

People's Republic of China

FY2015 Ex-Post Evaluation of Japanese ODA Loan

“Hubei Urban Flood Control Project”

External Evaluator: Shima Hayase, IC Net Limited

## 0. Summary

This project aims to carry out construction and repairs of dikes, culvert gates, pumping stations, and diversion canals for 18 areas in total including 14 cities and four counties on the Jiangnan Plain in Hubei Province in order to improve the flood control capacity of each city.

Consistency of this project with China's development policies and development needs on the national, provincial, and city levels at the time of the appraisal and the ex-post evaluation as well as with Japan's ODA policy toward China at the time of the appraisal is fully ensured, and thus, this project is highly relevant. Although a substantial change in the scope was made in the middle of this project since a flood control project by domestic funds advanced, the change was made in accordance with the project purpose and the actual outputs in total increased to more than the plan. Although the project costs were within the range of the plan, efficiency is fair due to considerable delay in the project period.

Through this project, flood control facilities with a design to meet the planned highest safe water level at the reference points were constructed in all subprojects<sup>1</sup>, and urban drainage facilities ensured planned drainage capacity.

During the comparison range, rainfall has been within the planned level, and the annual maximum water level and annual maximum were respectively below the highest safe water level and the flood drainage capacity, thus it can be said that predetermined flood safety has been secured<sup>2</sup>. Inundation area and duration, human damages, as well as the amount of maximum damages by levee breach or overflow have decreased sharply accompanying the completion of subprojects and have reduced to almost zero after the completion of all subprojects since 2014. Therefore, the effects yielded by this project can be evaluated as very high. Moreover, it is assumed that the decrease in flood damages has an effect of preventing economic loss of about 3.8 billion yen (about 265 million Chinese yuan<sup>3</sup>) per year on average occurred before the project started, and the impact on the promotion of urban development, promotion of tourism industry, and the improvement of living environment of residents can also be recognized. Accordingly, effectiveness and impact of this project are high.

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<sup>1</sup> Individual project of each city and county carrying out construction, operation, and maintenance of dikes and other facilities under the guidance of provincial government which are included in this project.

<sup>2</sup> However, verification of the effect of the project is based on the confirmation of only the secular change of annual rainfall, and it is not comparable up to the occurrence trend of rainfall.

<sup>3</sup> Conversion was made based on the average exchange rate during a period from 2000 to 2004 at 1 Chinese yuan=14.3 yen.

In general, no major problems have been observed in the institutional, technical, and financial aspects as to the sustainability of the effects yielded through this project, and thus the sustainability is high.

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

## 1. Project Description



Project Location



Dike Constructed (in Chibi City)

### 1.1 Background

The Yangtze River basin is a flood-prone area and serious damages were incurred by large-scale floods in 1931, 1954, and 1998. In the basin development plan *Yangtze River Integrated Flood Prevention Facilities System* (approved by the State Council in June 1999) which was revised reflecting such situations, (1) repairs and strengthening of dikes, (2) improvement of the flood prevention capacity through the construction of the Three Gorges Dam and dams in branches of the Yangtze River, (3) improvement of the mainstream and branches of the Yangtze River and branches of Dongting Lake and Poyang Lake, and (4) prohibition of felling of natural forests, reforestation, and prohibition of slope cultivation were included. Although Hubei Province has been developed as agricultural and heavy industrial areas as well as an transportation hub, the province has historically suffered from floods of the Yangtze River and the Han River, and damages were magnified by such factors as insufficient structure of existing dikes against water leakage and low urban drainage capacity caused by inadequate drainage channels and pumping stations.

### 1.2 Project Outline

The objective of this project is to improve flood control capacity of each city by carrying out the construction and repairs of dikes, culvert gates, pumping stations, and diversion canals of 18 areas in total including 14 cities and four counties on the Jiangnan Plain in Hubei Province, thereby preventing flood damages and contributing to stabilization of society and economy of the areas and to improvement of living conditions of local residents.



Figure 1: Yangtze River, Han River and the Subproject Sites

Loan Approved Amount/ Disbursed Amount	13,000 million yen / 12,509 million yen	
Exchange of Notes Date/ Loan Agreement Signing Date	March 2000 / March 2000	
Terms and Conditions	Interest Rate	0.75%
	Repayment Period (Grace Period	40 years 10 years)
	Conditions for Procurement:	Bilateral Tied
Borrower / Executing Agency	The Government of People's Republic of China/ Hubei Provincial People's Government	
Final Disbursement Date	April 2011	
Main Contractor (Over 1 billion yen)	<ul style="list-style-type: none"> <li>• China Gezhouba Water &amp; Power (Group) CO.</li> <li>• China Water Resources &amp; Hydropower Min River CONST. &amp; ENG. Bureau</li> <li>• Daye City's Hydraulic Engineering Company</li> <li>• Hubei Huaxia Water Conservation &amp; Hydro-Power CO., LTD.</li> <li>• Hubei International Trade Investment &amp; Development CO., LTD.</li> </ul> Xiangfan City's Hydraulic & Hydroelectric Engineering Group (all companies are Chinese)	

Main Consultant (Over 100 million yen)	None
Feasibility Studies, etc.	<ul style="list-style-type: none"> <li>• F/S (Hubei Province Investigation Design &amp; Research Institute of Water Conservancy and Hydropower June 1999)</li> <li>• F/S Final version (Hubei Province Investigation Design &amp; Research Institute of Water Conservancy and Hydropower December 2001)</li> <li>• SAPROF (JICA June – September 1999)</li> </ul>
Related Projects	<p><b>【ODA Loan】</b></p> <ul style="list-style-type: none"> <li>• Hunan Urban Flood Control Project (L/A March 2000)</li> <li>• Jiangxi Urban Flood Control Project (L/A March 2000)</li> </ul> <p><b>【Grant Aid】</b></p> <ul style="list-style-type: none"> <li>• The Project for Improvement of Dikes in Yangtze River (1999 - 2000)</li> </ul> <p><b>【Other International Donors】</b></p> <ul style="list-style-type: none"> <li>• Yangtze Flood Emergency Rehabilitation Project (World Bank 1999)</li> <li>• Yangtze Dike Strengthening Project (World Bank 2000)</li> <li>• Implementing the National Flood Management Strategy (Asian Development Bank 2007)</li> </ul>

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Shima HAYASE, IC Net Limited

### 2.2 Duration of Evaluation Study

The ex-post evaluation study was carried out as follows:

Duration of the Study: May 2015 – January 2017

Duration of the Field Study:

December 14, 2015 – December 24, 2015

April 15, 2016 – April 19, 2016

### 2.3 Constraints during the Evaluation Study

Since this project was implemented in wide areas of 18 cities and counties along the Yangtze River basin, in the ex-post evaluation, the whole picture of the project was grasped by collecting operation and effect indicators of all subprojects through the Ministry of Water Resources and implementing field survey through the survey on major subprojects (six cities<sup>4</sup>). Although local information was collected through interviews and questionnaire survey to subprojects as much as possible, judgment of local operation and maintenance are based on the observation of the situations in the cities for which the field survey was carried out, and therefore, situations of all cities are not reflected.

## 3. Results of the Evaluation (Overall Rating: A<sup>5</sup>)

### 3.1 Relevance (Rating ③<sup>6</sup>)

#### 3.1.1 Relevance to the Development Plan of China

(1) Relevance to the Development Plan at the Time of the Appraisal

In the *10th Five-Year Plan for the National Economic and Social Development (2001-2005)*, which was the national development plan of the People's Republic of China at the time of the appraisal, improvement of the systems for flood prevention and disaster mitigation against floods and flood damages in major areas were the priority issues regarding the development of flood control projects, and it was aimed that flood prevention facilities along seven major

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<sup>4</sup> After discussion with the executing agency, six cities representing regional characteristics, such as cities surrounded by mountains (Xiaogan City, Qianjiang City, Xianning City) and flat lands (Jingzhou City, Chibi City, Huangshi City), were selected from among subprojects whose scale of output was large.

<sup>5</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>6</sup> ③ High, ② Fair, ① Low

ivers<sup>7</sup> including the Yangtze River would reach the standards specified by the nation during the period of the five-year plan.

The basin development plan *Yangtze River Integrated Flood Prevention Facilities System (approved by the State Council in 1999)* placed the highest priority on repairs and strengthening of dikes as the project for preventing and mitigating flood damages of the Yangtze River, reflecting the heavy flood that occurred in 1998. In light of the above, it is fair to say that repairs and strengthening of the flood control infrastructures through this project were fully relevant to the China's National Development Plan at the time of the appraisal.

## (2) Relevance with the Development Plan at the Time of the Ex-post Evaluation

The *12th Five-Year Plan for the National Economic and Social Development (2011-2015)*, which is the National Development Plan of People's Republic of China at the time of the ex-post evaluation, shows a policy to continue strengthening the construction of flood control infrastructure and developing large rivers including the Yangtze River in order to strengthen the flood control, disaster prevention, and disaster deterrence systems. In the *National Water Resources Development Plan (2011–2015)* that was formulated to realize the objective, it was planned: (1) to develop large-scale rivers and lakes including the Yangtze River and construct important hollows and reservoirs that temporarily store flood waters outside the dikes; (2) to construct dikes for branches and improve river roads; and (3) to repair and reinforce dangerous dams and culvert gates, and to construct breakwater and to make comprehensive improvement of river estuaries.

