

Krueng Aceh Urgent Flood Control Project (I)

Report Date : October, 2002

Field Survey : None

1 . Project Profile and Japan's ODA Loan



Location Map of the Project



River Mouth of Ache River

1.1 Background

Krueng Aceh is a major river in the northern part of Sumatra Island with a length of 145 km and river basin area of 1,775 km², that flows from Suekek Mount through Banda Aceh City toward the Malacca Straits. This river had flooded almost every year, causing significant damage in the Aceh Besar Regency Region (with population of 1.65 million in 1980), including Banda Aceh Municipal. Typically, the flooding covered an area of 25,000 ha, comprising 2,700 ha of residential area, 7,500 ha of paddy field and 4,100 ha of coconut plantations and shepherding meadows.

This situation was caused by a limited river capacity -- 250 m³/sec, compared to the 5-year flood discharge (TR5) ¹ of 1,300 m³/sec. Floods in 1953, 1971, 1978, 1983 and 1986 resulted in severe damage to local communities, and sometimes in loss of life.

1.2 Objectives

To protect the city of Banda Aceh, located in the downstream reach of the Krueng Aceh River, from damage caused by recurrent five-year floods, by improving existing river channels in the section from the estuary to Indrapuri (43 km) and constructing of a new floodway (9.7 km).

1.3 Project Scope

The overall project scope consists of two stages, as shown below. This project corresponds

¹ The terms "5 year" and "50 year" floods are used to describe the estimated probability of a flood event happening in any given year. Using historic weather and hydrograph data, experts derive the estimated rate of flow or discharge of a river or creek. A 10 year flood has a 10 percent probability of occurring in any given year, a 50 year event a 2% probability.

to Stage I.

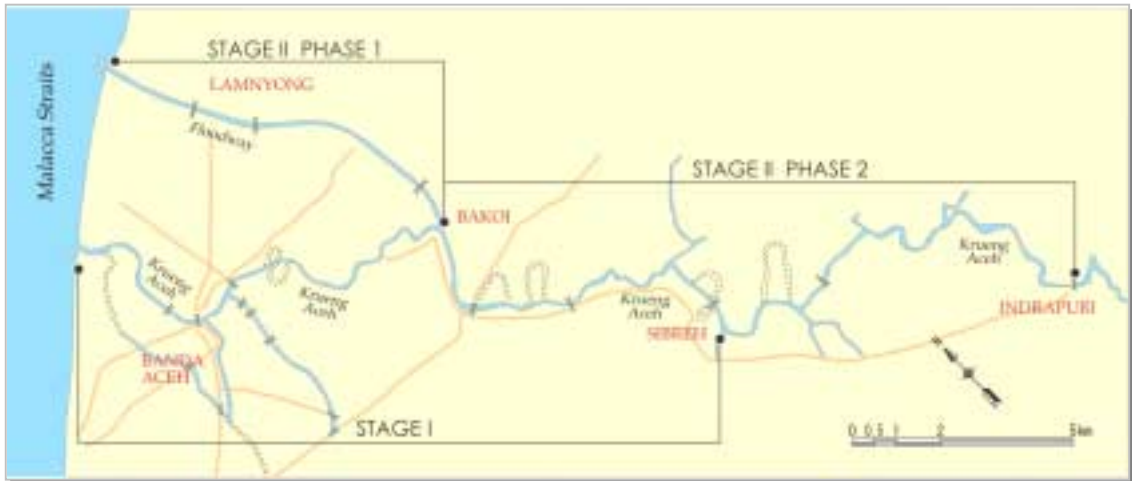
<Stage I>

- (a) Improving the existing river channel from the estuary to Bakoi, including two tributaries of the Daroy and Lueng Paga rivers, and installing a FFWS (Flood Forecasting and Warning System) at three locations.
- (b) Constructing dikes on the left bank of Krueng Aceh River from Bakoi to Sibreh in order to secure the main target area, the center of Banda Aceh, against floods. Dikes would also be constructed on some portion of the right bank.

<Stage II¹⁾>

- (Phase 1) Constructing the floodway from Bakoi to the estuary along the existing Lamnyong River and improving the upper reaches of the river from Bakoi to Indrapuri,
- (Phase 2) Constructing additional dikes on the right bank from Bakoi to Sibreh.

