Indonesia

Padang Area Flood Control Project(2)

Field Survey: July 2003

1. Project Profile and Japan's ODA Loan

Project site location map

Rehabilitated section of the Tabing drainage channel

1.1. Background

The provincial capital of West Sumatra, Padang City had a population of around 590 thousand (as of 1993; the city's population stood at 820 thousand in 2001), and played key roles as the center of political and economic activity in the western part of the Sumatra, and as the strategic point for air and sea routes. Industries in the Padang City and its environs were represented by agriculture and commerce, and the city was becoming increasingly industrialized as the center of development on the island of Sumatra.

Since precipitous mountains were located to the east of the Padang City and numerous rivers flow into the city area, the geographical characteristic often brought floods in the city, causing damage and influence on economic activity. The flood of November 1986, in particular, inundated an area of 3,450 hectares, causing severe damage to 6,100 houses, and 31 thousand people. In this context, a flood control plan was drawn up in 1988 with the cooperation of the Japanese government (engineering services (E/S) by the ODA loan). In the following, the flood control project (Padang Area Flood Control Project (I)) was implemented between 1990 and 1996, aiming at the Arau, Jirak and the other waterways, flowing through the old city area. However, insufficient measures had been taken to mitigate flooding on the rivers flowing through the new city area that is located to the north of the old city with conspicuous population growth. Thus, the implementation of a flood control project targeting the new city area was considered desirable.

1.2. Objectives

(Following the Phase I Project that was implemented / completed ahead,) the project carries out the improvement works on major rivers corresponding to a 25-year flood probability, those on tributaries corresponding to a 10-year flood probability and those on urban drainage channels

corresponding to a 5-year flood probability, with the aim of mitigating the flood damage in the rapidly urbanizing new city area of the Padang City.

1.3. Outputs

The project comprised the civil engineering works and consulting service components outlined below.

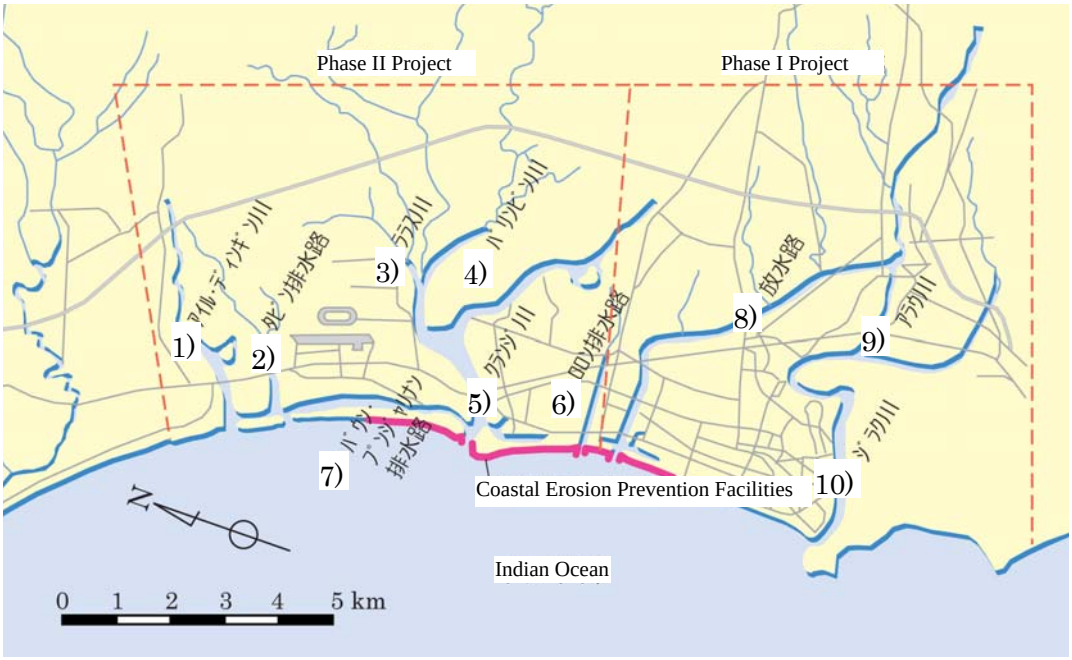
（1） Civil engineering works

- River improvement works corresponding to a 25-year flood probability on mid- and downstream reaches of major rivers (Krunge River and Air Dingin River)
- River improvement works corresponding to a 10-year flood probability on major tributaries (Balimgbing River and Laras River)
- Improvement works corresponding to a 5-year flood probability on urban drainage channels (Tabing, Baung-Penjalinan and Lolong）
- Construction of underground drains, waterfall channels, roads and bridges in conjunction with the aforementioned improvement works
- Coastal erosion prevention facilities (additional)