In the *12th Five-Year Plan for the Hubei Province Economic and Social Development (2011-2015)*, which is the Development Plan of the Hubei Province and was formulated reflecting the above, six flood control projects<sup>8</sup> at 12.22 billion Chinese yuan in total were deployed for strengthening the construction of flood control, disaster prevention, and disaster deterrence systems.

In light of the above, the strengthening of the flood control / flood prevention capacity continues to be a priority area of both the national and provincial development plans also at the time of ex-post evaluation, and thus, this project has been highly relevant.

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<sup>7</sup> Haihe River, Liaohe River, Huaihe River, Yellow River, Songhuajiang River, Yangtze River, and Zhujiang River

<sup>8</sup> Six projects were implemented during the *12th Five-Year Plan for the Hubei Province Economic and Social Development (2011-2015)* which included: Han River Short-Term Priority Project (6,980 million Chinese yuan); Dan River Improvement Project (510 million Chinese yuan), Tangbai River Improvement Project (190 million Chinese yuan); Jingnan Four Rivers Improvement Project (4,270 million Chinese yuan); Yuan River Improvement Project (210 million Chinese yuan); and Lishui River Improvement Project (60 million Chinese yuan).

### 3.1.2 Relevance to the Development Needs of China

#### (1) Relevance to the Development Needs at the Time of the Appraisal

In Hubei Province, large-scale rivers, such as the Yangtze River and the Han River, are adjacent to large cities, and those cities usually suffered from flood damages during the rainy season because rainfalls are concentrated in the summer season. Meanwhile, existing urban drainage facilities, such as dikes, drainage channels, and pumping stations, failed to satisfy flood prevention standards (recurrence interval<sup>9</sup>) in 90% or more of the cities, which became a factor of expanding flood damages.

In the large-scale flood that occurred in 1998, the Yangtze River recorded the highest ever water level at 32.09 m, causing damages along the basin to extend to about 223 million afflicted people and damages of about 3 trillion yen (approximately 200 billion Chinese yuan<sup>10</sup>) in total<sup>11</sup>. As can be seen, safety of local residents was threatened and severe economic losses were incurred, and thus the need for flood control measures was very high.

#### (2) Relevance to the Development Needs at the Time of the Ex-post Evaluation

In 2010, the second highest water level following 1998 was recorded at 31.94 m at the Yangtze River due to heavy rain, causing damages including: 18.21 million afflicted population; 100,000 collapsed houses; about 100 fatalities; and economic loss at 27.35 million yen<sup>12</sup> (2.11 million Chinese yuan) in the province<sup>13</sup>. Threats of seasonal rise of river waters and concentrated heavy rains still exist on the Yangtze River and other large rivers, and thus, at the time of ex-post evaluation, this project has been highly relevant to the country's and the province's development needs of expanding dikes and urban drainage facilities into wide areas of the entire large-scale river basin.

### 3.1.3 Relevance to Japan's ODA Policy

At the time of the appraisal, in the *Second Country Study for Japan's Official Development Assistance to the People's Republic of China (1998)*, the *Japan International Cooperation Agency* (hereinafter referred as to JICA), in which an economic cooperation program for China was studied, a proposal was made to shift the focus area of economic cooperation for China from conventional assistance such as economic infrastructures to "reduction of poverty

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<sup>9</sup> Prevention standards or capacities to be achieved by the dikes. It is expressed as the probability that a flood that exceeds a certain size will occur.

<sup>10</sup> Conversion was made based on the exchange rate according to materials at the time of the appraisal at 1 Chinese yuan=15 yen.

<sup>11</sup> Materials provided by JICA

<sup>12</sup> Conversion was made based on the average exchange rate in 2010 at 1 Chinese yuan=12.96 yen.

<sup>13</sup> Statistic value by Hubei Provincial Water Resources Bureau

and interregional disparities,” “environmental conservation,” “agricultural development and food supply,” and “establishment of a systematized market economy” where China’s self-efforts are difficult to reach. In addition, the “Fourth Round of Loan Assistance (1996 – 2000)” placed its focus on the environment, food, and poverty measures, in addition to conventional economic infrastructures, targeting inland China. Furthermore, the *Medium-Term Strategy for Overseas Economic Cooperation Operations (1999-2002)* designated its focus areas on (1) support for poverty reduction and economic and social development, (2) efforts for working on global problems, and (3) support for economic structural reform.

In light of the above, this project corresponds to measures toward environmental conservation and reduction of poverty and interregional disparities in inland China, and thus this project was confirmed to be consistent with Japan’s ODA policy and JICA’s assistance policy at the time of the appraisal.

#### 3.1.4 Relevance to Appropriateness of Project Planning and Approach

At the time of the appraisal, subprojects of this project were selected under the following selection criteria and 18 cities and counties were finally determined through field survey by flood control experts. The selection, in which socio economic criteria were taken into account, was appropriate in accordance with needs of flood control measures.

##### Selection criteria of subproject

- (1) Importance: From population and other social indicators, important areas in terms of safety of citizens and economic stability
- (2) Threat of floods: the areas where serious damages were inflicted by floods of 1996 and 1998 in particular
- (3) Economic rationality : areas where social and economic benefits in line with infrastructure improvements are expected
- (4) Financial feasibility: existence of capability to repay loan and procure funds

Source: Hubei Provincial ODA Loan Urban Flood Control Project Managing Office

A substantial change in the scope occurred in the middle of project implementation (for details of the change, please refer to outputs in 3.2 Efficiency). The largest change was made due to the reason that the Feasibility Study (hereinafter referred as to F/S) was replaced from a preliminary version of F/S at the time of the appraisal (June 1999) to a revised version of F/Y (December 2001) that was formally approved by the National Development and Reform Commission (NDRC) in 2002. This change occurred since facilities with high priority had



been constructed by domestic funds in advance immediately after the appraisal<sup>14</sup>.

Although this change was substantial, including the withdrawal of Wuhan City that accounted for almost a half of the new construction and repairs of dikes, the construction moved forward without obtaining a formal prior consent of JICA. It seems that closer communication and coordination were necessary between the executing agency of the Hubei Province and JICA. However, the problem is not taken into consideration for the relevance rating, because the final scope was in accordance with the project purpose and the change was made in such a manner as not to substantially damage the project's effects.

In light of the above, the improvement of infrastructures for strengthening flood prevention and flood control capacity is a priority area of the development plans and development needs of China, the Yangtze River basin, and the Hubei Province at the time of the appraisal and the ex-post evaluation and is also highly relevant with Japan's ODA policy at the time of the appraisal. Therefore, the relevance of the project is high

## 3.2 Efficiency (Rating ②)

### 3.2.1 Project Outputs

#### (1) Plan and Actual of the Project Outputs

At the time of the appraisal (1999), it was planned to construct and repair dikes, culvert gates, and pumping stations in 18 areas in total including 14 cities and four counties on the Jiangnan Plain. Actually, flood prevention facilities including dikes, flood prevention walls<sup>15</sup>, and dike roads, and urban drainage facilities including culvert gates and sluiceways, pumping stations, diversion canals, and sewers were constructed in 17 areas except Wuhan City that was excluded from the scope at the initial stage of the project.

When comparing the plan at the time of the appraisal with the actual achievement, a total extension of flood prevention facilities<sup>16</sup> increased to 453.7 km (112% over the plan). In case of urban drainage facilities, although the distance of renovation work of diversion canals was shortened to 53% of the plan to 40.5 km, the distance of newly constructed diversion canals<sup>17</sup>

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<sup>14</sup> In November 1999, the Ministry of Water Resources of the People's Republic of China added 690 million Chinese yuan of budget for the construction of dikes at priority area of the Yangtze River basin. By using the budget, a project at Wuhan City, construction of dikes at Huangshi City, and construction of flood prevention walls at Xiangfan City that had been planned in this project were carried out in advance. Accordingly, these were excluded from the scope of this project.

<sup>15</sup> Measures to prevent floods by constructing buffer walls or wave preventive walls at rapid streams of rivers or lowlands which are more likely to be damaged by floods by heavy rains and during flood seasons.

<sup>16</sup> Since classification method of each item differed between the time of the appraisal and ex-post evaluation, the comparison between the plan and actual result is made based on the total extension of culvert gates.

<sup>17</sup> New construction of diversion canals created the water flow leading to rivers or lakes from moats where waters were present in cities, which not only improved the flood control capacity but also contributed to environmental improvements such as water quality improvement and elimination of bad odor of rivers.

was 15.7 km (462% over the plan). The number of new construction and renovation of culvert gates and sluiceways was 106 locations (663% over the plan), the number of pumping stations was added one location to 15 locations, and other facilities which were not included in the plan were constructed actually at 23 locations. Although a substantial reduction of scope occurred due to the withdrawal of the largest subproject (Wuhan City) immediately after starting the project, subprojects of five cities were added into the scope, and project outputs have increased as a whole.