Figure 1: Project map



1.4 Borrower / Executing Agency

The Government of the Republic of Indonesia / Directorate of Water Resources for Western Region, Directorate General of Water Resources, the Ministry of Settlement and Regional Infrastructure (Former Directorate General of Water Resources Development (DGWRD) of the Ministry of Public Works)

¹⁾ Stage II Phase 1 (Floodway) was completed in October 1993, nine months after completion of Stage I. Stage II Phase 2 was to be financed by the Indonesian Government's own funds, but it had not commenced as of 2002 for lack of government funds.

1.5 Outline of Loan Agreement

Loan Amount	4,659 million yen
Loan Disbursed Amount	2,821 million yen
Exchange of Notes/Loan Agreement	April, 1983 October, 1983
Terms and Conditions	
Interest Rate	3.0 % p.a.
Repayment Period (Grace Period)	30 years (10 years)
Procurement	General Untied (Partially Untied for Consulting Service)
Final Disbursement Date	July, 1991

2 . Result and Evaluation

2.1 Relevance

The Krueng Aceh Urgent Flood Control Project was a two-stage project that aimed to improve the existing river course and create a floodway in order to increase the flood control capability of the river basin.

The project purpose --alleviating flood damage in the city of Banda Aceh, the capital of Aceh Besar District-- was one of the most urged needs recognized by the Government at the time of appraisal, considering the chronic inundation in the area. Thus, the Project was considered relevant at that time.

At present, its purpose is consistent with national policy on water resources development i.e., "Conservation of River Channel and Improvement of River Function," and remains relevant.

2.2 Efficiency

2.2.1 Project Scope

There were some revisions and modifications in the scope of works as follows:

- a) Modification of the type of and material for levees, revetments and diversion weirs, the width of the inspection road, and the shape of bridge pillars and foundations.
- b) Incorporation of jetty construction at the estuary of Lamnyong Floodway.
- c) Change of construction method for the culvert drainage foundation, which is connected with the highway.

These revisions and modifications were made considering the efficiencies and effectiveness of: 1) construction methods, 2) river hydraulic factors and 3) economic costs.

2.2.2 Implementation Schedule

The Project (Stage I) was carried out by DWRD, the Ministry of Public Works (reorganized as the Ministry of Settlement and Regional Infrastructure) and completed in

January 1993, about 5 years later than originally scheduled. This delay was caused by:

- 1) a land acquisition problem (cf. 2.4.3),
- 2) design modifications,
- 3) a delay in the tender process, and
- 4) additional construction works.

Among these, the most critical factor was land acquisition.

2.2.3 Project Cost

The total project cost was 4,504 million Yen, well within the amount originally planned (5,253 million Yen). The total loan disbursement was 2,821 million Yen, which is about 60% of the original amount of 4,659 million Yen. The cost under-run of the ODA disbursement is due to depreciation of the Rupiah against the Japanese Yen during project implementation (cf. Comparison of Original and Actual Scope).

2.3 Effectiveness

2.3.1 Flood Control

Table 1 shows historical data for flooding in the project area. Frequent floods occurred prior to the project appraisal (before 1983), but no considerable flooding has occurred since the project completion date (1992). According to the historical data, there was a flood in the upstream area in 1995 that inundated an area of 600 ha. But damage attributed not to levee overtopping, but to water flowing through an irrigation gate opened by mistake in operation, according to a report written by the Project Office. Hence the flood in 1995 was due to human negligence, not to facility capability.