（2） Consulting services

- Review of the detailed design (D/D), bid assistance and other technical services relating to the construction work, and construction supervision

Figure 1: Map of the areas covered by the project (Padang City)



1) Air Dingin River, 2) Tabing Drainage Channel, 3) Laras River, 4) Balimgbing River, 5) Krunge River, 6) Lolong Drainage Channel, 7) Baung-Penjalinan Drainage Channel, 8) Flood Relief Channel, 9) Arau River, 10) Jirak River

1.4. Borrower / Executing Agency

The Republic of Indonesia / Ministry of Settlement and Regional Infrastructure

1.5. Outline of Loan Agreement

Loan Amount	4,859 million yen
Loan Disbursed Amount	4,811 million yen
Exchange of Notes	December 1995
Loan Agreement	December 1995
Terms & Conditions	
Interest Rate	2.3%
Repayment Date	30 years
(Grace Period)	(10 years)
Procurement	General untied
Final Disbursement Date	December 2001

2. Results and Evaluation

2.1. Relevance

This project was implemented and completed as the successor to the completed Phase I Project (1991-1996: area covered: 1,500ha), the purpose of which was to prevent flooding in the old city area (the Arau, the Jirak and drainage canals). At the appraisal, the sixth five-year national development plan (1994-1999) called for "the implementation of flood control projects in urban areas where population and assets are concentrated and in irrigated agricultural areas", thus the project was highly relevant with the purpose of alleviating flood damage in new city area of the Padang City.

Furthermore, when the project was evaluated, the water resource development and management program incorporated in the national development plan (2000-2004) states the need for the development of infrastructure to control floods and prevent coastal erosion, thereby still ensuring the relevance of this project.

2.2. Efficiency

2.2.1. Outputs

This project carried out improvement works in the Krunge River, the Balimgbing River and the Air Dingin River, which flow through comparatively new city area (residential area), in addition to improvement works at the major urban drainage channels around the river mouths, and the construction of wharfs and revetments designed to prevent coastal erosion. The various works in coastal area were deemed to be relevant as they were designed to protect the lives and property of the Padang City residents from natural disaster. The detailed design for the improvement of the Anai Kandis River was also implemented in the context of the necessity for further flood control measures in the Padang City and its surrounding area.

2.2.2. Project Period

Despite a three-year delay in the relocation schedule[1], the project was completed in November 2001: 8 months behind the original schedule.

2.2.3. Project Cost

The total cost was initially planned to be 6,068 million yen, but the project was completed for 5,773 million. This resulted from efficient ordering due to the depreciation of the local currency and competitive bidding, etc.

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[1] The relocation schedule was delayed because of: 1) an increase in the number of households for relocation (from 660 to 1,066) and a sudden rise in land price / compensation in the wake of the Asian currency crisis, leading to the fact that the initial land acquisition / compensation budget was insufficient; 2) some land owners demanded more compensation than had been provided under government regulation, which required more time than anticipated for adjustments; and 3) in some cases, family members / relatives raised objections after the agreement had been reached with the registered landowner, thereby delaying the agreement process.

2.3. Effectiveness

[Flood Control Effects]

The river improvement and other works undertaken in this project increased the flow capacity of rivers and waterways. In accordance with the initial plans, the flow capacity of the two main rivers (Krunge River: 870m^3/s; Air Dingin River: 600m^3/s) now corresponds to a 25-year flood probability; that of the tributaries to a 10-year flood probability (Balimbing River: 270m^3/s; Laras River: 5m^3/s); and that of urban drainage channels to a 5-year flood probability (Tabing channel: 42m^3/s; Baung-Penjalinan channel: 5.5m^3/s; Lolong channel: 9.5m^3/s); with all subsequently handling the maximum flow rates (for details of the two main rivers, refer to Table 2).