Table 1: Plan and Actual of the Flood Prevention Facilities

(Unit: km)

		Plan at Appraisal (1999)				Actual (2015)						Plan/ Actual Ratio
		Dikes		Others	Subtotal	Dikes		Flood Prevention Walls		Others <sup>18</sup>	Subtotal	
		New	Renovation	Renovation		New	Renovation	New	Renovation	Renovation		
1	Wuhan City	0	59.5	0	59.5	0	0	0	0	0	0	0%
2	Jingzhou City	0	48.0	6.6	54.6	0.1	34.1	11.5	0	27.0	72.7	133%
3	Huangshi City	0	28.2	0	28.2	0	0	0	0	0	0	0%
4	Huanggang City	/				/						—
5	Xiangfan City	0	26.1	18.5	44.6	0	26.1	0	0	4.5	30.6	69%
6	Xiaogan city	0	56.9	0	56.9	0	56.9	0	0	16.0	72.9	128%
7	Xianning City	5.3	12.5	6.5	24.2	2.1	8.8	6.6	0	7.3	24.9	103%
8	Xiantao City	0	13.0	0	13.0	0	13.0	0	0	7.5	20.5	158%
9	Qianjiang City	0	9.4	0	9.4	0	20.6	3.7	0	9.5	33.8	360%
10	Zhongxiang City	0	24.2	0	24.2	0	24.2	0	0	24.2	48.4	200%
11	Shayang County	0	14.9	0	14.9	0	7.5	5.0	0	23.1	35.6	239%
12	Chibi City	6.7	1.0	0	7.7	0.1	7.8	7.1	1.2	8.1	24.3	315%
13	Yuanan County	4.0	0.4	0	4.4	2.3	0	1.8	0.4	0	4.4	100%
14	Anlu City	3.9	2.8	1.5	8.2	3.0	2.5	4.6	0	8.1	18.2	222%
15	Xiaochang County	4.5	14.1	0	18.6	0	12.7	0.4	2.3	25.8	41.2	221%
16	Daye City	2.1	0.4	0	2.5	0	7.0	0.6	0	7.7	15.3	612%
17	Yunmeng County	0	25.6	0	25.6	0	1.5	0	0	0	1.5	6%
18	Danjiangkou City	0	7.0	0	7.0	0	0	4.5	0	5.0	9.5	136%
<b>Total</b>		<b>26.5</b>	<b>344.0</b>	<b>33.1</b>	<b>403.5</b>	<b>7.5</b>	<b>222.8</b>	<b>45.8</b>	<b>3.8</b>	<b>173.8</b>	<b>453.7</b>	<b>112%</b>

Source: Materials provided by Hubei Provincial ODA Loan Urban Flood Control Project Managing Office

Note: Since the figures are rounded off to the first decimal place, there are some part which does not agree with the total on the number.

<sup>18</sup> Including evacuation routes at the time of flood and pathways created in the middle section of dikes, etc.

Table 2: Plan and Actual of the Urban Flood Control Facilities

Unit	Plan at Appraisal (1999)				Actual (2015)				
	Culvert Gates	Pumping Station	Drainage Channels		Culvert Gates / Sluiceways	Pumping Station	Sewers and Drainage		Others
	New / Renovation	New/ Renovation	New	Renovation	New / Renovation	New /Renovation	New	Renovation	
	locations	locations	km	km	locations	locations	km	km	locations
1 Wuhan City	0	1	0	0	0	0	0	0	0
2 Jingzhou City	0	2	0	0	22	2	0	11.8	5
3 Huangshi City	0	2	3.4	9.0	0	3	9.3	0	0
4 Huanggang City	0	2	0	0	1	2	1.8	0	0
5 Xiangfan City	11	0	0	0	11	0	0	0	0
6 Xiaogan city	0	2	0	0	32	2	3.0	0	0
7 Xianning City	0	0	0	0	5	0	0	0	0
8 Xiantao City	1	0	0	14.6	3	0	0	0	1
9 Qianjiang City	0	1	0	12.3	1	1	0	18.3	0
10 Zhongxiang City	0	2	0	0	1	2	0	0	0
11 Shayang County	2	0	0	15.8	2	0	0	2.0	1
12 Chibi City	0	1	0	0	8	1	0	0.9	0
13 Yuanan County	0	0	0	0	1	0	1.6	5.1	4
14 Anlu City	0	0	0	1.5	4	0	0	0	2
15 Xiaochang County	0	0	0	23.5	14	0	0	2.3	0
16 Daye City	0	1	0	0	1	2	0	0	0
17 Yunmeng County	2	0	0	0	0	0	0	0	0
18 Danjiangkou City	0	0	0	0	0	0	0	0	10
<b>Total</b>	16	14	3.4	76.7	106	15	15.7	40.5	23
<b>Appraisal/Actual Ratio</b>					<b>663%</b>	<b>107%</b>	<b>462%</b>	<b>53%</b>	—

Source: Materials provided by Hubei Provincial ODA Loan Urban Flood Control Project Managing Office

Note: Although the names of classification differ between the time of the appraisal and the ex-post evaluation, names in the actual values are described more precisely and the same facilities are indicated virtually according to the explanation of the executing agency. However, there were no item of “Others” at the time of the appraisal and they were added by the change during the project implementation. Specifically, bridge and other facilities are included.

During the project implementation, a substantial change of the scope was made as follows.

(2) Change of F/S

The contents of the change of F/S replaced in 2001 are summarized as shown in Table 3. Replacement was made because high priority facilities were constructed by domestic funds

after the appraisal. Renovation of 59.5 km of dikes and construction of pumping stations planned in Wuhan City, construction of dikes at Huangshi City etc. were excluded from this project.

Table 3: Change in Replaced F/S

Items	F/S at Appraisal (1999)	Replaced F/S (2001)	difference
Number of the Target Cities and Counties	18 cities/counties	17 cities/counties	- 1 city
Total Length of the New Dikes	26.5 km	7.5 km	- 19 km
Total Length of the Renovated Dikes	344 km	235.35 km	- 108.65 km
New/Renovate Pumping Stations	14 locations	15 locations	+ 1 locations

Source: Materials provided by Hubei Provincial ODA Loan Urban Flood Control Project Managing Office

### (3) Cancellation of Outputs

In April 2005, the executing agency determined the cancellation of the plan of constructing 14 km of dike and culvert gates at two locations in Yunmeng County at the stage when 1.5 km of dike had already been constructed, and the plan was excluded from the scope of this project<sup>19</sup>. The reason for the cancellation was that although resettlement of 48 households was planned at the planned construction site of flood prevention facilities, the compensation costs exceeded the financial capacity of the county and the payment became impossible. In 2011 when financial resources and funds of the county were secured, the dikes and culvert gates originally planned in this project were constructed by domestic funds, and the flood prevention standards which Yunmeng County targeted were attained.

### (4) Addition of Project Outputs

As an alternative to the cancelled subproject of Wuhan City, outputs of five cities were added in 2009 (Table 4). This addition was made because the necessity of improving flood protection capacity arose accompanying the creation of a new development district<sup>20</sup>, and construction needs of dikes and protection walls arose to cope with the new protection standards of Jingzhou City, Chibi City, and Daye City that became higher than the time of appraisal in 2009. Therefore, this change was in accordance with the objective of this project and it was the change that heightened the effects of the project further.

<sup>19</sup> This change proceeded without receiving prior approval of JICA, and the fact was found out at the time of the ex-post evaluation.

<sup>20</sup> In China, according to the local development plan, barren lands are appointed in the new development area, and are developed. Output of the Project was added because higher flood prevention standards were adopted to the newly developed areas in the cities.

Table 4: Contents of Addition of Outputs at Five Cities and Reasons for Addition

Name of City (approval date) Amount applied for additional budget	Flood prevention facilities	Urban drainage facilities	Reasons for addition
Jingzhou City (July 2009) 511 million yen	0.1 km of dike, 4.6 km of revetment road	Culvert gates at four locations	New construction of culvert gates and dikes is necessary at upstream areas to adjust water amount through separate sewer systems and to reduce flood risks. Repairs of drainage channels of the areas not satisfying the standards are necessary.
Qianjiang City (July 2009) 725 million yen	11.2 km of dike, 3.7 km of flood wall, 2.1 km of emergency evacuation road	12.2 km of sewers and drainage	Dikes that do not satisfy drainage capacity and do not have emergency evacuation roads exist in the newly developed district.
Chibi City (February 2009) 761 million yen	2.3 km of dike, 2.8 km of flood wall	Culvert gates at four locations	Districts where dikes are not constructed exist in the City. Also, the flood prevention capacity of the newly developed district does not meet the probability of 50 years of flood prevention standards. Culvert gates are necessary because a problem of deposition of sediments exists.
Anlu City (July 2009) 498 million yen	2.8 km of dike, 0.9 km of flood wall	Culvert gates at two locations	Construction of dikes and flood walls is necessary because the newly developed district that was constructed does not meet flood prevention standards. Culvert gates for drainage are necessary at these intersections.
Daye City (February 2009) 723 million yen	5 km of dike, 5.7 km of emergency evacuation road	Pumping station at one location	Dikes that are lower than the design water level exist, and they are required to be strengthened. There are also dikes whose emergency evacuation roads are not constructed.

Source: Materials provided by JICA

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The planned project cost at the time of the appraisal was 23,920 million yen (3,133 million Japanese yen in foreign currency; 20,787 million Chinese yuan in domestic currency). The actual project cost was 18,660 million yen (1,538 million Japanese yen in foreign currency; 17,122 million Chinese yuan in domestic currency), which was within the budget (78% of the planned amount) despite the increase in project outputs. The reasons are because: the amount of material unit prices, etc. was estimated higher when formulating the budget; and efforts were made to save costs through implementation of international bidding and bulk purchase of materials, if possible.

### 3.2.2.2 Project Period

The actual project period was from April 2000 to April 2015 (181 months), which substantially exceeded the project period from April 2000 to December 2005 (69 months) planned at the time of the appraisal (262% over the plan). The main reasons were: start of civil engineering work was delayed because it took 152 months for the resettlement which had been planned to be completed in six months; and the period of civil engineering work was extended accompanying the addition of project outputs of five cities in 2009.

