

Sri Lanka

Greater Colombo Flood Control and  
Environmental Improvement Project (II) (III)

External Evaluator : Tomoko Tamura  
(Kaihatsu Management Consulting Inc.)

Field Survey: From February 2009 to April 2009

1 . Project Description and Outline of the ODA Loan Assistance



Map of project area  
(Entire Sri Lanka)



An improved drainage in Kaudana area

1.1 Background

Sri Lanka is an island country located 30km southeast of India. The total area of the country is approximately 0.8 times the size of Hokkaido, Japan. The target area of the project, Greater Colombo, covers Colombo City (area of Colombo Municipal Council), which is the largest commercial city in the country, and the area of four surrounding local authorities. The target area has a total extent of 104 km<sup>2</sup> and population of 1.2 million<sup>1</sup>. The population size is similar to that of Saitama City, Japan, and the area extent is similar to the total area of Setagaya-ku and Nerima-ku in Tokyo, Japan.

Greater Colombo has been vulnerable to flooding, as most of its area consists of low-lying land, which is less than 6 meters above sea level, and some of the areas of less than 1 meter above sea level, which had functioned as “retention areas” to keep rainwater temporarily, were reduced by the need for land-fillings for development activities. Citizens of the area have suffered from frequent floods every year, and their economic and social activities have often been interrupted by inundation.

1.2 Objective

The objective of this project is to mitigate flood damages by improving old or undeveloped drainages in the most affected area (five in Colombo Municipal Council (CMC) area and two in

<sup>1</sup> Census of population and housing 2001, Department of census and statistics, Sri Lanka.

Dehiwala Mount Lavinia Municipal Council (DMMC) area), thereby contributing to the improvement of the living environment of the area. Additionally, the phase II<sup>2</sup> aimed at improving the living standards of low-income communities in the project area through provision of basic infrastructure, such as water-supply, sewerage system and electricity-supply facilities.

### 1.3 Borrower/Executing agency

Democratic Socialist Republic of Sri Lanka/ Sri Lanka Land Reclamation and Development Corporation : SLLRDC

### 1.4 Outline of the Loan Agreement

Approved amount/ Disbursed amount	(II) : 4,367 million yen/ 3,548 million yen (III) : 6,180 million yen/ 5,874 million yen
Exchange of Notes/ Loan Agreement	(II) : July 1994/ July 1994 (III) : October 1996/ October 1996
Terms and Conditions -Interest rate, Repayment Period, (Grace period) -Condition for Procurement	(II) : 2.6%, 30 years (10 years) (III) : 2.1%, 30 years (10 years) -General untied
Final Disbursement Data	(II) : October 2001 (III) : December 2005
Main Contractor	(II) : Kajima Corporation (Japan)/ Keangnam Enterprises, Ltd. (Korea) (III) : Jilin International Economic & Technical Corporation (China), Geo-Engineering Corporation (China)
Main Consultant	(II) : Nippon Koei Co., Ltd (Japan) (III) : Nippon Koei Co., Ltd (Japan) / WS Atkins International Ltd.
Feasibility Study (F/S), etc.	1993 F/S: SLLRDC

## 2. Evaluation Results (Rating : C)

### 2.1 Relevance (Rating: a)

This project has been highly relevant with Sri Lanka's national policies and development needs at the times of both appraisal and ex-post evaluation; therefore its relevance is high.

<sup>2</sup> "Greater Colombo Flood Control and Environmental Improvement Project Phase II" hereinafter referred to as "the phase II" and "Greater Colombo Flood Control and Environmental Improvement Project Phase III" referred to as "the phase III".

### 2.1.1. Relevance to national policies

At the time of the project appraisal, flood control was given priority in Sri Lanka's national policies. The "National Environment Action Plan (1992-96)" was the guiding plan for implementing flood control.

The flood control was still given priority in the national policies at the time of the ex-post evaluation. "Mahinda Chintana (2006-2016)," a national development policy plan of the present government, specifies the implementation of active flood mitigation measures.

### 2.1.2. Relevance to sector policies

At the time of the project appraisal, flood control in the Greater Colombo area was identified as the most urgent issue in the policies of the urban environmental and flood control sector. The government developed its "Metropolitan Environmental Improvement Programme (MEIP)<sup>3</sup>," and was actively involved in flood mitigation measures for Greater Colombo.

The flood control was identified as an urgent issue in the policies of the urban environmental and flood control sector at the time of the ex-post evaluation as well. SLLRDC has been implementing flood mitigation measures in the area continuously based on the "Study on Storm Water Drainage Plan for the Colombo Metropolitan Region" formulated in 2003 by a JICA Expert Team<sup>4</sup>.

### 2.1.3. Relevance to needs

There was urgency and a critical need for flood control in the target area at the time of the project appraisal. The inundation damage in the five areas of the phase II was the most serious level within the area of CMC. In addition, the level of inundation damage in Attidiya, one of the two areas of the phase III, was the most serious in Greater Colombo. It was advised that drainages in Kaudana, another area of the phase III, should be improved together with those in Attidiya, as they belonged to the same drainage system.

Low-income families were living along the open drainage in the Serpentine area of the phase II. There was an urgent need to improve their living conditions by provision of basic infrastructure, such as piped water- and electricity-supply facilities.

There was a critical need for flood control in the target areas at the time of the ex-post evaluation as well, as the area had become further urbanized and more populated. Living conditions in the area along the open drainage in Serpentine have been improved to a certain extent; however, as well as in St. Sebastian, which is also one of the target areas of the phase II,

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<sup>3</sup> The program aimed at flood control of Greater Colombo region, improvement of living standard of the poor families, improvement of solid waste management, improvement of sewerage system and improvement of environment of Beira Lake.

<sup>4</sup> SLLRDC implemented the dredging and cleaning of drainages in the Kolonnawa area and the construction of the Mutuwel Tunnel recently based on the JICA Study. Currently, SLLRDC is participating in the "Lunawa Environmental Improvement and Community Development Project", which is implemented with the assistance of an ODA loan from JICA.

there is still significant need to improve the sanitation conditions.