Although it was not possible to obtain official records for the period covering 1994 through 2002, based on the results of interviews with project stakeholders and city residents[2], there have been no report of damage due to the overflow from external water (external overflow hereinafter) on the scale of that witnessed prior to 1993 (Table 3). The project office reports that 215mm of rainfall was recorded over a 24-hour period in February 2003; however, the flow rate of the Air Dingin River was 600m^3/s, corresponding to a 25-year probability. Notwithstanding, no flood damage due to external overflow occurred, except a part of the section at the mouth of the Air Dingin River. Without the improvement works in this project, it would have been possible that a large scale of external overflow occurred due to the shortage of 300 m^3/s of flow capacity; it is considered that the effects of the project have been sufficiently realized[3]. (It should be noted that whilst this rainfall caused localized flood damage due to external overflow in a part of the section at the mouth of the Air Dingin River) (For details, see 2.5 Sustainability).

[2] According to the statements of the 100 beneficiaries questioned in this survey (covering the Nangaro, Padang Utara, and Koto Tangah areas), the flood that occurred in December 1986 remains vivid in their memory, with 32 of the 98 beneficiaries who remember conditions at that time. The area was inundated for 1-2 days, with the depth of 0.5-1.5 meters and tangible damage was to household effects. Whilst the memories of flood / inundation in other years were less distinct, none of the respondents pointed to any damage since 2001. This serves to convey that the damage occurred at the mouth of the Air Dingin River in February 2003 was localized.

[3] Although the construction of embankments was planned, land acquisition was not carried out and thus the embankments had not been improved. According to the project office, under the condition that, in addition to a high tide, the river mouth was blocked due to the sedimentation, the river water flowed backward into the aforementioned area, causing the flood damage due to external overflow.

Table 1: Flow capacities and maximum discharges of main rivers

Year	Krunge River			Air Dingin River		
	Flow capacity (m^3/sec) (a)	Maximum discharge (m^3/sec) (b)	(b)/(a)	Flow capacity (m^3/sec) (a)	Maximum discharge (m^3/sec) (b)	(b)/(a)
1993	450	236	0.52	300	236	0.79
1994	450	316	0.70	300	316	1.05
1995	450	199	0.44	300	199	0.66
1996	450	236	0.52	300	236	0.79
1997 (start)	450	215	0.48	300	215	0.72
1998	600	202	0.34	400	202	0.51
1999	700	199	0.28	500	199	0.40
2000	800	292	0.37	550	292	0.53
2001 (completion)	850	218	0.26	600	218	0.36
2002	870	190	0.22	600	190	0.32
2003	870	-	-	600	600	1.00

Source: Padang Area Flood Control Project Office

*1: The 2003 maximum discharge figure for Air Dingin River is as estimated by the Project Office

Table 2: Past Record of flood damage caused by external overflow

Year	Flooded area (ha)		Details of damage
1981.11	1,444	(549)	No record
1982.12	1,281	(356)	2,280 houses, 11,400 people, 11,325mil. Rp.
1986.11	3,450	(2,386)	6,141 houses, 30,705 people, 30,502mil. Rp.
1988.11	682	(632)	1,214 houses, 6,070 people, 6,030mil. Rp.
1992.02	780	(255)	1,388 houses, 6,940 people, 6,894mil. Rp.
1993.06	1,309	(683)	2,330 houses, 11,650 people, 11,573mil. Rp.
2001 (completion)	0	(0)	--
2002	0	(0)	--
2003.02 (*1)	20	(20)	300 houses, 1,800 people

Source: Padang Area Flood Control Project Office; figures in brackets indicate project areas affected by flooding.

*1: The record for February 2003 is the estimate of the Project Office

Figure 2: Beneficiaries (residents living near the Lolong drainage canal)

Although Floods frequently occurred before, there has been no flood damage (due to over-topping) since the drainage channel was rehabilitated.