Table 1: Flooding record in the project area**<Before Project >**

	Maximum flood discharge (m ³ /sec)	Flooded area (ha)	Flood damage (10 ⁶ Rp.)	Inundation days (days)	Inundation height (m)
Dec. 1970	500	3,000	320	2	1.0
Jan. 1971	1,100	8,500	720	4	3.0
Dec. 1971	160	1,000	32	1	0.5
Jan. 1972	700	6,500	580	3	2.0
Dec. 1972	180	2,000	43	1	0.5
Jan. 1973	1,000	8,000	780	4	3.0
Mar. 1973	150	1,000	57	1	0.5
Nov. 1973	170	1,500	58	1	0.5
Jan. 1974	600	6,000	1,037	3	2.0
Dec. 1974	160	1,000	77	1	0.5
Jan. 1975	900	7,500	1,400	3	2.0
Mar. 1975	600	6,000	1,200	3	2.0
Dec. 1975	150	1,000	139	1	0.5
Jan. 1976	170	1,500	190	1	0.5
Dec. 1976	150	1,000	180	1	0.5
Feb. 1977	150	1,000	210	1	0.5
Nov. 1977	170	1,500	250	1	0.5
Feb. 1978	160	1,000	300	1	0.5
Jul. 1978	1,300	9,700	6,755	4	3.0
Dec. 1978	1,200	9,700	6,500	4	3.0
Jan. 1979	800	7,000	4,500	3	2.0
Nov. 1979	160	1,000	454	1	0.5
Dec. 1980	140	1,000	609	1	0.5
Jan. 1981	150	1,000	820	1	0.5
Feb. 1982	180	1,500	1,100	1	0.6

<After Project >

	Maximum flood discharge (m ³ /sec)	Flooded area (ha)	Flood damage (10 ⁶ Rp.)	Inundation days (days)	Inundation height (m)
1991	--	--	--	--	--
Year of Completion	--	--	--	--	--
1992	--	--	--	--	--
1993	--	--	--	--	--
1994	--	--	--	--	--
1995	500	600	3,000	2	1
1996	--	--	--	--	--
1997	--	--	--	--	--
1998	--	--	--	--	--
1999	--	--	--	--	--
2000	2,000	2,400	50,000	3	3

Source : SP&FC, Aceh Special Province

In December 2000, there was a large flood with an estimated peak discharge of 2,000 m³/sec, the magnitude of a 50-year flood, which far exceeded the designed discharge level of 1,300 m³/sec, the equivalent of a five-year-period flood. The 2000 flood caused serious inundation in the City of Banda Aceh and in the surrounding area, resulting in 5 people injured or died. The magnitude of the flood was so great that the facilities (levee) could not contain the floodwaters within the river's natural course, and some sections of

the embankment and revetment were heavily damaged (see Figure 2).

In addition, the Project Manager of the Shore Protection and Flood Control Project (SP&FC) of Aceh Special Province, the current operation and management organization of the project facilities, commented that the FFWS (flood forecasting and warning system), installed at three locations, has not functioned well because of mechanical damage since short after completion of the Project. Presently, the system is operated manually, and water level measurements are communicated by phone, not by remote sensing system as planned.

2.3.2 Recalculation of EIRR (Economic Internal Rate of Return)

EIRR of the Project was re-calculated following the assumptions²⁾ made at the time of project appraisal, applying the annual cost data on the actual disbursement basis and adjusting the computation with the economic cost conversion ratio. The EIRR for 50 years of operation was re-evaluated at 12.4%, while the projection at the time of appraisal was 10.5%. The difference results mainly from the cost under-run, around 85% of the original estimate, in the implementation stage.

2.4 Impact

2.4.1 Impact on Economy

It is not easy to analyze the impact of the Project on the economy, even when sufficient macroeconomic data are available. However, when a subsequent project was evaluated in 2000, namely the Krueng Aceh Flood Control Project Stage II Phase I, an interview survey of randomly selected beneficiaries was carried out in an effort to understand their perception of the project's effect and impact. In that survey, 94 out of 100 beneficiaries responded that the flood control projects in the area, including this one (Stage I), had contributed to revitalizing and stabilizing the regional economy, from which it can be inferred that this project is valued for its positive impact on the economy.

2.4.2 Impact on Environment

According to the Project Manager of the SP&FC, no negative environmental impact directly caused by the Project has been observed.