## 2.2 Efficiency (Rating: a)

The implementation period of the phase II was longer than planned while that of the phase III was carried out almost as planned. The total period of these projects was slightly longer than expected. The project cost was lower than that of planned for both phases II and III. If taking only these factors into consideration, the rating for effectiveness could have been “b”. However, it was finalized as an “a”, taking into consideration the fact that the phase III had created several additional outputs, such as additional civil construction works and implementation of the Integrated Environmental Management Programme, of which necessity was identified during the course of project implementation.

### 2.2.1 Outputs

“Civil construction”, “Community Development Programme”, “Procurement of O&M equipment” and “Consulting services” were the four planned output components of the projects. In addition to these, the “Integrated Environmental Management Programme” was conducted under the phase III. Achievement of each component is described below.

#### (1) Civil construction

As shown in Tables 1 and 2, improvement of the five drainage systems under the phase II and the two systems under the phase III was conducted as planned. For easy operation and maintenance of the system, small scale underground drainages, including underground drainage pipes and underground box culverts, were replaced by open drainages or side drains in the detailed design of the phase III. Construction works were done according to the revised designs.

Table 1 Planned and Actual Outputs of the phase II

Name of drainage system	Plan at the time of project appraisal (total extension)	Actual (total extension)
St. Sebastian 2	Underground drainage pipes and box culvert and side drains (1,074m)	Underground drainage pipes and box culvert and side drains (1,449m)
Dematagoda	Underground box culvert (563m)	Underground box culvert (533m)
Unity Place	Underground drainage pipe (850m)	Underground drainage pipe (835m)
Torington West	Underground box culvert and pipe (2,469m)	Underground box culvert and pipe (2,049m)
Serpentine	Upgrading of existing open drainage (widening and deepening of the drainage and heightening of the banks) (1,686m)	Design changes were adopted. Along the middle part of the drainage, where a lot of houses of low-income families were lined close together, the widening and deepening of the drainage were not conducted. Instead, flow in the upper system was diverted through a newly constructed underground box culvert in the upstream of the drainage. (1,877m)

(Source: Final Design Report and Project Completion Report of the phase II)

Table 2 Planned and Actual Outputs of the phase III

(Unit : m)

Items	Attidiya scheme		Kaudana scheme	
	Plan	Actual	Plan	Actual
Underground drainage pipes	27,840	2,603	14,935	460
Underground box culverts	4,020	3,527	390	0
Open drainages	0	9,503	0	3,612
Side drains	2,590	52,773	3,090	20,050

(Source: Project Completion Report of the phase III)

As mentioned earlier, several additional works, of which necessity was identified during the project implementation, were conducted under the phase III in the balance of the fund. By the additional works, the remaining areas of the drainages in the upper stream of the two drainage systems were improved. These drainages were not included in the original scope of the projects due to the limitation of funds. The walls of several open drainages were strengthened with concrete trough or wet masonry. The Waras Ganga (Waras River), which is located downstream of the two drainage systems, was dredged. An irrigation anicut in the river was removed, and a bridge was constructed.

Improvement of the drainages in upper stream was conducted to prevent localized flooding in the area. Strengthening of walls with concrete trough was conducted to improve efficiency of maintenance. Deposits and anicut in the Waras Ganga were blocking the flow of the river, and there was a risk that discharged water from the drainage systems improved by the project would stagnate at that point. Dredging of the river and removal of the anicut were conducted to reduce such risk. A new bridge was constructed in order to ensure that people living in the community around the river could have convenient travel and transport access, even after the removal of the anicut.

It was confirmed by the external evaluator during site inspections that these additional works contributed to the realization of the expected effects of flood control in the target area of the project.



Open side drains with slab lids for easy operation and maintenance (Attidiya)



Underground drainage pipe at Unity Place

## (2) Integrated Environmental Management Programme

The “Integrated Environmental Management Programme”, of which necessity was identified during a course of the project implementation, was conducted additionally under the phase III as available funds remained in the balance of the budget of the project. The major activities of the programme were as follows:

- Situation analysis of water quality and environment of the target area and monitoring of water quality
- Construction of community-based solid waste management centers
- Quality improvement of industrial waste water
- Improvement program of solid waste management
- Improvement of quality of domestic waste water and construction of sanitation facility
- Clean up campaigns and awareness programme

It is considered that the programme has been contributing to the improvement of the environment of the area, in light of the fact that DMMC has been conducting recycling programme and awareness creation programme and that the community-based solid waste management centers and sanitation facility constructed under the programme have been presently used as well.



Clean-up campaign



Auditing of industrial waste water

### (3) Community Development Programme

The Community Development Programme planned under the phase II was conducted only partly. The reasons for this incompleteness could not be identified, as SLLRDC does not have any documents explaining the reasons. The TOR for the consulting services of the phase II stipulated that the Community Development Programme was to be planned and implemented not by the team providing consulting services of the phase II, but by the experts, who were in charge of the resettlement programme, providing consulting services for the “Greater Colombo Flood Control and Environmental Improvement Project phase I”, which was implemented in parallel with the phase II. There is no record to show how the experts in the phase I contributed to the Programme; however, SLLRDC deemed that the Programme was not completely implemented as the project itself did not have the necessary allocation of human resources with expertise.

#### (a) Programme for families to be resettled

It was planned to implement vocational training and provide loans for an income

generation programme by introducing a “community development fund” for 41 households in Serpentine area, which were to be resettled. None of these activities were implemented.

(b) On-site upgrading for families living along the canal

It was planned that water supply and electricity would be provided to 400 households living along the drainage in Serpentine area. However, the plan was not implemented. The provision of sewerage connections for several houses, improvement of an O&M road for the drainage and construction of a public toilet were conducted under the components of the civil construction work.