According to the interview to beneficiaries, the inundation period in the Padang City was 1-2 days, while flood water now drains off within 1-2 hours as a result of the river improvement and urban drainage channel rehabilitation works in this project. The master plan targeted no flood damage; however, in order to achieve this target, it is necessary to promote the rehabilitation of feeder drainage channels that lead to the main urban drainage. Currently, they cope with the implementation of the rehabilitation works of feeder drainage channels in cooperation with the provincial government's urban development department in order to compensate the budget shortfall in the Padang City that has jurisdiction over the channels. In fiscal 2003, a budget of approximately 12 billion Rp. (allocations from the ADB, GOI and the provincial government) was assigned to the rehabilitation of the Ujung Gurun drainage channel.

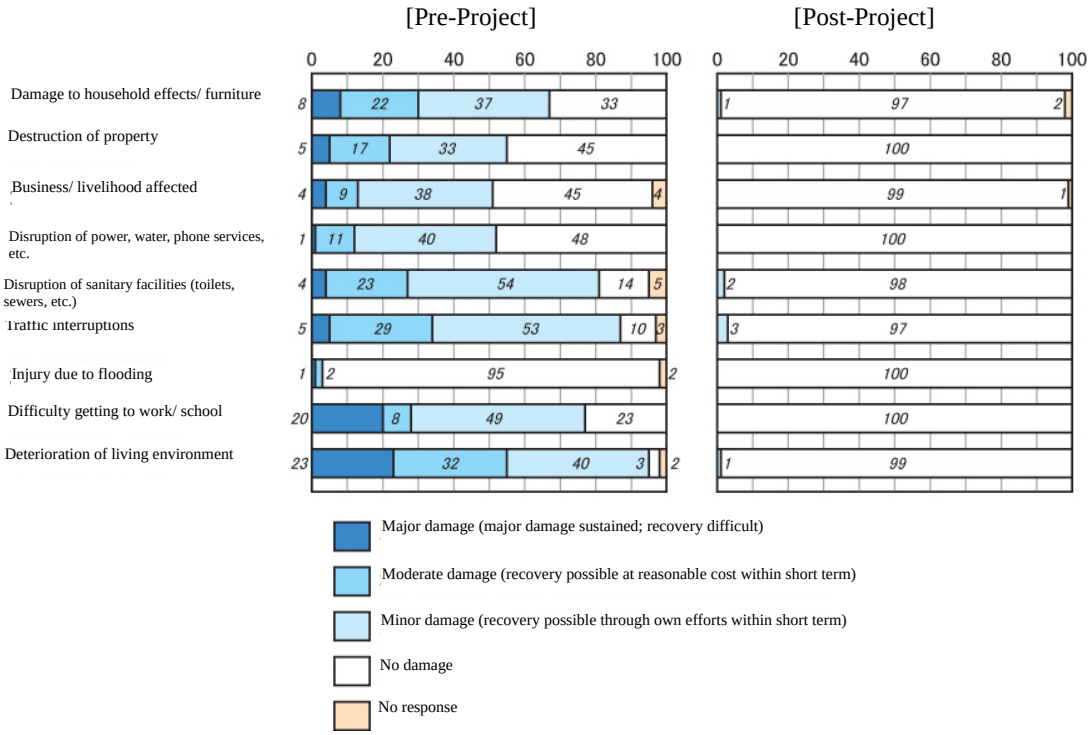
In addition, the coast conservation project (the construction of wharfs and revetments to prevent erosion) was implemented with the aim of conserving properties, having substantial flood control effects. Although the coast was previously eroded at an average rate of 2.2 meters a year, in contrast, there are now signs of recovery (in places, 70 meters of area toward the sea have been restored).

Figure 3: A coast restored by the construction of revetments

A coastal embankment can be seen from the center to the left-hand side of the photograph.