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

The economic internal rate of return (EIRR) was re-calculated<sup>21</sup> based on the construction cost, operation and maintenance costs, and actual amount of damage, etc.<sup>22</sup> provided by the executing agency, which resulted in 9.88% at the time of ex-post evaluation against 7.84% at the time of the appraisal (Table 5). Before completing this project, average loss of about 3.8 billion yen (271.47 million Chinese yuan)<sup>23</sup> was incurred per year as a total for the 17 cities; however, damages were mitigated and the amount of loss was reduced to almost zero at the time of the ex-post evaluation. It is almost at the same level of the social discount rate used by most international organizations (10% to 12%), and it also indicates that the project generates higher benefits than the general EIRR of projects against floods in China, which is 6% to 7%. Since damages by levee breach or overflow were serious in Hubei Province, it explains that the project to mitigate such damages was highly significant from the social point of view also.

Table 5: Comparison of EIRR at the Appraisal and the Ex-post Evaluation

Plan at Appraisal (1999)	Result at Ex-post Evaluation (2015)
<b>EIRR 7.84%</b>	<b>EIRR 9.88%</b>
Prerequisite • Cost : Construction, Operation and Maintenance • Benefit: Damage Amount Assumption • Project Life : 50 years	Prerequisite • Cost : Construction, Operation and Maintenance • Benefit: Damage Amount • Project Life : 50 years

Source: The evaluator re-calculated according to the data provided by Hubei Provincial ODA Loan Urban Flood Control Project Managing Office

In light of the above, although the project costs were within the plan, the project period

<sup>21</sup> Although the EIRR values at the time of the appraisal and the ex-post evaluation were presented from the executing agency, numerical ground and calculation method of benefits and operation and maintenance costs were unknown. Therefore, re-calculation was made by using the plan and the actual for the construction costs and by using the actual value of benefits up to the time of the ex-post evaluation.

<sup>22</sup> Based on data provided by 17 cities and counties, average value of annual flood damages from 2000 to 2004 before the completion of the project was used for the benefits, and the total value of costs that were actually incurred in 17 cities and counties was used for operation and maintenance costs.

<sup>23</sup> The average amount of flood damages per year based on data provided from 17 cities and counties.

substantially exceeded the plan, and therefore, efficiency of the project is fair.

### 3.3 Effectiveness<sup>24</sup> (Rating:③)

#### 3.3.1 Quantitative Effects (Operation and Effect Indicators)

Although no indicators were set at the time of the appraisal, upon agreement with the executing agency, operation indicators for this evaluation are set to measure how project outputs contribute to the improvement of the flood control capacity at the subproject implementation areas. Specifically it was checked whether the annual highest water level and annual maximum flow volume at the reference point<sup>25</sup> of each subproject fall within the range of planned highest safe water level and flood drainage capacity, provided that external factors (such as rainfalls) is within the range of the planned scale. In addition, flood prevention standards (recurrence interval) and prevention of damages by levee breach or overflow are positioned as effect indicators.

##### (1) Operation Indicators

###### 1) The Planned Highest Safe Water Level<sup>26</sup> and the Annual Highest Water Level at a Reference Point

If the annual highest water level at a reference point is lower than the planned highest safe water level, this means that if rainfall is within the range of the post records, the safe water level is being maintained. Out of 15 subprojects excluding cancelled Wuhan City, and Yunmeng City and Huanggang City whose construction of flood prevention facilities was not included in the scope, seven subprojects<sup>27</sup> had a design where the planned highest safe level exceeded the highest water level before the start of the project. Eight other projects<sup>28</sup> were in a dangerous situation where the annual highest water level exceeded the planned highest safe level. After the project implementation, the annual highest water level is within the planned highest safe water level in seven subprojects except Anlu City<sup>29</sup>.

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<sup>24</sup> Rating for Effectiveness is to be put with consideration of Impact.

<sup>25</sup> Observed values at the reference points set in the areas where rivers were improved and in which the relevant project areas are included.

<sup>26</sup> The highest water level considered flood prevention facilities can endure. Dikes are designed to drain the water under the water level safely. In China, the standards are changed in accordance to the modification of the city development plan. For reasons such as the farm land being developed to a residential area, or the area has a record breaking scale of rain fall and flood, etc., the standards are strengthened progressively. In the areas of the subprojects other than that of figure 2, the standards were strengthened progressively, too.

<sup>27</sup> Seven cities and counties of Jingzhou City, Huangshi City, Xiangfan City, Xiaogan City, Zhongxiang City, Shayang County, and Chibi City fall under this category.

<sup>28</sup> Eight cities and counties of Xianning City, Xiantao City, Qianjiang City, Yuanan County, Anlu City, Xiaochang County, Daye City, and Danjiangkou City fall under this category.

<sup>29</sup> In Anlu City, the annual highest water level at the reference point exceeded the planned highest safe water level by 0.1 – 0.3 m from 2013 to 2015, but damages by levee breach or overflow did not occur since urban drainage functions were strengthened under this project.

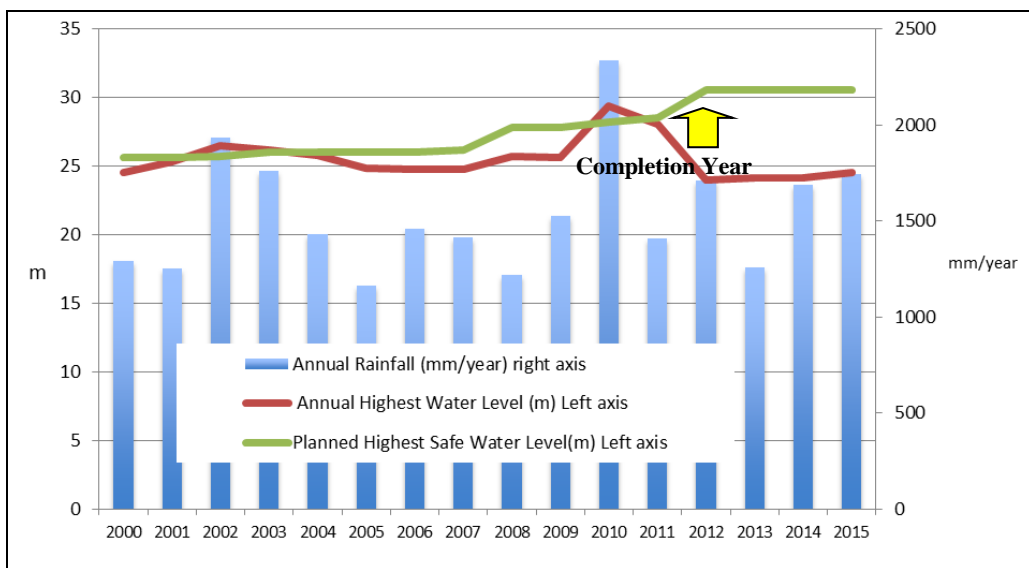


Wave-dissipating concrete blocks (Qianjiang City)



Dike and culvert gate (Xiaogan City)

Looking at Xianning City as an example, the annual highest water level exceeded the planned highest safe water level before the project completion in 2002, 2003, and 2010 when outstanding precipitation was recorded. After the project completion, the highest water level of 2012 and 2015, when precipitation recorded almost at the same level with 2003, was substantially lower than the planned highest safe water level and the threat of flood could be avoided by a difference of 5 m or over.



Source: Materials provided by Hubei Provincial ODA Loan Urban Flood Control Project Managing Office

Figure 2: Transitions of Planned Highest Safe Water Level and Annual Highest Water Level of Xianning City

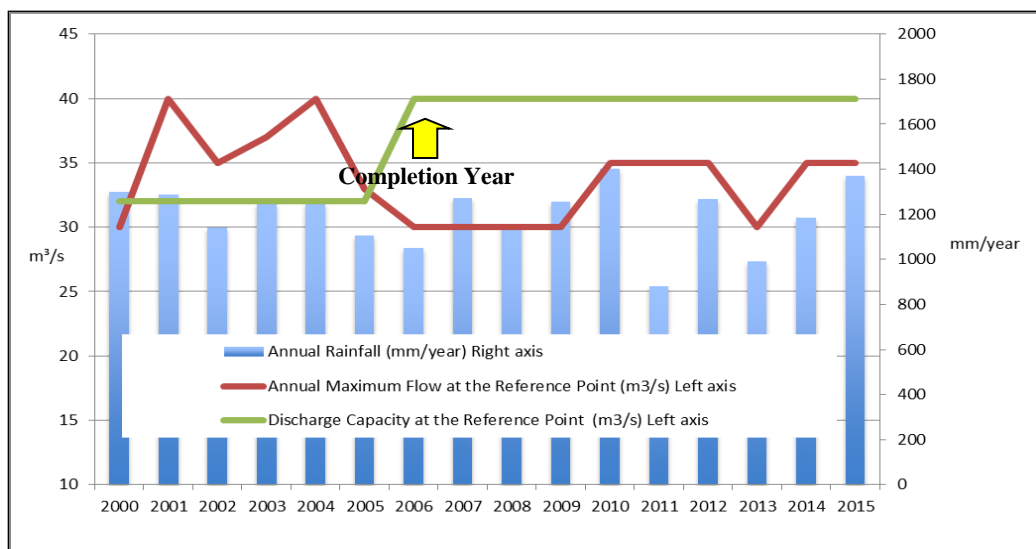
According to interviews with subprojects, concerning seven subprojects which already had a design where the planned highest safe level exceeded the highest water level before the start of the project, flood control measures other than the method of raising the planned highest safe water level at a reference point were implemented, such as construction of a protection wall as flood preventive measures at rapid streams of rivers and installation of wave-dissipating concrete blocks at river junctions, etc.