(4) Procurement of equipment for operation and maintenance

The procurement of equipment was implemented almost as planned with minor adjustments in the selection items after reviewing the needs.

(5) Consulting Services

The TOR of the consulting services for the phase II included a review of the F/S and supervision of civil works of the target five areas, a review of the F/S of the other urgent areas<sup>5</sup>, water quality monitoring, development of environmental conservation action plans and capacity building of SLLRDC. The consulting services of the phase III included detail design of the two target areas, support in the tendering process of the main civil works, supervision of civil works and monitoring of water quality.

Consulting services of both the phase II and III were conducted as planned. Table 3 below shows the planned and actual MM of the services. The total MM of the phase II and III in actuality was slightly fewer than the planned MM.

Table 3 Planned and Actual MM of the Consulting Services

	Plan		Actual	
	Foreign	Local	Foreign	Local
Phase II	160MM	378MM	148MM (93%)	313MM (83%)
Phase III	245MM	456MM	252MM (103%)	488MM (107%)
Total	405MM	834MM	400MM (99%)	801MM(96%)

(source : Project Completion Reports)

The implementation period of the phase II was planned as 63 months, i.e. from July 1994 to September 1999, and that of the phase III was planned as 86 months, i.e. from October 1996 to November 2003. The total period of implementation of the phase II and III was planned as 149 months. The actual implementation period of the phase II was 84 months, i.e. from July 1994 to June 2001, and that of the phase III was 87 months, i.e. from October 1996 to December

<sup>5</sup> Colombo Municipal Council area, which has serious inundation damages and is not included in the target area of the phase II, Dehiwala Mount Lavinia Municipal Council area and Moratuwa Municipal Council area and so on.

2003. The total actual implementation period of the phase II and III was 171 months, which is 114% that of the original plan and slightly longer than expected. The actual implementation period of the phase III was 101% that of the original plan, which is only one month longer than expected. However, the actual implementation period of the phase II was 133% that of the original plan, which was 21 months longer than expected. The main reasons for the delay in the phase II were as follows:

- During the course of procurement of a civil contractor, detailed investigation of and re-evaluation for one of the contractors which applied to the procurement became necessary, as the technical level of the contractor was in question.
- The evaluation committee had to deal with a law suit filed by an unsuccessful civil contractor.
- There were not enough applicants for procurement of O&M equipment. For the first tender call, there was only one applicant for some packages. Therefore, the procurement method was changed to an item-wise tender from a package-wise tender in order to realize a proper competitive bidding. However, there were still no applicants for some items for the second tender call. Eventually, tenders had to be called three times in total.

### 2.2.3 Project cost

The project cost for the phase II was planned as 5,173 million yen, including the JICA loan portion of 4,367 million yen and that of the phase III was planned as 7,859 million yen including the JICA loan portion of 6,180 million yen. The actual project cost was 4,234 million yen, including the JICA loan portion of 3,548 million yen, and 7,640 million yen, including the JICA loan portion of 5,875 million yen, for the phase II and III respectively. The total cost of the phase II and III was 91% that of the original plan thus lower than planned. Actual cost vs. originally planned cost of the phase II was 82%. As to the phase III, it was 97% including the cost of the additional works in the actual cost. The effective awarding of contracts by international competitive bidding was the main factor that contributed to the reduction of the project cost.

### 2.3 Effectiveness (Rating: b)

The effectiveness of the project is moderate, as considerable degree of inundation damages remain in several target areas, although the damages were reduced in every area. The inundation damages remained mostly in the areas of the phase II. The main reason is that secondary drainages and side drains in shanties<sup>6</sup> in the areas, which were not included as targets of the project, had not been improved adequately by responsible authorities, namely Colombo Municipal Council and Road Development Authority respectively, although population density in the areas had become higher. Lack of adequate operation and maintenance of the drainage systems of the phase II, due to the absence of a responsible authority, which will be explained later, is another main cause for the remaining of inundation damages.

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<sup>6</sup> “Shanties” are the areas where houses of low-income families are lined up close together.



### 2.3.1 Operation and effect indicators

The effectiveness of the projects could not be examined by operation and effect indicators, as SLLRDC and local authorities in the target areas did not have historical data on functions of the drainage systems, such as water levels and amounts of water discharge. Thus the external evaluator could not determine whether the projects had achieved the expected levels of the flood control by examining water levels of the drainages and amounts of water discharged per second on the days of heavy rain, which tended to occur once every two years<sup>7</sup>.

The effectiveness of the projects could also not be examined by using inundation damages as an effect indicator, as neither SLLRDC nor local authorities kept any records of the damages or complaints in the target areas.

Taking the above mentioned limitations into consideration, the external evaluator determined the effectiveness of the projects by referring to a questionnaire survey conducted at the ex-post evaluation, with samples drawn from 250 households randomly selected in the target areas. The main findings of the survey are shown below.<sup>8</sup>

#### (1) Changes in frequency, depth and duration of inundation before and after the projects

Table 4 shows changes in frequency, depth and duration of inundation based on responses from 228 sample households of the questionnaire survey<sup>9</sup>. All of these 228 households, out of 250 sample households in total, had experienced inundation of their houses before the project. It was ascertained that the inundation damages were reduced in every aspect in all the areas. The target areas of the phase III show remarkable improvement, although St. Sebastian 2 and Torington West in the phase II still have inundation to some extent.

