such risks, the procurement of equipment to measure hydrogen sulfide concentration is proposed. This would make it possible to start cleaning after confirming the gas-generation conditions, thereby ensuring the working safety of the workers.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

None.

5.2 Additionality

None.

(End)