2) Comparison between the Discharge Capacity and the Annual Maximum Flow at a Reference Point

The discharge capacity ( $m^3/s$ ) at a reference point is the maximum volume of water that can flow down safely at the reference point. In the comparison of the discharge capacity between the time of the ex-post evaluation (2015) and the time of the appraisal (1999), the discharge capacity increased at 12 subprojects<sup>30</sup> and the original discharge capacity was maintained at four subprojects<sup>31</sup>.

Moreover, when the discharge capacity is compared with the annual maximum flow ( $m^3/s$ ), if the annual maximum flow is less than the discharge capacity, this means that water increased by heavy rains, etc. can flow down safely. Looking at Huanggang City as an example, it shows that the discharge capacity improved with the project completion and for the duration analyzed the annual maximum flow maintained a level lower than the discharge capacity (Figure 3).



Source: Materials provided by Hubei Provincial ODA Loan Urban Flood Control Project Managing Office

Figure 3: Transitions of the Maximum Flow and the Discharge Capacity at a Reference Point in Huanggang City

(2) Effect Indicators

1) Flood Prevention Standards (Recurrence Interval)

<sup>30</sup> 12 cities and counties of Jingzhou City, Huanggang City, Xiaogan City, Xianning City, Xiantao City, Qianjiang City, Shayang County, Chibi City, Yuanan City, Anlu City, Xiaochang County and Daye City fall under this category.

<sup>31</sup> Four cities and counties of Xiangfan City, Zhongxiang City, Yunmeng County and Danjiangkou City fall under this category.

Out of 17 cities, flood prevention standards of flood prevention facilities have improved in 15 cities and counties, and flood prevention standards of urban drainage facilities have improved in 13 cities and counties by implementing this project.

Concerning four cities and counties in which the standards were already satisfied at the time of the appraisal, the project was not targeted for the entire basin including reference points but targeted for narrow areas, such as partial repairs of dikes and rapid stream portions or river junctions, and so, it is not possible to confirm the effects of this project based on the flood control capacity at reference points. Accordingly, the effects will be judged based on damage situations of individual cities and counties in the section “2) Damage Situations by Levee Breach or Overflow” shown below.

## 2) Damage Situations by Levee Breach or Overflow

The annual damage area, inundated time (Figure 4), human damages, and the loss amount (Figure 5) by levee breach or overflow after 2000 in 17 cities and counties where subprojects were implemented started to decline substantially from around 2005 when some of the subprojects were completed and approached almost zero at the time of the ex-post evaluation<sup>32</sup>.

In four cities and counties of Huanggang City, Xiangfan City, Xiaochang County, and Danjiangkou City in which flood prevention standards were satisfied at the time of the appraisal, damages are almost gone after 2006, which indicates that this project had the planned effects.

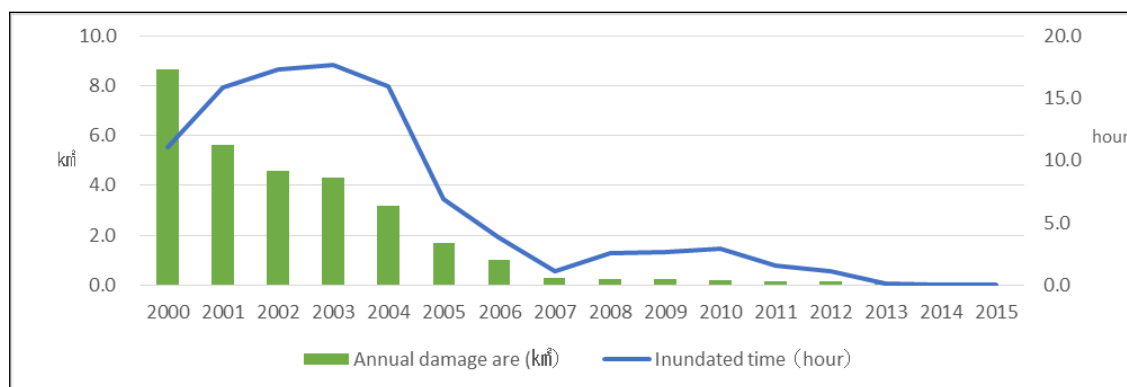


Figure 4: Transitions of the Annual Damage Area and Inundated Time by Levee Breach or Overflow

<sup>32</sup> Completion year of each city and county is as follows. Completion in 2005: Xiantao City, Qianjiang City, Chibi City, and Daye City/completion in 2006: Zhongxiang City, Anlu City, Xiaochang County, Yunmeng County, and Danjiangkou City/completion in 2008: Huanggang City, Xiangfan City, Xiaogan City, and Shayang County/completion in 2009: Huangshi City and Yuanan County/completion in 2011: Jingzhou City, additional work in Qianjiang City and additional work in Chibi City/completion in 2012: Xianning City and additional work in Anlu City/completion in 2013: additional work in Daye City/completion in 2014: additional work in Jingzhou City.

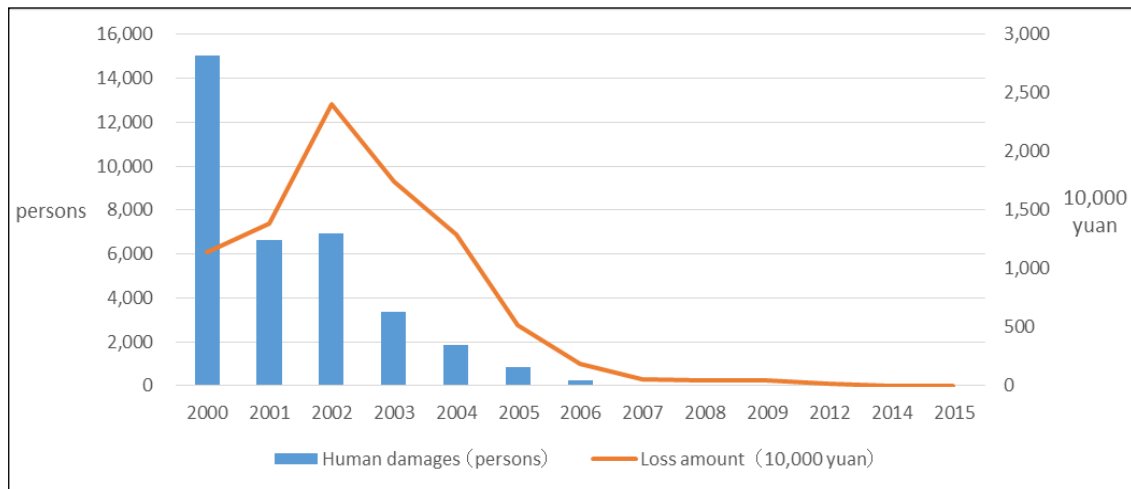


Figure 5: Transitions of the Human Damages and the Annual Maximum Loss Amount by Levee Breach or Overflow

### 3.3.2 Qualitative Effects (Other Effects)

Because no specific qualitative effects were set at the time of the appraisal, for the ex-post evaluation, the qualitative effects were integrated and evaluated together with the effects of the project at the impact level as shown in the section “3.4 Impacts.”

## 3.4 Impacts

### 3.4.1 Intended Impacts

The objective of this project is to “stabilize society and economy of the area and to improve living conditions of local residents” by preventing flood damages. Concerning “stabilization of society and economy,” economic effects by the prevention of floods are considered from situations of damage mitigation, while individual cases are looked at concerning the impact on local society and economy. In addition, concerning the impact of floods to be given to social and economic activities and living environment, confirmation will be made by a beneficiary survey for residents and a company survey.

#### (1) Economic Effect by Prevention of Floods

A total of annual maximum loss by levee breach or overflow of 17 subprojects from the start of this project until the year before 2005, when project outputs started completion, stood at about 3.8 billion yen (271.47 million Chinese yuan)<sup>33</sup> on average during a period from 2000 to 2004. From this value, it can be inferred that the project had the effect of preventing

<sup>33</sup> Estimation was made based on the average exchange rate during the period at 1 Chinese yuan = 13.9862 yen that was used for the calculation of project costs.

economic loss by preventing flood damages at the subprojects sites. The total value of loss decreased sharply after 2005 and economic loss has been prevented along with the progress of this project. It is fair to say that economic effects are attained in the subproject sites.

## (2) Impact on Local Society and Economy

Although comparison was made between transitions of house prices of 17 subproject cities and counties and house prices of Hubei Province as a whole, such prices are influenced by many factors including commodity prices and railroad and other infrastructure improvements, and therefore, it was not possible to extract only the relationship with this project quantitatively.

On the other hand, positive impacts are reported, which include: the development around rivers was promoted due to mitigation of flood damages; and the development of cities and tourism industry was promoted accompanying the improved river environment at the time of construction of facilities under this project. As individual cases, the following are the cases of Xianning City and Jingzhou City.

### Impact Case 1) Effect of building the foundation for the urban development: Xianning City

Although Xianning City was close to Wuhan City, the capital city of Hubei Province, and was also an area with high potential of the development accompanying the expansion of urban area of Wuhan City, the population of Xianning City remained around 100,000 persons before starting the project, since the development of the City had been hampered by repeated inundation damages because the flow of the Gan River that curves and runs through the City is rapid and causes flood damage in a short time.