During the field survey, a questionnaire-based survey of beneficiaries awareness was implemented. The evaluation team visited 30-35 households in the Nangaro, Padang Utara and Koto Tangah areas, and obtained responses from 100 individuals. In the survey, the questions were presented such as the record of flood damage and the evaluation of safety in local area, the contents and the degree of effects and impacts due to the project, and additional opinions and requests. Figure 6 shows the results of a comparison of flood damage based on the memories of beneficiaries between before and after the project completion. From the figure, it was confirmed that there has been a considerable decline in flood damage in the target area., including reductions in damage to household effects / furniture (more than 60%) and reductions in damage to property (approx. 50%), etc.

Figure 4: Comparison of Pre- and Post-Project Flood Damage



Source: Compiled from results of the PEDAC2003 beneficiaries awareness survey

The number of beneficiaries in the area covered by both this project and the Phase I project is estimated to be about 820,000 people.

Recalculation of the Economic Internal Rate of Return (EIRR)

The EIRR for the entire project; both the Phase I and Phase II Project, was recalculated to be 16.1%, on the assumption at the time of appraisal[4], while the original EIRR was 15%. The increase in EIRR is attributed to increased benefits due to land development effects (rise in land price), etc., despite an increase in local currency cost.

2.4. Impact

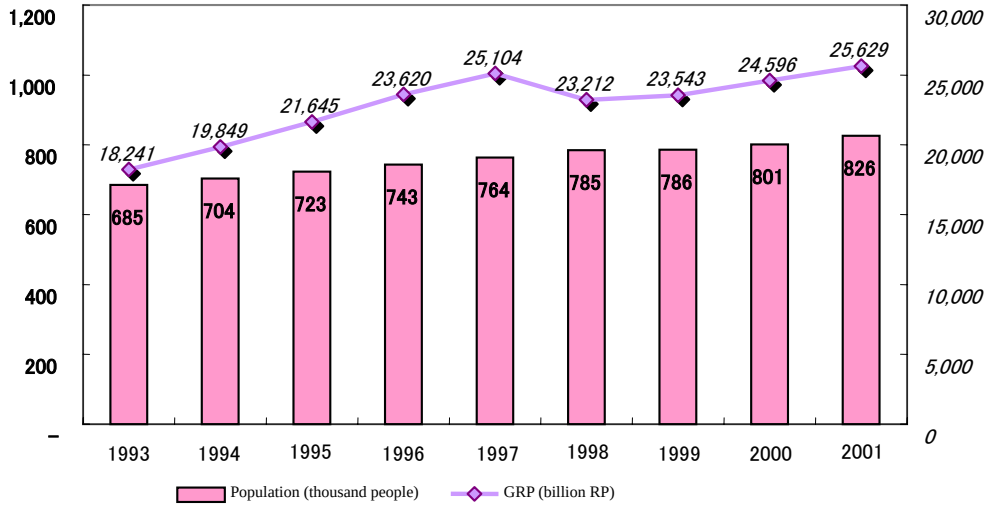
[Socio-economic Impacts (1): Contribution to regional economic activity]

The figure fro induces such as population and gross regional domestic production (GRP) for the Padang City generally continues to increase (despite the temporary drop in GRP recorded at the end of 1997 due to the influence of the Asian currency crisis, there has been a subsequent upward trend) and economic activity in each region is expected to expand. The annual average economic growth rate for the Padang City (1995-2001) is 3.4% and largely exceeds the national average (1.2%). As seen in section 2.3 Effectiveness, there was a major flood in 1993 prior to the project

[4] Besides construction cost, project cost included land acquisition / relocation compensation cost, additional investment cost, and operation and maintenance cost. Benefits were assumed to be the reductions in damage to property and agricultural production and the land development effects of the project.

implementation, which caused a damage of estimated 11.57 billion Rp. (equivalent to approximately 0.6% of GRP for the year). Without the flood control measures in this project, there would likely have been a considerable damage to economic activity in the region, when the flood as of February 2003 had occurred.