2.4.3 Impact on Society --- Land Acquisition---

During project implementation a total land area of 853 ha was acquired from FY 1985/86 to 1991/92 and compensation of 27,471 million Rupiahs (3,320 Rupiahs/m²) was paid. However, land acquisition was not completed easily. Since most of the owners had inherited their land from ancestors for generations, it took longer than expected to reach an agreement on the land price and compensation rate, according to the current Project Manager. Although negotiations took a long time, landowners eventually started to relinquish their land when they saw that the Project was functioning well. Consequently,

²⁾ There was a flood in 1995 that caused some inundation, although the magnitude was less than a 5 year return period flood. But as the flood was caused mainly by mistake in operation of irrigation system as stated in 2.3.1, in this evaluation, EIRR is recalculated based on the assumption that the project still sustains the original capability to protect the area from flood of 5 year return period magnitude.

the land for the Project was acquired without serious conflict.

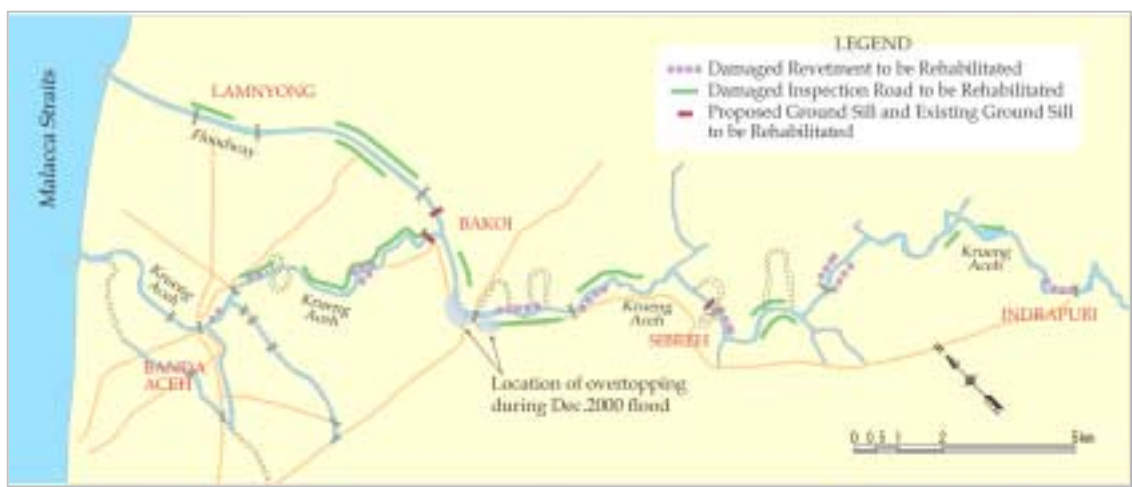
2.5 Sustainability

2.5.1 Current Status of Facility

A field survey could not be carried out during the study period for this evaluation, because of security problems in Aceh.

To get information on the current conditions of the flood control infrastructure constructed under the Project, the survey team invited the Project Manager of the SP&FC, Aceh Special Province, to Jakarta for an interview. In this interview it was confirmed that the Project faces many difficulties. The situation is summarized as follows:

Figure 2 : Current status of the facilities



Source : SP&FC, Aceh Special Province.

- A) Sedimentation in the river channel has been increasing at 1) the river mouth of the floodway and 2) the junction of the floodway and the original river course. Because of this condition, the river channel has shallowed, increasing the likelihood of water overtopping the levees and embankment. This situation is most likely to occur at the river crossing point in Bakoi, where flooding inundated in 2000 when a flood magnitude of 2,000 m³/sec (50-year flood) was recorded after heavy rain.
- B) Damage to existing river structures is a great cause for concern because of: 1) water leakage due to deterioration of the tidal gate, 2) damage to the revetment, levee, ground sill, sluice gate, and other facilities stemming from riverbed degradation, and 3) riverbed degradation, conceivably caused by sand mining on upstream reaches and sand trapped in the existing weir (see Figure 2). The deterioration of river structures may affect surrounding infrastructures such as roads and bridges.
- C) An increase in aquatic weeds has been reported in the Krueng Aceh River. Since water quality is not monitored and controlled, eutrophication has been progressing in the river section closest to the urban area, into which a large quantity of domestic water has been discharged. After the floodway was constructed in Stage II Phase I, the water flow velocity in the existing river section decreased, which might have