Table 4 Changes in Frequency, Depth and Duration of Inundation Before and After the Projects

		Phase II					Phase III	
		Serpentine	St. Sebastian 2	Dematagoda	Torington West	Unity Place	Attidiya	Kaudana
Frequency of inundation (times/year)	Before	2.6	3.0	2.1	4.7	1.9	3.4	3.5
	After	0.8	1.8	0.7	2.2	0.7	0.5	0.2
Inundation depth (cm)	Before	42	35	24	60	27	28	23
	After	9	19	5	21	4	3	1
Inundation duration (hours)	Before	123.2	68.5	46.9	104.7	18.3	7.5	16.6
	After	33.4	43.4	5.2	20.6	1.0	1.1	0.3

<sup>7</sup> The design report and the project appraisal document of the phase II said that the drainage systems would be designed with a return period of two years, which means the facility would have a resistant against heavy rainfall expected to occur once every two years. This should be considered as the “expected level of flood control” of the projects. The possible heavy rainfall every two years is defined as “rainfall more than 72mm per hour”

<sup>8</sup> It should be noted that the findings of the questionnaire survey do not represent measured data, but show the summary of the replies given by the respondents. During the survey, enumerators tried their best to obtain accurate information from the respondents by discussing the questions with the respondents; however, the replies depended on the respondents’ memories, knowledge and perception.

<sup>9</sup> The figures in Table 4 show averages of the samples of the areas; therefore, they do not represent figures of every area, where localized flooding remains.

(Source: Questionnaire Survey)



Flooding before the project (1998)  
(De Soysa road in Attidiya : phase III)



Inundation damages were reduced drastically  
after an underground drainage was constructed  
by the project (De Soysa road)

(2) Beneficiaries' perception of reduction of inundation damages

Figure 1 shows the replies in the questionnaire survey to the question of “Were inundation damages to your house reduced after the project?” Most of the respondents in the areas of the phase III and Unity Place in the phase II acknowledged reduction of the inundation damages after the project; however, 19% – 47% of the respondents in other areas did not acknowledge the reduction of inundation. On average, 78% of the respondents acknowledged the inundation reduction.

(Unit : %)

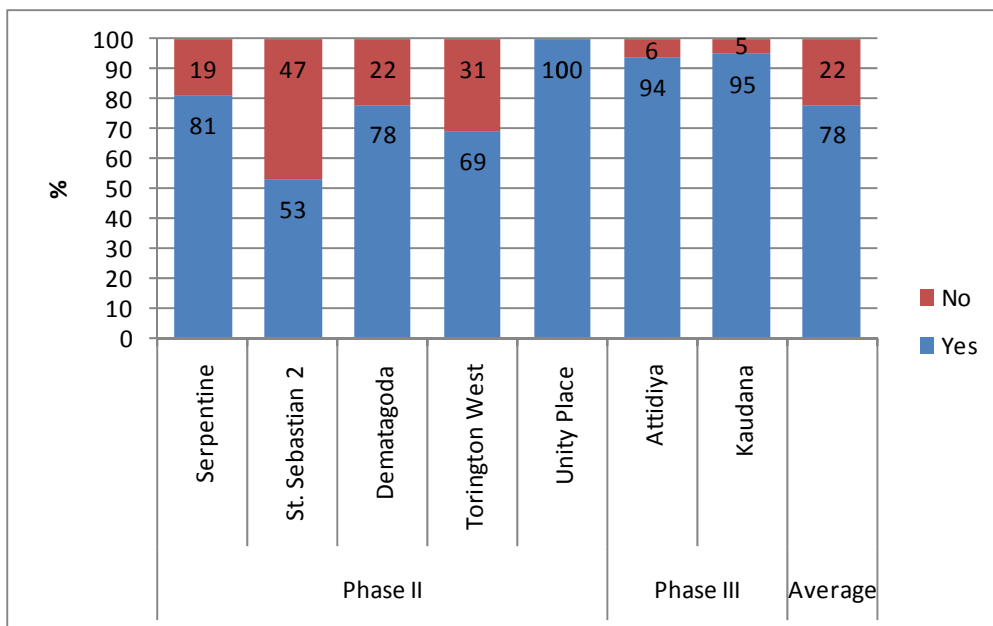


Figure 1 “Were inundation damages to your house reduced after the project?”

(Source: Questionnaire Survey)

93% of the respondents who replied positively to the above-mentioned question (total of 178 households) answered that the reduction of inundation was realized because of the

“development of nearby drainages”, which confirmed that the reduction was effected owing to the projects. Effects of the phase III are more significant because not only main drainages but also secondary drainages and side drains were developed. Regular operation and maintenance of the drainage systems conducted by DMMC also contributed to the significant improvement.

(3) Reasons for remaining of inundation damages

After the questionnaire survey, engineers representing SLLRDC and the external evaluator visited the area, where inundation damages remain to some extent, and analyzed main causes of the damages. The following is the result of the analysis:

<Secondary drainages, storm water drainages and side drains were not developed adequately>

- Although drainages developed by the projects are functioning most of the time, flooding still occurs because secondary drainages, storm water drainages and side drains are not properly functioning as they are old or have not been developed adequately. This situation was observed mostly in shanty settlements in the areas of the phase II, particularly St. Sebastian 2, Dematagoda and Serpentine.
- In the phase II, it was expected that secondary drainages and side drains would be developed by CMC and by Road Development Authority, while the main drainages would be developed by the project (see the Figure 2)<sup>10</sup>. However, it was observed during the ex-post evaluation that the above-mentioned objectives had not been realized. As a result, waste, storm and road surface water are not being treated properly, making some areas vulnerable to flooding.

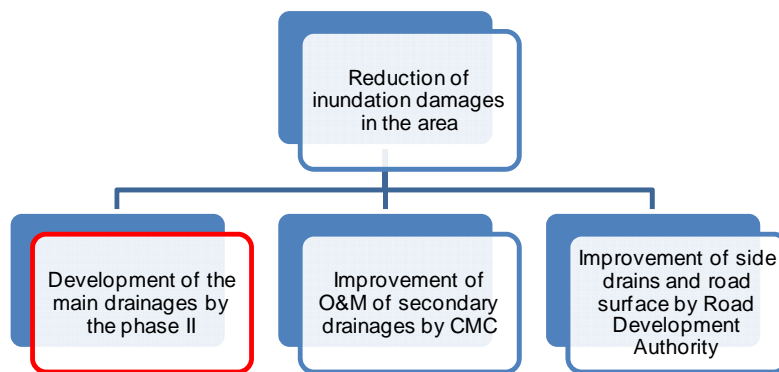


Figure 2 Expected measures for reduction of inundation damages at the time of project appraisal (phase II)

These problems have become more serious as the areas have now a lot of unauthorized construction, with houses and shops constructed on the drainages and drains, and the areas

<sup>10</sup> An appraisal document mentioned about the assumption, however, it was difficult to say whether CMC and Road Development Authority had agreed with the assumption, as there was no document to show it.

have become more over-crowded by illegal occupations. Measures taken by relevant authorities, such as local authorities, to prevent the above-mentioned problems have not been effective enough. In this way, the areas still suffer from flood and inundation damages, as the expected integrated measures for flood control were not implemented adequately.