Figure 5: Population and GRP for the Padang City (Real GRP on a 1993-price base)



Source: Padang City Statistics Office

[Socio-economic Impacts (2): Incentive to improve land use and property value]

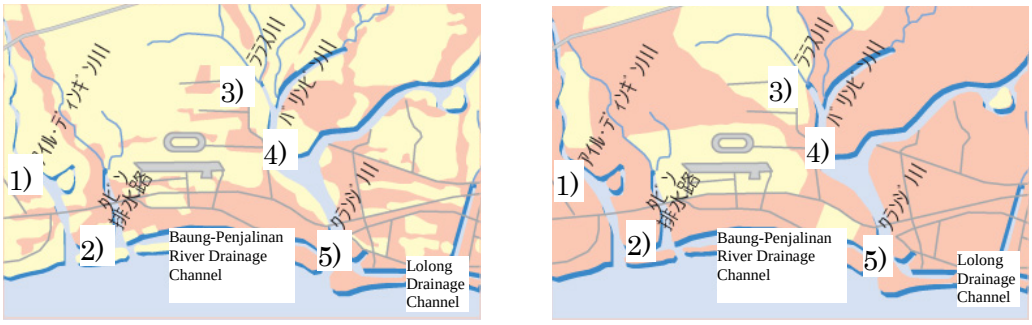
The significant reduction in flood damage has made it possible to build permanent residences on the area that were previously marshy and unsuitable for such construction, which activated the housing and real estate development around the downstream area of the Air Dingin River and peripheral to the Tabing drainage channel. This accompanied with an increase in land price. The land price of the project office site (a backwater area of the Krunge River) has risen from 5,000 Rp /m^2 to 350,000 Rp /m^2 (2003). The land price in residential area around the Lolong drainage channel (an area around the Pangeran Beach Hotel that is frequently used by foreign visitors) has risen from 30,000 Rp/m^2 to 300,000 Rp/m^2. Even bearing in mind an increase in the cost of living during the project implementation[5] there have been a dramatic increase in land price, and property values have climbed due to an improved level of safety in the area.

The improved safety in the area also brought a change in the city's land use plan. The area along the two main rivers where the flood occurred frequently was not incorporated into earlier land use plan of the Padang City. However, the long-term land use plan revised in 2000 (target year 2010) targeted the use of land, including the banks of main rivers (Figure 6). By improving the safety, it is understood to have established the conditions to enable limited inner city space to be utilized effectively.

[5] Taking prices for fiscal 1996 to be 100, the prices for fiscal 2002 were 262.2 (International Financial Statistics Yearbook: IMF).

Figure 6: Changes in Land Use in Area Peripheral to the Main Project Rivers

[Urban area in 1996] **[Plan for Urban area in 2010]**



The pink area represent for urban area use (residential / commercial).The land use plan that was revised in 2000 (right) shows that whilst land around the airport has been designated for recreation (open space) and the upper regions of the river as a water conservation area, almost all other areas are available effectively.

Note: The scope of urban area in 1996 was drawn up based on the "Present Land Use of Padang City (1996)", whilst that in 2010 was drawn up based on the 2010 map of planned land use presented in "Revisi RUTR Kota Padang Th.1983-2003 (revised in 2000).

1) Airdingin River, 2) Tabing Drainage Channel, 3)Lalas River, 4) Balingbing River, 5) Krunge River

[Socio-economic Impacts (3): Recognitions of project beneficiaries]

As a part of the beneficiary awareness survey, respondents were asked about the socio-economic impacts by the river improvement works, etc. in this project. In addition to the aforementioned improvements in land use and property prices (78%), respondents also cited higher levels of quality of life[6] (34%). Moreover, respondents also pointed to the fact that the improvements in the environment surrounding the city's waterways that resulted from the river improvement works, have reduced the incidence of mosquitoes, leading to a decreased likelihood of suffering from dengue fever and other infections that infected and fell ill via mosquitos.

[Environmental Impacts]

Residents in 1,066 households were relocated during this project. Compensation was executed to these residents by the Land Acquisition / Relocation Compensation Committee, which consisted of members from the project office and various municipal government agencies, in conformity with the standards stipulated under Indonesian law. Until now, there have been no complaint of dissatisfaction from any of these residents.

An Environmental Impact Assessment (EIA) study was conducted during 1992-1994 prior to project implementation, and sufficient consideration was to be given for monitoring of the incidence of muddying as well as environmental impacts on animals and plants during the construction work. According to the result of the monitoring during the implementation, despite the fact that the work caused some muddying, the impact of this phenomenon was not so strong as that to induce environmental degradation. Regarding the influence on animals and plants, since there was a section along the Baung-Penjalinan waterway that formed the habitat for a rare bird species (known locally as Kentel), the bank protection work on that section was cancelled in consideration of its impact on animals and plants in the area.