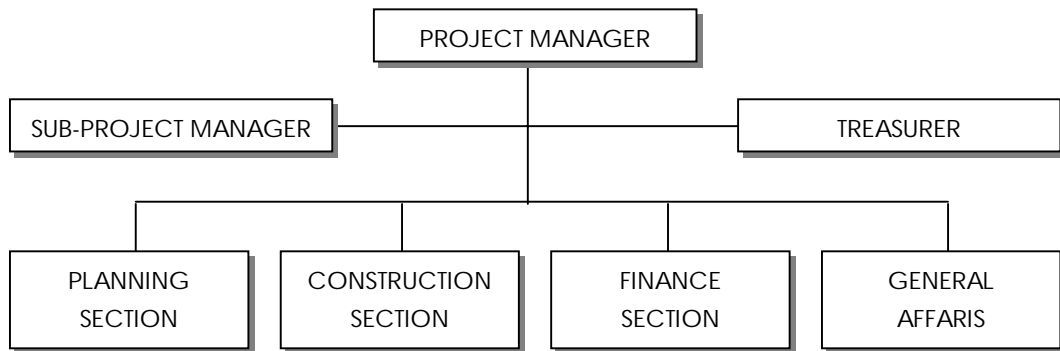
contributed to eutrophication of the river.

This situation requires proper rehabilitation of the damaged facilities as described in B), by reconditioning the damaged gates and repairing concrete structures in order to cope with the deterioration and thereby sustain the original flood control capacity. In response to A) and C), sedimentation in the lower reaches of Krueng Aceh river and the floodway should be excavated appropriately, but an advance study of the mechanism of flood occurrence is necessary as well as water quality monitoring. These countermeasures can be taken if the O&M organization is in sound condition, both in terms of finance and human resources, but the organization has many constraints and difficulties at the moment, as stated below (cf. 2.5.2 and 2.5.3)

2.5.2 O&M Organization

The Central Government recently turned over this project to the Local Government (Provincial Government), and it is presently being managed by the Shore Protection and Flood Control Project (SP&FC) of Aceh Special Province. The actual operating unit is the construction section of SP&FC, where 10 people are working on both construction and O&M (see the organization chart in Figure 3).

Figure 3 : Organization of SP&FC, Aceh Special Province



Source : SP&FC, Aceh Special Province.

Note : Construction Section is actually in charge of the O&M activities for flood control facilities.

According to an assessment by the Project Manager of the SP&FC, the technical capability of the O&M staff is sufficient, but the number of staff members is inadequate. The Project Manager added that since O&M activities are becoming more critical to the performance and effectiveness of the Project, the organization should be rearranged to create a separate section for O&M.

2.5.3 Financial Status

Though the Project has already been transferred to the Local Government, the present O&M body remains financially dependent on the Central Government, given the current, unstable socio-economic situation in Aceh. The budget allocation from the Central Government for O&M activities is as follows:

Table 2 : Budget allocation for O&M (Unit: Rp. million)

1999	2000	2001
75	75	175

Source : SP&FC, Aceh Special Province.

According to the Project Manager, the ordinal budget (75 million Rp.) is sufficient for regular O&M work. Although in 2001 the O&M budget was increased to repair damage caused by the flood in December 2000, this amount was sufficient only for temporary repairs, not for permanent restoration.

2.5.4 Toward the Sustainability

This project has been contributing, to a certain extent, to its objective of protecting the city from damage caused by recurrent floods. However, the project has faced problems and difficulties, as stated above, in maintaining its physical operation, including sedimentation in the lower reaches and structural defects in the revetment and ground sill. If these problems are left unresolved, the facility will, sooner or later, cease to function all together. To cope with this situation, the relevant government authorities (i.e. GOI or Province) should secure sufficient O&M resources (financial and human) so that the project can be managed autonomously, in good condition

3 . Recommendations

Urgent rehabilitation work should be carried out after an inspection on site conditions.