Since the inundation threat was gone as the result of construction of dikes and related facilities under this project, the area around the Gan River has become a new development district, and the City population grew sharply to 450,000 persons by 2015. Also, the development of hot spring resort located upstream of the river progressed due to the strengthening of dikes. The number of tourists recorded 4.84 million persons in 2015, which is four times the number of tourists in 2008, and tourism revenues reached 2.7 billion Chinese yuan.



The Gan River before the project implementation (provided by Xianning City Water Bureau)  
Dike of rapid flow of the Gan River constructed by this project

Impact Case 2) Impact on the promotion of tourism industry: Jingzhou City

Under this project, dredging work of the moat around the old castle and castle wall built 2000 years ago was carried out and the strengthening of protection walls around the moat and new construction of diversion canals were also carried out. Through this work, the moat where turbid water was present could be linked to a branch of the Yangtze River or a lake. Although the work was targeted to enhance the urban drainage functions, the landscape of the castle and castle walls, and water flow and water quality of the moat were also improved.



Moat around improved castle walls  
(Jingzhou City)

Moreover, since the water depth became 10 m from 1.5 m resulting from the removal of sludge, it became possible to hold a dragon boat race as a centerpiece of the City’s tourism. The recognition as a tourist site was enhanced, resulting in the increase in the number of tourists by 4.3-folds and tourism revenues of the City grew by 2-folds in 2015.

(3) Beneficiary Survey

Concerning “stabilization of local society and economy” and “improvement of living environment of residents,” a beneficiary survey<sup>34</sup> (60 samples) was implemented for residents

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<sup>34</sup> A beneficiary survey was carried out through a site-visit for 60 residents around the project sites of Jingzhou City and Xianning City (30 residents each) at places where facilities covered by this project are concentrated and where benefit areas are easy to identify. Since the survey was carried out for households which agreed on the survey, random sampling has not been made. Since the answers are only from residents who are cooperative with the

of Jingzhou City and Xianning City, and confirmation was made on the change of flood damages, living environments, and psychological change toward the threat for floods before the implementation of the project (2000 – 2010) and after the project (after 2011).

In Jingzhou City, 83% of respondents feel that flood damages were mitigated. Concerning living environment, more than 70% of respondents answered that the living environment was improved. In particular, the improvement effects of the environment of rivers, such as trash, bad odor, and landscape, were strongly recognized, and 80% said that the frequencies of using<sup>35</sup> rivers, dikes, and areas around them increased. A total of 77% recognized the improvements of psychological effects, such as reduction of anxiety toward floods. Concerning economic effects, more than 70% recognized improvements such as the opening of retail shops and the growth of tourists. On the other hand, half of respondents answered that real estate prices have increased, those who answered that loss caused by flood damages was mitigated were less than a half of the respondents, and 6% of respondents answered that inundation damages to houses or lands were not mitigated or not improved much.

In Xianning City, however, since flood damages became zero after the project, all respondents recognized the improvements compared to years before 2010 in all items, including: inundation damages caused by floods; change of living environment; frequencies of visiting dike; anxiety toward floods; and economic impacts. In the case of Jingzhou City, although damages were mitigated by the project implementation, the speed was slow, and thus it is assumed the result as mentioned above was induced.

#### (4) Company Survey

A company survey<sup>36</sup> was conducted for 20 companies around the project sites to confirm situations of flood damages and change of company activities before (2000 – 2010) and after (2011 and thereafter) the project implementation.

Almost all companies that responded in Jingzhou City and Xianning City recognized the mitigation of inundation damages by floods on companies. Concerning earnings of companies, seven companies in Jingzhou City and all companies in Xianning City responded that their earnings improved and they cited the reasons that distribution (move-in/move-out) was no longer hampered by inundation and commuting of employees was no longer hindered by floods.

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survey and are more likely to be overvalued and a sample size is small against the number of beneficiaries, they cannot be said to represent the entire beneficiaries under this projects. Therefore, it represents the expressions of only some of the beneficiaries for the change of their surrounding environments.

<sup>35</sup> As methods of using the river, walking, jogging, fishing, nature exploration, and dancing were cited.

<sup>36</sup> A corporate survey was carried out through a site-visit survey for 20 companies (10 companies in each city) around the project sites of Jingzhou City and Xianning City at places where facilities covered by this project are concentrated and where benefit areas are easy to identify.

### 3.4.2 Other Impacts

#### (1) Impact on the Natural Environment<sup>37</sup>

At the time of the appraisal, no negative impacts on the natural environment were anticipated. During the project implementation, the executing agency of Hubei Province was in charge of the natural environment monitoring (water quality, air, and noise) under each dedicated section of the Environmental Protection Department. Environmental protection groups were established in each city and county of Subproject Management Offices (SMO), and the groups were in charge of submitting reports on environmental activities of the respective city and county, thoroughly implementing environmental management and monitoring plans pertaining to the project and carrying out internal and external coordination and supervision and management activities. The categories of the environmental monitoring by the subprojects and the results are shown in the below Table 6.

Table 6: Categories, Method and Result of Environmental Monitoring Implemented by the Subprojects

Items	Monitoring Method and Result
Water Quality	The subprojects were to monitor at 12 points at the inlet of lakes in Jingzhou, Huangshi, Huanggang, Xiaogan, and Xiangfan cities, one section of upper and lower stream each in the cities and counties including Xiantao City, Qianjiang City, Zhongxiang City, Chibi City, Daye City, Anlu City, Yuanan County, Shayang County, Xiaochang, City Danjiangkou City, and Xianning City. Duration of the monitoring was from the beginning and the end of construction, and frequency was divided into three periods (flood period, dry period, normal period). Environmental stations in the cities and the counties were the organization responsible for the duty. If any problem found in water quality, necessary measurement such as improving waste water processing etc. was taken.
Air Pollution	Each subproject selected 3 to 5 observation points in the representative construction sites where construction was mainly carried out. Monitoring items were selected according to the source of pollutant. The environmental monitoring stations conducted quarterly monitoring in every year. The result was within the standard.
Noise	Each subproject selected 4 to 6 sample points from the representative construction area in the city, and monitored them once every two months. Counties set 2 sample locations, and monitored them quarterly. The monitoring result was within the standard.

Source: Materials provided by Hubei Provincial ODA Loan Urban Flood Control Project Managing Office

In the aforementioned beneficiary survey implemented for residents, six items of environmental pollution (waste disposal, gas emissions, dust, turbid water, noise, and vibration) during the implementation of this project were confirmed. In Jingzhou City, more than 90% of respondents answered that ‘they were not bothered at all’ or ‘they were not bothered very much’ and there were none that answered that ‘they were extremely bothered’

<sup>37</sup> The Environmental Impact Assessment Report of this project was approved by the State Environmental Protection Administration in March 2000.

or 'they were somewhat bothered'. On the other hand, according to the survey in Xianning City, 30%, 33%, 20%, 23%, 43% and 30% responded that 'they were extremely bothered' or 'they were somewhat bothered' respectively by gas emissions, waste disposal, dust, turbid water, noise, and vibration, which exceeded the answers of 'they were not bothered at all' or 'they were not bothered very much'. For these questions, more than a half of the respondents in Xianning City selected the answer of 'they are not sure' or 'no reply'. Because the construction of buildings such as the high-rise housings or office buildings and railroads were carried out around the river in the city for the same time period, it is assumed that the respondents did not notice about these types of environmental pollution or they could not respond by extracting the impacts by the work of this project only.

In the above-mentioned company survey, among the nine companies in Jingzhou City replied to the questionnaire, seven companies answered that 'they were not bothered at all' or 'they were not bothered very much' regarding all the items about the impacts on natural environment. On the other hand, in the column where to write contents if negative impacts on environment occurred, among the two companies responded that 'they were somewhat bothered', one said 'the improvement of environment around the company', and the other wrote that 'there was no pollution'. All the four companies in Xianning answered they were not bothered at all. Only four companies answered to each items, and the answer rate was low. However, all the 10 companies filled their answer in the column as they did not worry about pollution, 'there was no pollution'. About the companies of the cities, it may be said that they consider that approximately no negative impact to the natural environment were caused during the construction.

## (2) Resettlement and Land Acquisition

Comparing the total value of 16 subprojects except Xiaogan City in which land acquisition did not take place (Table 7), 65.09 million Chinese yuan were expected to be needed for the land acquisition of the construction site of flood prevention facilities and urban drainage facilities (471 hectares) in the plan at the time of the appraisal, but 74.60 million Chinese yuan (115% over the plan) were needed actually to acquire 413 hectares (88% of the plan). The acquisition cost increased by 31% to 181,000 Chinese yuan/hectare against the plan at 138,000 Chinese yuan/hectare because of the soaring land prices<sup>38</sup>.

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<sup>38</sup> According to the Hubei Province Statistical Yearbook, house prices and the consumer price index between 2001 and 2014 rose respectively 11% and 17% per year on average. Since the project completion extended substantially to 2015 from 2005, 31% increase seems to be within a reasonable scope in the light of price increase during the period.