<Inadequate O&M of the drainages developed by the project>

- The open drainage in Serpentine area, which was renovated in the phase II, is often overflowing, causing flooding during heavy rains, as the drainage, especially its downstream sections, is blocked by garbage and deposits.
- The underground drainage at Torrington West (Slaiman Terrace), which was constructed in the phase II, sometimes overflows and causes flooding during heavy rains. The overflow seems to be happening mainly because sediment deposits built up where the underground drainage flows into an old drainage have not been removed.



Drainages with garbage  
(Open drainage in Serpentine area)

<Mixed factors>

- Several houses around the open drainage in Sattisara Mawata in Attidiya, which was constructed by the phase III, still experience inundation once or twice a year. Possible reasons for the inundation are: elevation of the said houses is relatively low, deposits and garbage stuck at the iron grill (trash rack) in the drainage were not removed regularly, and the capacity of the drainage at this place may not be adequate to treat heavy flow from upstream.
- Shanties along Torrington Avenue in Torrington West in the phase II often experience flooding when the Torrington South Canal, which runs along the east side of the area, overflows during heavy rains because the capacity of the Canal has been reduced due to the lack of dredging for several years. In addition to that, the area is vulnerable to flooding, as side drains and secondary drainages are either old or undeveloped and not functioning properly.

### 2.3.2 Results of Economic Internal Rate of Return (EIRR)

Economic Internal Rates of Return (EIRR) for the phase II and III at the time of the project appraisal were 9.1% and 14.1% respectively. The rates were calculated with the following conditions:

- Cost: Cost of the project and O&M cost for the facility developed by the project
- Benefit: Reduction of inundation damages and increase of land value

- Project life: 30 years after the completion of the projects

The EIRR for the phase II and III re-calculated at the time of the ex-post evaluation with the same conditions mentioned above were 19.3% and 7.5% respectively. As for the phase II, although the delay in the completion of the project gave a slight negative impact on the EIRR, the reduction of the project cost largely contributed to an increase in the EIRR. As a result, the EIRR was increased. As for the phase III, the EIRR was reduced since the creation of benefit of the project was delayed as a whole, although the planned civil works were completed within the expected time period. This was because, in some places, benefits were not created until the completion of the additional works, which opened up the entire drainage systems, while benefits were gradually created before that in other places.

## 2.4 Impacts

### 2.4.1. Impacts to project areas and target communities

#### (1) Improvement of living environment due to reduction of flooding

As Figure 3 shows, the results of the questionnaire survey indicate that 52% and 76% of the beneficiaries of the phase II and III respectively replied positively to the question: “Was the living environment around your house improved after the project?” Respondents who replied negatively to the question gave examples of environmental problems they still have, such as, garbage dumping in drainages and road sides nearby their houses, unpleasant odors and mosquito breeding in the drainages.

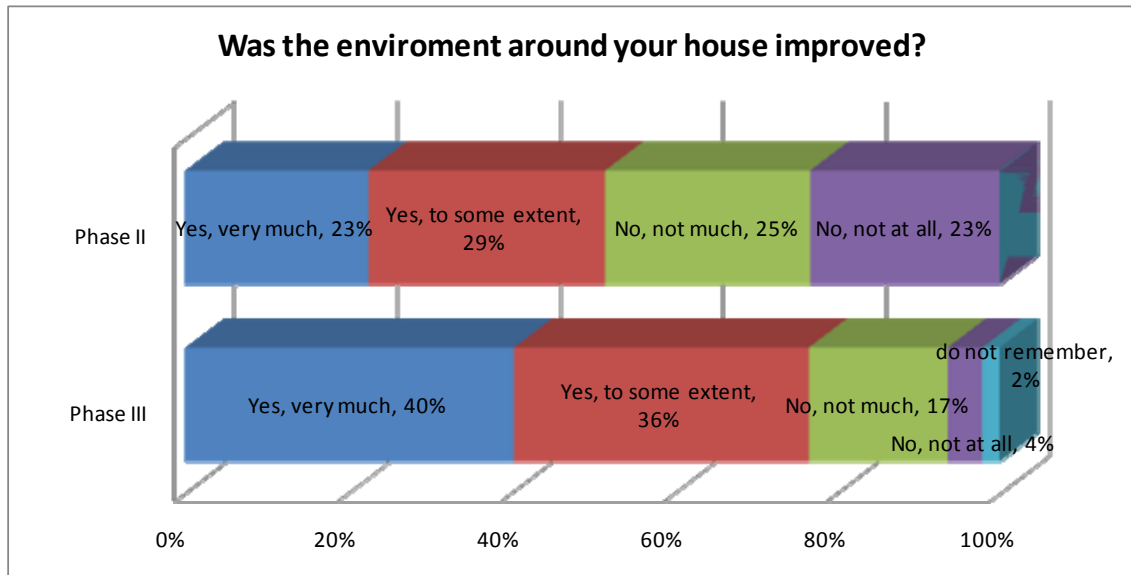


Figure 3 Improvement of Living Environment

(Source: questionnaire survey)

#### (2) Reduction of diseases caused by inundation

- Statistical analysis on reduction of diseases caused by the inundation could not be carried out as institutions of public health in the target areas did not have necessary data on the numbers of patients contracting the relevant diseases before and after the projects. Recent

data on the numbers of patients hospitalized with Dengue fever in the target areas did not show significant improvement after the projects. Dengue fever is observed by public health officers working in the area to occur more frequently in communities living along drainages and canals.