[6] Multiple indices compiled from factors such as increases in income levels and improvements in hygiene conditions.

After the project completion, project stakeholders pointed to the fact that there was no specific problem such as environmental degradation, rather the project had a favorable impact by preventing the erosion of sloping river banks, etc. This was also borne out by the results of the beneficiary awareness survey, with 95 percent of respondents stating that they had no specific concern about the environmental impact of the project, despite some complaints about the incidence of muddying and noise during the project implementation.

2.5. Sustainability

2.5.1. Executing Agency

(1) Technical Capacity

According to the executing agency, whilst there are sufficient personnels, they have no opportunity to receive training and there is room for improvement in the level of technical skills. The project's consulting services covered the creation of an O&M manual, which is believed to have contributed to raising the technical capacity of the executing agency, but the executing agency has expressed its wish for technical transfer through a new project.

(2) Operation and Maintenance (O&M) System

Prior to decentralization, the administrative structure was such that river improvements fell under the jurisdiction of Directorate General of Water Resources, Ministry of Settlement and Regional Infrastructure, whilst urban drainage channels were under the control of the Directorate General of Urban and Rural Development (former Cipta Karya); however, after the decentralization, in principle, the responsibility for the O&M of both rivers and drainage channels was to be transferred to the local government (Padang City). However, the O&M for infrastructure (bank protection infrastructure) on the rivers is not completely transferred from the central to the local government (O&M of urban drainage channels has already been transferred to the local government).

(3) Financial Status

Prior to decentralization, the Padang City Settlement and Infrastructure Bureau had a total annual budget of 30-40 billion Rp.; however, that has subsequently dropped by almost the half (the FY2003 budget is 17 billion Rp.). Although the annual O&M budget for infrastructures related to the project is 0.3 billion Rp., there has been no problem due to O&M funding.

2.5.2. Operation and Maintenance Condition

All the facilities improved / developed in this project are in favorable condition and there are not deemed to be any notable problem with the functions.

3. Feedback

3.1. Lessons Learned

None.

3.2. Recommendations

None.

Comparison of Original and Actual Scope

Item	Planned	Actual
1. Outputs		
Construction work		
1) Urban river rehabilitation work	Rehabilitated section L=22,800 m	15,597 m
- the Krunge River	6,700 m	4,341 m
- the Air Dingin River	3,592 m	2,109 m
- the Balimbing River & the Laras River	4,653 m	3,976 m
- Urban drainage canals	7,855 m	5,171 m
2) River rehabilitation work		
- Excavation work	952,840 m^3	1,078,825 m^2
- Embankment work	421,942 m^3	535,189 m^3
- Filling of old river channels	135,245 m^3	70,376 m^3
- Bank / bed protection work		
Concrete cribs	34,547 m^2	6,611 m^2
Concrete lining	33,980 m^2	16,415 m^2
Gabion	24,672 m^3	4,703 m^3
Groin	15 locations	0
Wet masonry work	--	95,456 m^2
Revetment work on urban Rivers	8,698 m^3	10,641 m^3
3) Structural installation work		
- Dams	5 locations	4 locations
- Underground drains	90 locations	130 locations
- Overflow work	1 location	2 locations
- Intake openings / dams	1 location	2 locations
4) Bridge construction / rehab	18 locations	17 locations
5) Access roads	98,771 m^2	104,447 m^2
6) Gauging stations	4 locations	0
7) Construction of beach conservation structures	--	5,318 m
Consulting Services		
1) Duration	57 months	65 months
2) Division of labor	Foreign consultant: 94 M/M Local consultant: 207 M/M Total: 301 M/M	Foreign consultant: 144 M/M Local consultant: 357 M/M Total: 501 M/M
2. Project Period		
L/A	December 1995	As the left
Consultant selection	July 1995 – June 1996	September 1995 – May 1996
Land acquisition	April 1995 – March 1998	April 1993 – August 2001
Consultant selection		
1) Preliminary survey	July 1996 – September 1996	January 1996 May 1996 September 1999 (Package V)
2) Tender	October 1996 – April 1998	July 1996 – July 1997 October 1999 – March 2000 (P V)
Construction work	April 1998 – September 2000	July 1997 – September 2001
Consulting services		
1) Review of detailed design	July 1996 – December 1996	July 1996 – March 1997
2) Construction supervision	January 1997 – March 2001	April 1997 – November 2001
3) Detailed design for rehabilitation of the Anai Kandis	--	October 2000 – November 2001
3. Project Costs		
Foreign currency	2,445 million yen	1,525 million yen
Local currency	3,623 million yen (80,540 million Rp.)	4,248 million yen (270,871 million Rp.)