Table 7: Plan and the Actual of Resettlement and Land Acquisition

	Plan at Appraisal (1999)		Actual (2015)	
	Area (ha)	Cost (10,000 Chinese yuan)	Area (ha)	Cost (10,000 Chinese yuan)
Total (Plan/Actual Ratio)	471	6,509	413 (88%)	7,460 (115%)

Source: Materials provided by Hubei Provincial ODA Loan Urban Flood Control Project Managing Office

Comparing the plan and actual of resettlement of 12 subprojects except five cities in which resettlement did not take place (Table 7), the actual land area acquired was about 60% of the plan and the number of residents and households resettled was 50% or less than the plan, whereas compensation costs increased by 145% to 118.91 million Chinese yuan from the plan of 81.88 million Chinese yuan. Actual costs required for the resettlement increased by 2.4-fold to 390,000 Chinese yuan/hectare against the plan of 160,000 Chinese yuan/hectare.

In the plan at the time of the appraisal, a period required for the resettlement was expected to be around six months; however, it actually took 152 months. During the extended period, land prices or house prices that required the compensation increased. Also, since the compensation cost of the land acquisition and resettlement accompanying the construction of electric power facilities and railroads that was carried out at the same time with this project were set relatively high because they are profit-earning businesses<sup>39</sup>, the compensation amount for this project was also forced to be raised near those costs during the land price negotiations. These are the factors of increasing the compensation costs.

Table 8: Plan and the Actual of Resettlement

	Plan at Appraisal (1999)				Actual (2015)			
	Area (ha)	Number of Residents (persons)	Number of Households (households)	Amount of Compensation (10,000 Chinese yuan)	Area (ha)	Number of Residents (persons)	Number of Households (households)	Amount of Compensation (10,000 Chinese yuan)
Total	512	15,847	3,225	8,188	304	7,259	1,544	11,891
	Plan/Actual Ratio				<b>59%</b>	<b>46%</b>	<b>48%</b>	<b>145%</b>

Source: Materials provided by Hubei Provincial ODA Loan Urban Flood Control Project Managing Office

Although resettlement and land acquisition were implemented by each subproject, negotiations of land acquisition prices, compensation contents of resettlement, and resettlement arrangement were proceeded with in accordance with policies and ordinances including the *Land Administration Law of the People's Republic of China*, *Regulations on Compensation for Land Expropriation and Resettlement for Large- and Medium-scale Water Resources and Hydropower Generation (March 2001)* by the State Council and the *Ordinance*

<sup>39</sup> Price for resettlement compensation was not unified, the businesses such as railroad that have income from fees set higher unit price for resettlement compensation than this project that has no fee collection from the users.

*on the Settlement for the Improvement Project of the Three Gorges on the Yangtze River (enforcement in March 2001), etc.* According to interviews with the subprojects, it was reported that although the public interest in the flood control project is high, unit prices of resettlement compensation were set lower than those of railroad or electricity projects because earnings from the flood control project, such as fee revenues, are not directly expected, which made resettlement negotiations with residents difficult. In addition, since unified compensation unit price standards were not set in the province, each SMO at city/county level had to negotiate compensation details and the monetary amount individually, which also served as a factor for the difficulty in obtaining agreement from residents. In some cases, the work was delayed and the contents of project and construction site were reconsidered because resettlement negotiations faced difficulties. Among others, the reason that the subproject of Yunmeng County was cancelled in the middle was because the costs required for the resettlement increased.

According to a survey implemented for resettled residents<sup>40</sup> concerning the impacts to their lives accompanying the resettlement and the degree of satisfaction for compensation, all respondents answered that their lives improved quite well or well after the resettlement compared to pre-settlement concerning the living environment, accessibility to life infrastructures, damage situation to houses or lands due to heavy rains, and livelihood. If the space of houses before and after the resettlement is compared, respondents resettled to larger houses than pre-resettlement houses: respondents of Jingzhou City resettled from houses with a size of about 85 m<sup>2</sup> on average to houses of 104 m<sup>2</sup> (increased by 22%); and respondents of Xianning City resettled from houses with a size of 113.4 m<sup>2</sup> on average to houses of 137.8 m<sup>2</sup> (increased by 21%). Respondents were satisfied with compensation and life at resettled places. According to interviews with subprojects, the reason is that: although their former houses were located in the flood risk area and suffered from inundation damages every year during the rainy season, damages were mitigated resulting from resettlement or the place of resettlement was selected in a location several hundred meters away from the former houses.

### (3) Other Impacts

When dikes and diversion canals were newly constructed under this project in Xianning City, cleaning and dredging of rivers were also carried out. By doing so, not only was water drained properly at the time of floods, but also water flowed smoothly from upper reaches.

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<sup>40</sup> A survey for resettled residents was carried out through a site-visit survey for 20 residents who resettled from areas close to rivers to different areas of Jingzhou City and Xianning City (10 residents each). The survey was carried out for residents whose former locations and resettled locations can be specified instead of selecting samples at random from a list of resettled residents.

Turbid water in rivers was eliminated and water quality<sup>41</sup> that had been classified as Classification V before the project implementation improved to Classification III fit for drinking and swimming after the completion of the project (2012). Although the main purpose of this project is to improve the living environment, this is a case where the impact was extended to the natural environment, such as the improvement of water quality.

In light of the above, this project has largely yielded its planned effects. Therefore, effectiveness and impact of this project are high.

### 3.5 Sustainability (Rating ③)

#### 3.5.1 Institutional Aspects of Operation and Maintenance

##### (1) Institutional Aspects of Operation during Project Implementation

Hubei Provincial ODA Loan Urban Flood Control Project Managing Office (PMO) established in the Ministry of Water Resources of Hubei Province was in charge of specific operation of the project during the project implementation, and carried out oversight of the subprojects and communication and coordination with JICA and other related organizations. The PMO comprised the General Affairs Department, Financial Department, Procurement Department, Engineering Department, and Environment and Resettlement Department. Sections in charge of the project operation were also established in each subproject, which were in charge of construction, operation, and management of this project.

##### (2) Institutional Aspects of Operation and Maintenance after the Project Completion

Hubei Provincial ODA Loan Urban Flood Control Project Managing Office (PMO) is carrying out operation and maintenance after the project completion under the same system as that during project implementation. Upon the completion of this ex-post evaluation, PMO will be dissolved and repayment and other work will be taken over by the Foreign Capital and Foreign Affairs Office of the Hubei Provincial Ministry of Water Resources which is the PMO's supervising organization. Although the organization of the office will change, the same persons will be in charge, and therefore, no special changes are foreseeable concerning actual operation and management.

Operation of subprojects and supervision of maintenance of facilities are continuously

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<sup>41</sup> Water quality of river is classified from I to V under the Environmental Quality Standards for Surface Water. I.: mainly applicable to the water from sources, and the national nature reserves/II.: mainly applicable to first class of protected areas for centralized sources of drinking water, the protected areas for rare fishes, and the spawning fields of fishes and shrimps/III.: mainly applicable to second class of protected areas for centralized sources of drinking water, protected areas for the common fishes and swimming areas/IV.: mainly applicable to the water areas for industrial use and entertainment which is not directly touched by human bodies/V: mainly applicable to the water bodies for agricultural use and landscape requirement.

carried out by the PMO of each city and county. Since the scope of inspection expanded due to increase in project outputs, the number of staff members increased more than the plan with increase in technical personnel. According to interviews with subprojects, all subprojects responded that the current number of staff members is sufficient.

Since the flood control project is a project with high public interest, operation and maintenance of facilities constructed are carried out by local governments or state-owned companies (100% invested by the state). Each subproject has a specific organizational chart and chain of command, and sections responsible for operation and maintenance and their duties are clarified, and therefore, there are no problems identified.

To sum up, no major problems have been observed in the institutional aspects of the operation and maintenance during or after the project implementation.

### 3.5.2 Technical Aspects of Operation and Maintenance

#### (1) Technical Level of Operation and Maintenance

The Provincial Water Resources Department periodically confirms the level of maintenance personnel and engineers of operation and maintenance organizations of flood prevention and urban drainage facilities of each city and county, and implements training on flood control facility maintenance, flood control specialized techniques, and dike maintenance targeting engineers.

#### (2) Preparation of Operation and Maintenance Manuals and Inspection Situation

According to interviews with all 17 subprojects except Wuhan City, they responded that operation and maintenance manuals, patrol records, inspection records, and maintenance logbooks have been prepared. At facilities of six cities visited by the field survey, manuals, patrol records, inspection records, and maintenance logbooks have also been prepared and records according to determined frequencies have been kept in the logbooks.

The mechanism of confirming the technical levels and of succeeding techniques is in place and appropriate maintenance methods are applied at the site. Therefore, no major problems have been observed in technical aspects of operation and maintenance.

### 3.5.3 Financial Aspects of Operation and Maintenance

Budget for operation and maintenance of facilities at the Hubei Provincial Ministry of Water Resources is allocated on a priority basis because it falls under the priority project of the state. Moreover, according to interviews with subprojects, it is fair to say that operation and maintenance costs allocated from the budget mentioned above are sufficient, since revenues exceed expenditures in all cities and counties when comparing year-to-year expenditures (operation and maintenance costs) and revenues (total of National Subsidies,

Flood Prevention and Security Funds<sup>42</sup> and Water Resource Funds<sup>43</sup>). Since flood prevention and urban drainage projects are the ones with high public interest, national subsidies that are allocated to the national priority projects, such as the Yangtze River Basin Development Plan, are to be supplemented, and thus there is no probability of the situation occurring where problems arise on the sustainability of operation and maintenance costs.