Comparison of Original And Actual Scope

Item	Plan	Actual
(1) Project Scope		
1. River Improvement Works		
1) Construction Package. A	Kr. Aceh from Estuary to Bakoi (13.0 km) Kr. Daroy (2.4 km) Kr. Lueng Paga (4.5 km)	
- Excavation	360,000 m3	762,435 m3
- Dredging	150,000 m3	24,861 m3
- Embankment	270,000 m3	515,161 m3
- Spoiling	240,000 m3	667,728 m3
- Revetment	153,000 m2	129,620 m2
- Groin	28 units	45units
- Sodding	117,000 m2	722,290 m2
- Bridges	3 units	3 units
- Sluices	36 units	64 units
- Inspection Road	10 km	16 km
- Land Acquisition	63 ha	63 ha
- Land Compensation	123 ha	123 ha
2) Construction Package. B	Kr. Aceh from Bakoi to Sibreh (6.94 km)	
- Excavation	502,000 m3	1,203,227 m3
- Embankment	317,000 m3	152,257 m3
- Spoiling	185,000 m3	185,000 m3
- Revetment	85,000 m2	62,169 m2
- Groin	48 units	62 units
- Sodding	76,100 m2	101,172 m2
- Bridges	2 units	2 units
- Inspection Road	15 km	10 km
- Confluence Works	1 site	1 site
- Land Acquisition	33 ha	33 ha
- Land Compensation	116 ha	116 ha
2. Flood Warning System	3 stations (Tanjong, Indrapuri, Lampisan)	3 stations (Indrapuri, Aneuk Galong, Reudeup)
3. Consulting Services	348 M/M	348 M/M
- Foreign Consultant	278 M/M	278 M/M
- Local Consultant	70 M/M	70 M/M
(2) Implementation Schedule		
1. Loan Agreement	Aug.1983	Oct.1983
2. Employment of Consultant	Aug.1983 – Apr. 1984	Aug.1983 – Apr. 1984
3. Procurement of Contractor for Civil Works	Apr. 1984 – Apr. 1985	Apr. 1985
4. Land Acquisition	Jul. 1983 – Jun. 1986	Jul. 1983 – Aug. 1990
5. Construction	Apr. 1985 – Mar. 1988	Apr. 1985 – Mar. 1992
6. Engineering Services	Apr. 1984 – Mar. 1988	Mar. 1985 – Aug. 1989
(Scheduled Completion Date)	Mar. 1988	Jan. 1993

<p>(3) Project Cost</p> <p>Foreign currency</p> <p>Local currency</p> <p>Total</p> <p>ODA loan portion</p> <p>Exchange Rate</p>	<p>4,659 million yen</p> <p>7,643 million yen</p> <p>5,253 million yen</p> <p>4,659 million yen</p> <p>1 Rp. = 0.35 yen (In 1982)</p>	<p>2,821 million yen</p> <p>21,600 million Rp.</p> <p>4,504 million yen</p> <p>2,821 million yen</p> <p>1 Rp. = 0.11yen (Average during 1985-1992)</p>
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Independent Evaluator's Opinion on Krueng Aceh Urgent Flood Control Project

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Current situation in Aceh needs a very serious consideration about the relevant of the project. Protecting the city of Banda Aceh from damage caused by recurrent five-year flood is necessary, but not sufficient. The current day to day situation in Aceh creates more damage than the recurrent five year flood. As a result, the priority and needs of the people of the city of Banda Aceh and Aceh Special Province as a whole need to be reevaluated.

The impact of the project on the economy is questionable. The report stated that it is not easy to analyze the impact of a project on the economy. However, when it comes into conclusion, the report concludes that the project has a positive economic impact. Additional information about the negative environmental impact of the project, such as the deterioration of river structures (which may affect surrounding infrastructures), make the report conclusion about the economic impact of the project sounds quite strange.

Difficulties in land acquisition is usual in Indonesia. This is mainly caused by lack of project dissemination and a very low price of the land. In most cases, the real price of the land differs significantly from it's formal price. As a result, especially under a repressive regime of New Order Indonesia, less conflict in land acquisition should be put into a very serious question. There is a possibility that the society has been repressed by the government to support the project.

Serious attention needs to be put on the sustainability of the project. As in another projects, this problem is mainly caused by the loan driven development policy of the past. Theoretically, the project maybe important, but more important is the role of loan as a source of the project fund.