- In the questionnaire survey, 52% and 62% of the beneficiaries of the phase II and III respectively replied positively to the question: “Was the health situation of your family improved after the project?” Reduction of the inundation damages contributed to the improvement of the health situation of the families to some extent; however it was not a dominating factor, as only 62% of the beneficiaries replied positively to the above-mentioned question; while more than 95% of them acknowledged reduction of inundation damages in the phase III (see Figure 1). The beneficiaries explained in the questionnaire survey that in addition to reduction of inundation damages, regular garbage collection, prevention of odors and mosquito breeding in drainages by improving water quality were necessary to improve the health situation of the families.

### (3) Promotion of economic activities by flood mitigation

The case studies conducted for a factory, a hospital and a school in the target areas indicated that the project contributed to the reduction of inundation damages and the improvement of the operation of the institutions.

### (4) Reduction of cleaning workload after inundation

It was found by the questionnaire survey that households in the areas spent 17 hours on average for cleaning after an inundation, and 69% of them replied positively to the question: “Was your cleaning workload after inundation reduced after the project?” These replies include “reduced significantly (42%)” and “reduced to some extent (27%)”. At the time of project appraisal, it was expected that the project would reduce the “workload of female members of families” on the assumption that female members mainly engage in cleaning work. However, the questionnaire survey revealed that both male and female family members engaged in cleaning work, as the most common reply to the question of “Who engaged in cleaning work?” was “husband” and then “wife”, “son” and “daughter”.

### (5) Reduction of hindrances to commuting and schooling

According to the questionnaire survey, 85% of the households had difficulty in commuting on days of heavy rain due to frequent floods before the project. However, the number was reduced to 43% at the time of ex-post evaluation. In addition, 85% of the households had a difficulty in sending their children to school on days of heavy rain before the projects; however this was reduced to 39% at the time of ex-post evaluation.

## 2.4.2. Impacts on the natural environment

### (1) Deterioration of water quality of the drainages

Water in the open drainage in Serpentine in the phase II area is polluted by garbage, deposits

and sewerage, and is causing sanitation problems, such as odors and breeding of mosquito, to the residents living along the drainage. In addition to the absence of regular cleaning of the drainage, discharge of sewerage overflow from the nearby Prison Headquarters into the drainage at night and garbage dumping by the residents living along the drainage are the main reasons for deterioration of the water quality<sup>11</sup>.

In the phase II, the “Environmental Conservation Action Plan” was developed for CMC and the communities with an aim of preventing garbage dumping into the drainage. However, it is not known to what extent the plan was implemented. Water quality tests were conducted in the phase II and III, but no improvement was observed during the project implementation periods. Since the completion of the projects, testing has not been done.

## (2) Mosquito breeding by stagnation of water in side drains

At the time of the questionnaire survey, residents in several areas of the phase III indicated the problem of mosquito breeding in side drains, where water is stagnated. They believed that although they clean the drains and remove deposits often, water is stagnated in the drains because declination of the drainage is not sufficient. However, the problem was not recognized at the time of the joint inspection, which was conducted when SLLRDC handed over the responsibility of O&M to DMMC. There is a need to identify the reasons for stagnation by conducting a technical investigation and then to take necessary actions to solve the problem.

### 2.4.3. Resettlement and land acquisition

The total number of households to be resettled was planned as 82, 41 households each for phase II and III. The Project Completion Report of the phase II noted that 37 households were resettled, and the same report for the phase III does not mention anything about the resettlements.

At the time of the ex-post evaluation, basic information about the resettlements, such as lists of the households resettled, addresses of the original and new residences and procedures for resettlement, was not available and staff in charge of the resettlements at the time of implementation had left SLLRDC due to retirement or changes in their jobs. Therefore, the external evaluator could not confirm the actual number of households resettled and procedures for resettlement or examine the current living environment of the affected families.

## 2.5. Sustainability (Rating: c)

Sustainability is evaluated to be low, as it is not clear whether the responsibility for the O&M of the drainages of the phase II belongs to SLLRDC or CMC, and O&M work for the drainages has been conducted only sparsely, although O&M of the drainages developed by the phase III are conducted satisfactorily to some extent.

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<sup>11</sup> Sewerage from the Prison Headquarters is directly connected to the drainage. The residents explained that the reason they dump garbage in the drainage is because there is no regular garbage collection by CMC.

### 2.5.1. Executing agency

#### (1) Structural aspects of operation and maintenance

The O&M of the drainages developed by the phase II was planned to be done by SLLRDC at the time of project appraisal. The O&M was actually conducted by the organization for several years after the completion of the project. Thereafter, in 2007, SLLRDC considered that it was more appropriate for CMC to conduct the O&M work, and they had several discussions and a joint inspection with CMC. During the series of discussions, CMC agreed to undertake the O&M work. However, after that, CMC did not go through necessary procedures for taking over the work. Therefore, currently, it is not clear whether the responsibility for the O&M for the drainages belongs to SLLRDC or CMC.

Considering various factors, it seems that CMC has a certain responsibility for the O&M of the drainage; however, the project appraisal documents do not mention whether the roles of CMC in this regard were duly discussed or not. According to the interviews conducted with the stakeholders of the project, it was found that CMC had not been involved in the project adequately at the time of implementation. As a consequence, CMC does not have a sense of ownership of the drainages and its O&M work. This hindered the smooth transfer of the responsibility for the O&M, as mentioned above.

The phase III utilized the lessons learned from the phase II. Several measures were taken during the project implementation period for a smooth transfer of the responsibility for the O&M of the drainages developed by the phase III from SLLRDC to DMMC. As a result of these measures, responsibility of the O&M was taken over by DMMC after the completion of the project, without any problem. Currently, the newly established “Drainage Unit” of DMMC is implementing the O&M.