Table 9: Hubei Province Operation and Maintenance Cost Flood Prevention and Urban Flood Control Facilities

(unit: 10,000 Chinese yuan/year)

Item/Fiscal Year	2004	2005	2006	2007	2008	2009
<b>Expenditure</b>	<b>2,193</b>	<b>2,720</b>	<b>2,887</b>	<b>3,244</b>	<b>3,544</b>	<b>3,719</b>
<b>Revenue</b>	<b>2,932</b>	<b>3,546</b>	<b>3,829</b>	<b>4,178</b>	<b>5,404</b>	<b>4,787</b>
National Subsidies	2,864	2,986	3,220	3,448	3,578	3,784
Flood Prevention and Security Funds	38	43	50	86	90	90
Water Resource Funds	30	517	559	644	1,736	913
<b>Balance</b>	<b>739</b>	<b>826</b>	<b>942</b>	<b>934</b>	<b>1,860</b>	<b>1,068</b>
Item/Fiscal Year	2010	2011	2012	2013	2014	Ground Total Ratio
<b>Expenditure</b>	<b>3,866</b>	<b>4,131</b>	<b>4,696</b>	<b>5,068</b>	<b>5,499</b>	
<b>Revenue</b>	<b>5,050</b>	<b>5,510</b>	<b>6,423</b>	<b>6,745</b>	<b>7,937</b>	
National Subsidies	3,971	4,319	4,904	5,284	6,170	79%
Flood Prevention and Security Funds	98	91	159	121	162	2%
Water Resource Funds	981	1,100	1,360	1,340	1,605	19%
<b>Balance</b>	<b>1,184</b>	<b>1,379</b>	<b>1,727</b>	<b>1,677</b>	<b>2,438</b>	-

Source: Materials provided by Hubei Provincial Ministry of Water Resources

Note: The percentage of cumulative total is computed based on the percentage of cumulative total amount of revenue total from 2004 to 2014.

### 3.5.4 Current Status of Operation and Maintenance

According to answers to questionnaire and interviews for the project executing agency as well as the subprojects' implementation agency that are responsible for construction, operation and maintenance of flood prevention facilities and urban drainage facilities of each city and county, there have been no particular problems with operation and maintenance situations. In the field survey, it was confirmed that infrastructures and facilities have been maintained in a manner that they can demonstrate their functions as planned. In addition, facilities are well and neatly organized, and manuals and maintenance, inspection, and patrol records have been completely prepared. Maintenance logs have been appropriately recorded, and according to the records, if any problem was found in facilities, such problem was responded to promptly

<sup>42</sup> Funds are collected from companies in Hubei Province and are used for flood prevention and security works and maintenance of flood-control related infrastructures.

<sup>43</sup> Funds are a special fund used for the construction of flood control infrastructures. The sources of the funds are: the Central Water Resource Construction Funds used for the national policy and for the construction and maintenance of priority projects on the national level; and Local Water Resource Construction Funds used for local priority projects.

such as reporting, repair, or replacement of parts. At the time of the ex-post evaluation, all subprojects had the plan of periodical inspection and the plan of equipment replacement and repairs. As for the maintenance, such as spare parts, although pumps and some other parts are manufactured in foreign countries, no special problems have been observed on their availability or repairs, because agencies exist in neighboring cities. Through questionnaire and interviews survey for the province and subprojects and site-visit survey to six cities, it was confirmed that operation and maintenance of facilities have been carried out properly and there have been no particular problems in the situation.

In light of the above, no major problems have been observed in the institutional, technical, and financial aspects of the maintenance system of this project. Therefore, sustainability of the project effects is high.

#### **4. Conclusion, Lessons Learned and Recommendations**

##### 4.1 Conclusion

This project aims to carry out construction and repairs of dikes, culvert gates, pumping stations, and diversion canals for 18 areas in total including 14 cities and four counties on the Jiangnan Plain in Hubei Province in order to improve the flood control capacity of each city.

Consistency of this project with China's development policies and development needs on the national, provincial, and city levels at the time of the appraisal and the ex-post evaluation as well as with Japan's ODA policy toward China at the time of the appraisal is fully ensured, and thus, this project is highly relevant. Although a substantial change in the scope was made in the middle of this project since a flood control project by domestic funds advanced, the change was made in accordance with the project purpose and the actual outputs in total increased to more than the plan. Although the project costs were within the range of the plan, efficiency is fair due to considerable delay in the project period.

Through this project, flood control facilities with a design to meet the planned highest safe water level at the reference points were constructed in all subprojects, and urban drainage facilities ensured planned drainage capacity.

During the comparison range, rainfall has been within the planned level, and the annual maximum water level and annual maximum were respectively below the highest safe water level and the flood drainage capacity, thus it can be said that predetermined flood safety has been secured. Inundation area and duration, human damages, as well as the amount of maximum damages by levee breach or overflow have decreased sharply accompanying the completion of subprojects and have reduced to almost zero after the completion of all subprojects since 2014. Therefore, the effects yielded by this project can be evaluated as very high. Moreover, it is assumed that the decrease in flood damages has an effect of preventing

economic loss of about 3.8 billion yen (about 265 million Chinese yuan) per year on average occurred before the project started, and the impact on the promotion of urban development, promotion of tourism industry, and the improvement of living environment of residents can also be recognized. Accordingly, effectiveness and impact of this project are high.

In general, no major problems have been observed in the institutional, technical, and financial aspects as to the sustainability of the effects yielded through this project, and thus the sustainability is high.

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

#### 4.2 Recommendations

None in particular

#### 4.3 Lessons Learned

##### (1) Unified management method from start to completion of the project for subproject-type project management

This project was a large-scale project which required 15 years until the completion and in which 18 cities and counties participated. The executing agency, as the control tower, carried out detailed operation and management including: monitoring of all subprojects once each year during the implementation period; and if any difficulty arose in the subprojects such as resettlement negotiations and procurement of domestic currency, visiting the implementation site and supporting the settlement of problems. Although an issue of delay in communication and coordination with JICA occurred in the middle, generally the agency appropriately responded with complicated adjustments such as the change of F/S and substantial change of the scope.

The management of subprojects has been unified from project management and operation to material filing methods, videos/photos/media coverage have been kept as PR materials, and a review of the project has been also carried out by organizing an ex-post evaluation workshop<sup>44</sup> in each province, city and county after the completion of the project (in May 2015). This is a good example where an executing agency demonstrated its leadership in the project whose management was difficult due to a long-term project with participation by many subprojects. Fine-tuned monitoring carried out by the executing agency of this project from its start to the completion, support for problem solution, unified material management throughout all subprojects, and publicity methods can be utilized in other similar projects.

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<sup>44</sup> Meetings for reporting on the situation of project implementation and completion as well as media coverage in which subproject of each city and county were introduced, and were held on the level of each subproject implementation city and county and on the provincial level.

(2) The necessity of monitoring during project implementation in a country where domestic procedures are complicated

Since the construction of flood prevention facilities on the Yangtze River basin had been carried out by domestic funds in advance immediately after the start of this project, a substantial change occurred, including the cancellation of project at Wuhan City that was the largest subproject of this project. Also, Yunmeng County withdrew from the scope of this project in the middle due to the budget shortage of the county. These changes were proceeded before JICA's approval. Substantial change in the project contents requires procedures for each Development and Reform Commission, Finance Department, and other organizations at multiple levels including implementation city, county, province, and state, and it may take several years until formal approval is obtained from organizations in China. Because of the above reason, consent of JICA was left behind during such processes. Although the final scope change was in line with the contents of the objectives of this project and the change was made in such a manner as not to negatively affect the project effects greatly, it seems that more close communication and coordination were necessary between the executing agency and JICA.

In the project management in a country where domestic procedures are complicated as stated above, JICA should support an executing agency so that procedures for JICA and the central government are observed without delay by using progress reports and interim supervision, etc. and carrying out monitoring on the possibility of the change of project contents and in the situation of procedures for changes.



Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
(1) Project Outputs	<p><b>Flood Prevention Facilities:</b>            Construction of Dikes 26.5 km            Renovation of Dikes 344 km</p> <p>Other Renovation 33.1 km  <b>Total 403.5 km</b></p> <p><b>Urban Drainage Facilities:</b>            Construction/Renovation of Culvert Gates 16 locations</p> <p>Construction/Renovation of Pumping Stations 14 locations            Construction/Renovation of Diversion Canals 80.1 km</p>	<p><b>Flood Prevention Facilities:</b>            Construction of Dikes 7.5 km            Renovation of Dikes 222.8 km            Construction of Flood Prevention Walls 45.8 km            Renovation of Flood Prevention Walls 3.8 km            Other Renovation 5.0km  <b>Total 403.5 km</b></p> <p><b>Urban Drainage Facilities:</b>            Construction/Renovation of Culvert Gates and Sluiceways 106 locations            Construction/Renovation of Pumping Stations 15 locations            Construction of Sewers and Drainage 15.7 km            Renovation of Sewers and Drainage 40.5 km            Other 24 locations</p>
(2) Project Period	April 2000-December 2005 (69 months)	April 2000-April 2015 (181 months)
(3) Project Cost	<p>Amount Paid in Foreign Currency 3,133 million Japanese yen</p> <p>Amount Paid in Local Currency 20,787 million Japanese yen (139 million Chinese yuan)</p> <p>Total 23,920 million Japanese yen</p> <p>Japanese ODA Loan Portion 13,000 million Japanese yen</p> <p>Exchange Rate 1 Chinese yuan =15 yen( as of October 1999)</p>	<p>1,538 million Japanese yen</p> <p>17,122 million Japanese yen (122 million Chinese yuan)</p> <p>18,660 million Japanese yen</p> <p>12,496 million Japanese yen</p> <p>1 Chinese yuan =13.99 yen (average of January 2002-December 2011)</p>