Total	6,068 million yen	5,773 million yen
ODA loan portion	4,859 million yen	4,811 million yen
Exchange rate	1 Rp. = 0.045 yen (as of 1995)	1 Rp. = 0.0156 yen (the average during the implementation)

Third Party Evaluator's Opinion on
Padang Area Flood Control Project

Mr. Kusumo A.Martoredjo
Chairman
Indonesia-Japan Economic Committee

Sustainability

In general the Padang Area Flood Control project is very much effective in containing the external overflow due to over-topping from the rivers, so that it can be considered that the long term objectives particularly the socio-economic and environment impacts have been sufficiently realized. Land areas that previously hardly can be used for economic activities are now free from flood and the many people who settled in the areas concerned can have a better life.

The problem of sand sedimentation at the mouth of the Air Dingin river according to the Deputy Head of the Project has been solved and there is no more sand blocking the flow of the Air Dingin River into the sea by constructing jetties along the end banks of the rivers using such technique that made it possible the sand be swept to sea by the downturn of the tide. Subsequently no more flood occurred in the surrounding settlements.

The flood that occurred during the rainy season of 2003 and 2004 are not due to the over-topping of the rivers but due to urban drainage channels that are not effective enough in channeling the surface water caused by the heavy rainfall at certain times only and hardly bring much damage to the city of Padang since the flood subsides within practically short time.

This brings to attention the Operation and Maintenance System of the River Improvement and the Urban Drainage Channels. Up to now the operation and maintenance of the river banks and other infrastructures that was constructed during Phase I and Phase II for flood control and prevention of abrasion of the seashores fell under the Directorate General of Water Resources (Western Region) of the Ministry of Settlement and Regional Infrastructures. Thereby the cost for O&M is born by the Central Government. On the other hand the operation and maintenance of the Urban Drainage Channels fell under the Division of Space Planning and Settlement (Tata Ruang dan Pemukiman) of the Padang Municipal Authority. The Padang Flood Control Management (Badan Projek Pengendalian Banjir) do made the effort to control the outlet of the city drainage that are connected to the flood control canals but it is limited at the most up to 100 meters inward.

As for the funds available for operation and maintenance are very much limited, be it that being borne by the central government as well as the municipal authority. Consequently the management of the Padang Flood Control Project is having difficulties in employing permanent staff and workers. Even though there is no difficulty in finding technically suitable and capable and well qualified persons, it is being impaired by not enough funds available. The management is forced to employ a number of temporary staff and workers with no right for remuneration and other amenities as received by permanent staff and workers. As expected the temporary workers are not very dedicated and whenever there are lack of technical skills it is rather doubtful that it will be useful to train them knowing that they will leave at the first better opportunity that comes by.

Despite the shortage of funds available for operation and maintenance the management of the Padang Flood Control Project does their utmost to maintain and keep the project in good condition and their effort resulted that no more flood caused by overflow due to over-topping of the many rivers that run through the city of Padang. Aside of several bridges, canals, construction of rivers' embankment, dams, jetties and other structures along the seashores as well as road enlargements as part of the projects are added social, economic and environment benefits, some offers places for recreation for the people of Padang and its surrounding.

In our opinion the project is beneficial, while lesson learned is that funds for operation and maintenance should be taken into consideration in the future as well as how to integrate one project with the existing related structures, the synchronization of the O&M management system if it has to be under different authorities.