#### (2) Technical aspects of operation and maintenance

So far, there have been no particular technical problems for both the phase II and III with regard to the O&M of the drainages.

#### (3) Financial aspects of operation and maintenance

There have been no particular issues on the financial aspects of O&M of the drainages for both the phase II and III. As the amount of funds disbursed by the Treasury to SLLRDC was often inadequate for the organization to implement the O&M work for the canal and drainage networks, it has been spending its own funds as well. During the year 2007 and 2008, the organization spent a large amount only for the O&M. Except for those years, the amount of expenditure for the O&M on average in recent years has been around 80 million rupees, which is equal to around 65 million Japanese yen, using the exchange rate at the time of the ex-post evaluation. Most of the expenditure was for the O&M of the canals developed by the “Greater Colombo Flood Control and Environmental Improvement Project phase I”. SLLRDC has the opinion that around 10% of the total expenditure has been spent for O&M of the phase II.



DMMC has been allocating funds for the O&M of the drainages developed by the phase III on a priority basis. The O&M budgets have been increasing due to inflation. Currently, the Drainage Unit of the DMMC does not feel there are any problems in implementing the O&M work based on the present amount of allocation.

#### 2.5.2. Current status of operation and maintenance

The main tasks for O&M of the drainages of phase II and III are inspection of the drainages and cleaning of deposits and suspended solids in the water of the drainages.

The following are the tasks currently implemented for the drainages of the phase II:

- SLLRDC has been cleaning out deposits and suspended solids from the outfalls of the drainages, where the water of the drainages runs into canals, when necessary.
- CMC has cleaned the open drainage of Serpentine around once every two years<sup>12</sup>.
- Neither inspection nor cleaning of the underground drainages in Dematagoda, St. Sebastian-2, Unity Place and Torington West has ever been conducted after the completion of the project.

As for the drainages developed by the phase III, the Drainage Unit of DMMC is conducting the O&M work, mainly cleaning, according to the annual plans. The Unit also removed deposits on a priority basis in response to complaints made by the residents. Repair works have also been conducted; for example, broken lids on the side drains were replaced by new ones.

The results of the questionnaire survey showed that 65%–83% of the respondents were dissatisfied with the cleaning currently conducted by the local authorities and relevant government institutions. Residents of the phase II areas were especially unhappy about the current situation. For example, the residents in Serpentine believe that it is absolutely not sufficient to clean the drainage only once every two years.

### 3. Conclusion, lessons learned and recommendations

#### 3.1. Conclusion

Relevance and efficiency of the projects are high and effectiveness is moderate; however some problems have been observed in terms of sustainability. In light of the above, this project is evaluated to be fairly satisfactory.

#### 3.2. Lessons learned

- (1) It is unclear which institution has responsibility for O&M of the drainages of the phase II. Therefore, cleaning of the drainages has not been implemented adequately. This is one of the factors hindering the effectiveness of the project in the areas of the phase II. Considering the fact that not only SLLRDC, but also local authorities have responsibility for O&M of the drainages, it is necessary for projects on flood control to duly study roles and

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<sup>12</sup> CMC cleaned the drainage in Serpentine in response to frequent complaints made by residents of the area, although it considers that it does not have responsibility for O&M of the drainage.

responsibilities of the local authority in the area regarding the O&M. It is also necessary for the projects to assist organizational and technical capacity building of the local authorities, if needed, in order to establish an efficient system of O&M.

- (2) Effectiveness of the phase III, which implemented not only the main drainages but also secondary drainages and side drains, activities to improve water quality and environment, and dredging of the downstream of the drainages, was found to be higher than that of the phase II. It is necessary for a flood control project to adopt a comprehensive approach, which includes activities not only for main drainages but also for other related matters, such as development of secondary drainages and side drains.
- (3) Based on the current situation of the open drainages developed by the project, it was recognized that an open drainage may create environmental and sanitary problems, if garbage dumping and deterioration of water quality of the drainage are not prevented. Therefore, for the construction or improvement of an open drainage, it is necessary to encourage the relevant local authority to conduct periodical garbage collections, not only during the project implementing period, but also after that, as well as urge superior authorities and the Ministry of Environment to conduct effective monitoring and follow-ups of the local authority.
- (4) Evaluation of resettlement programme could not be conducted in the ex-post evaluation for both phases II and III due to the unavailability of information. An executing agency of a project that includes resettlement programme is advised to keep a list of the people resettled, addresses of old and new residences, resettlement procedures, etc, for a certain period, in order to follow up on the living conditions of the resettled people.

### 3.3 Recommendations

<To the executing agency>

- (1) It is recommended that SLLRDC and CMC resume discussions about the transfer of the responsibility of the O&M of the drainages developed by the phase II, and promptly designate a responsible institution for the O&M. It is also suggested that the superior authorities of the two institutions, namely, the Ministry of Urban Development and the Ministry of Local Government, sufficiently facilitate and follow-up the above-mentioned process.
- (2) If it is found that the above-mentioned transfer process will take a long time, it is advised that SLLRDC starts cleaning the underground drainages, which has never been done, and also start periodical cleaning of the open drainage, in consultation with the Ministry of Urban Development. CMC should cooperate in the above-mentioned clean-up work with SLLRDC by offering laborers or budget.
- (3) In order to solve the sanitary problems caused by the open drainage in Serpentine, periodical cleaning of the drainage, regular garbage collection and continuous creation of awareness among the community by strengthening the integrated efforts of the relevant institutions, mainly CMC, are needed. It is also advised that CMC and SLLRDC urge the

Prison Headquarters to remove their sewerage connection to the drainage.

- (4) For further reduction of inundation damages to the shanties in the phase II areas, collective efforts by CMC, SLLRDC and other officials are required to develop secondary drainages and side drains, create awareness among the community and control illegal occupation.
- (5) DMMC is advised to enhance the progress management of O&M works and further promote regular inspections and cleaning.
- (6) SLLRDC and other responsible institutions are advised to conduct technical investigations and take necessary actions to improve the situation for the particular places in the phase III areas, where frequent inundation remains (e.g., Sattisara Mawatha), and where discharged water is stagnated in the drains and causing mosquito breeding.
- (7) SLLRDC and other responsible institutions are advised to implement inundation studies and measurement of water levels at selected observation points regularly in order to examine inundation damages and evaluate effects of the flood control.
- (8) SLLRDC is recommended to identify the households that were resettled by the projects and investigate whether they have any complaints.

<To JICA>

- (1) It is recommended that JICA continues advising responsible Sri Lankan officials to designate a responsible institution for the O&M works of the drainages developed by the phase II and also monitor whether the transfer process is completed and an appropriate system for O&M work has been established.
- (2) The target areas of the phase II and III are different and the effects of the projects do not have any continuity or relationships, although these projects have a common name. Therefore, there is no need to implement a combined ex-post evaluation for these two projects. As the project appraisal of the phase II was conducted around 15 years ago, and the project was completed around 8 years ago, it was not surprising that SLLRDC did not have sufficient and detailed documents of the project, and the officers of SLLRDC involved in the project did not remember precise details about the project at the time of the ex-post evaluation. Effects of the phase II had never been evaluated officially for the last 8 years until the ex-post evaluation was conducted, although there were several issues with regard to the sustainability of the effects of the project, such as the remaining of inundation damages and sanitary problem. With these factors taken into consideration, in order to implement more meaningful and efficient ex-post evaluations, it is recommended that the evaluation should be conducted no later than two years after the completion of each project, as defined in the rules of JICA, even though the names of the projects are the same, as long as there is no particular benefit in conducting a combined evaluation.

### Comparison of Original and Actual Project Scope

Item	Original	Actual
(1) Project Output	<p>&lt; <b>Civil construction</b> &gt;</p> <ul style="list-style-type: none"> <li>• Phase II : Improvement of the five target drainage systems</li> <li>• Phase III : Development of the two target drainage systems</li> </ul> <p>&lt; <b>Community development programme</b> &gt;</p> <ul style="list-style-type: none"> <li>• Programme for families to be relocated</li> <li>• On-site upgrading for families living along the canal</li> </ul> <p>&lt; <b>Procurement of equipment for O&amp;M</b> &gt;</p> <ul style="list-style-type: none"> <li>• Vehicles and tools for cleaning of drainages</li> </ul> <p>&lt; <b>Integrated Environmental Management Programme</b> &gt;</p> <ul style="list-style-type: none"> <li>• Not planned</li> </ul> <p>&lt; <b>Consulting Services</b> &gt;</p> <p>(phase II) Foreign: 160MM, Local: 378MM</p> <p>(phase III) Foreign: 245MM, Local: 456MM</p>	<p>&lt; <b>Civil Construction</b> &gt;</p> <ul style="list-style-type: none"> <li>• Phase II : Improvement of the five target drainage systems</li> <li>• Phase III : Development of the two target drainage systems with design changes taking the convenience of operation and maintenance into consideration</li> <li>• Additional works were conducted as follows: <ul style="list-style-type: none"> <li>▫ Improvement of the upper stream of the drainage system</li> <li>▫ Dredging of Waras Ganga River, which is located downstream of the two drainage systems.</li> <li>▫ An irrigation anicut in the river was removed and a bridge was constructed at a downstream location of Waras Ganga River.</li> </ul> </li> </ul> <p>&lt; <b>Community development programme</b> &gt;</p> <ul style="list-style-type: none"> <li>• Programme for families to be relocated was not conducted</li> <li>• A part of on-site upgrading for families living along the canal was conducted</li> </ul> <p>&lt; <b>Procurement of equipment for O&amp;M</b> &gt;</p> <ul style="list-style-type: none"> <li>• Vehicles and tools for cleaning of drainages</li> </ul> <p>&lt; <b>Integrated Environmental Management Programme</b> &gt;</p> <ul style="list-style-type: none"> <li>• Conducted as additional work</li> </ul> <p>&lt; <b>Consulting services</b> &gt;</p> <p>(phase II) Foreign: 148MM &amp; local: 313MM</p> <p>(phase III) Foreign: 252MM &amp; local: 488MM</p>
(2) Project period	<ul style="list-style-type: none"> <li>• Phase II: July 1994 - September 1999 (63 months)</li> <li>• Phase III: October 1996 - November 2003 (86 months)</li> </ul>	<ul style="list-style-type: none"> <li>• Phase II: July 1994 - June 2001 (84 months)(133% vs. plan)</li> <li>• Phase III: October 1996 - December 2003 (87 months)(101% vs. plan)</li> </ul>
(3) Project cost	<p><b>Phase II</b></p> <p>Foreign currency: 3,330 million yen Domestic currency: 1,843 million yen (830 million rupees) Total: 5,173 million yen ODA loan portion: 4,367 million yen Exchange rate: Rs.1.0=¥2.22 (as of July 1994)</p> <p><b>Phase III</b></p> <p>Foreign currency: 3,899 million yen Domestic currency: 3,960 million yen (2,052 million rupees) Total: 7,859 million yen ODA loan portion: 6,180 million yen Exchange rate: Rs.1.0=¥1.93 (as of October 1996)</p>	<p><b>Phase II</b></p> <p>Foreign currency: 2,639 million yen Domestic currency: 1,594 million yen (1,009 million rupees) Total: 4,234 million yen ODA loan portion: 3,548 million yen Exchange rate: Rs.1.0=¥1.78 (Average between 1994 and 2001)</p> <p><b>Phase III</b></p> <p>Foreign currency: 4,129 million yen Domestic currency: 3,511 million yen (2,317 million rupees) Total: 7,640 million yen ODA loan portion: 5,875 million yen Exchange rate: Rs.1.0=¥1.41 (Average between 1997 and 2005)</p>