People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan

Hunan Urban Flood Control Project

External Evaluator: Hiromi Suzuki S., IC Net Limited

0. Summary

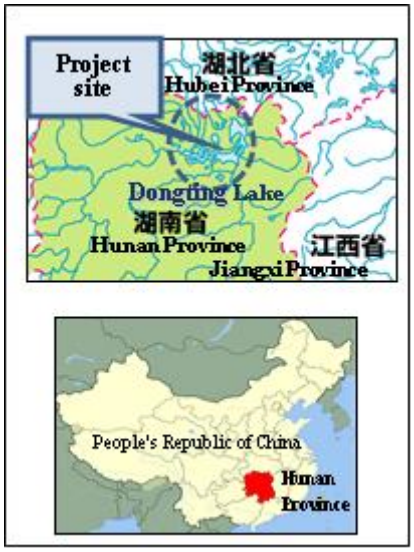
The project aims to construct or repair dikes, floodgates, and pumping stations in 22 cities around Dongting Lake in Hunan Province to improve each city's flood control capacity.

This project is highly relevant to China's development policies and needs at the national, provincial, and municipal levels and to Japan's ODA policy towards China during the appraisal and the ex-post evaluation. After the completion of this project, the discharge capacity has exceeded the annual maximum flow volume at the reference points for flood control in all the subprojects and the planned highest water level has also exceeded the annual highest water level at the reference points, which generally indicates that the floodwaters flowed down safely. Especially, the main effect of this project can be said to be the improvements in flood control standards (probability of return[1]). The flood control standard of the cities where it was predicted that a flood would occur "once every 10 to 20 years" has greatly improved to "once every 100 to 200 years." That of the cities with the standard of "once every five years" and "once every four to 10 years" has also greatly improved to "once every 50 years" and "once every 20 years" respectively. In addition, the effect indicators of inundation area and duration, as well as annual maximum damages by levee breach or overflow have become zero after the completion of this project for almost all the subprojects, even though the trends in precipitation have not changed much before and after the project. Thus the status in which the project is yielding its effects can be evaluated as good. Moreover, the impact on the living environment of people and the business environment of companies can also be recognized, thus the level of achievement in terms of effectiveness and impact is high. Although the project costs were lower than planned, due to the considerable delay in the completion of the project, the efficiency is fair. In general, no major problems have been observed in the organization, technical level and financial status of the operation and maintenance the project, thus the sustainability is high.

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

[1] These are 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 in any given year (annual exceedance probability).

1. Project Description



Project Location

Changde City: Dike constructed under the project

1.1 Background

China has areas prone to damage from floods due to the geographical and meteorological conditions. Especially, large-scale floods have frequently occurred in the Yangtze River basin. In recent years, the basin suffered large scale floods with probabilities of return of once every 50 to 100 years in 1931, 1954, and 1998. The development of the flood control infrastructure had been lagging behind in Hunan Province, Hubei Province, and Jiangxi Province located in central China where flood damages were especially severe. The large scale food that occurred in 1998 mainly affected the middle basin of the Yangtze River (areas around Dongting Lake in Hunan Province, Poyang Lake in Jiangxi Province, and branch river basins in Hubei Province) (see Figure 1). Because the water level rose in Dongting Lake in Hunan Province, Poyang Lake in Jiangxi Province, inflowing rivers, and the main stream of the Yangtze River, water leakage occurred in multiple places along the dikes. In Jiujiang City, Jiangxi Province, dikes along the mainstream of the Yangtze River collapsed because of water leakage, causing tremendous damages: about 223 million people were affected and damages totaled about 3 trillion yen. The reasons why the flood damages reached such high proportions were (1) low flood control capacity due to the decrepit state of the dikes or shoddy construction; (2) insufficient development of urban drainage facilities, such as pumping stations; (3) decline in water-retaining functions due to upstream deforestation; and (4) decline in the flood control functions due to reclamation of the lakes. Responding to the 1998 large scale flood, the Chinese Government made efforts to recover flood control functions, carrying out the long-and medium-term flood prevention measures such as total prohibition on the felling of natural forests along the upper reaches of the Yangtze River, and starting recovery works of the area of flood detention reservoirs from 1998. This project is part of the Japanese ODA Loan projects on flood control for

the three provinces that are located along the middle reaches of the Yangtze River, namely Hunan Province, Hubei Province, and Jiangxi Province, that the Chinese Government requested the Japanese Government to assist.

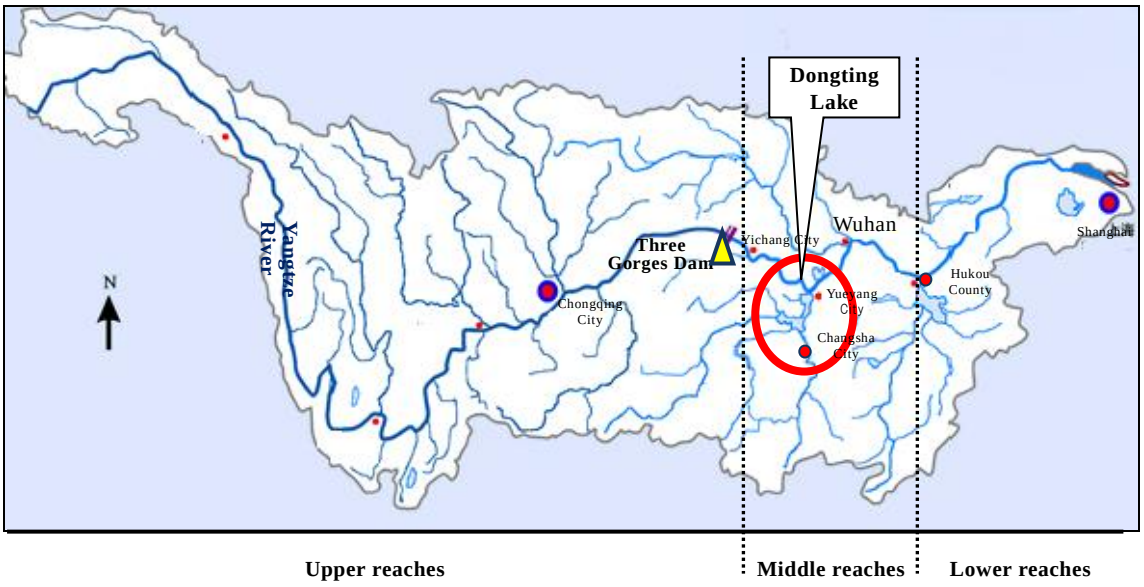
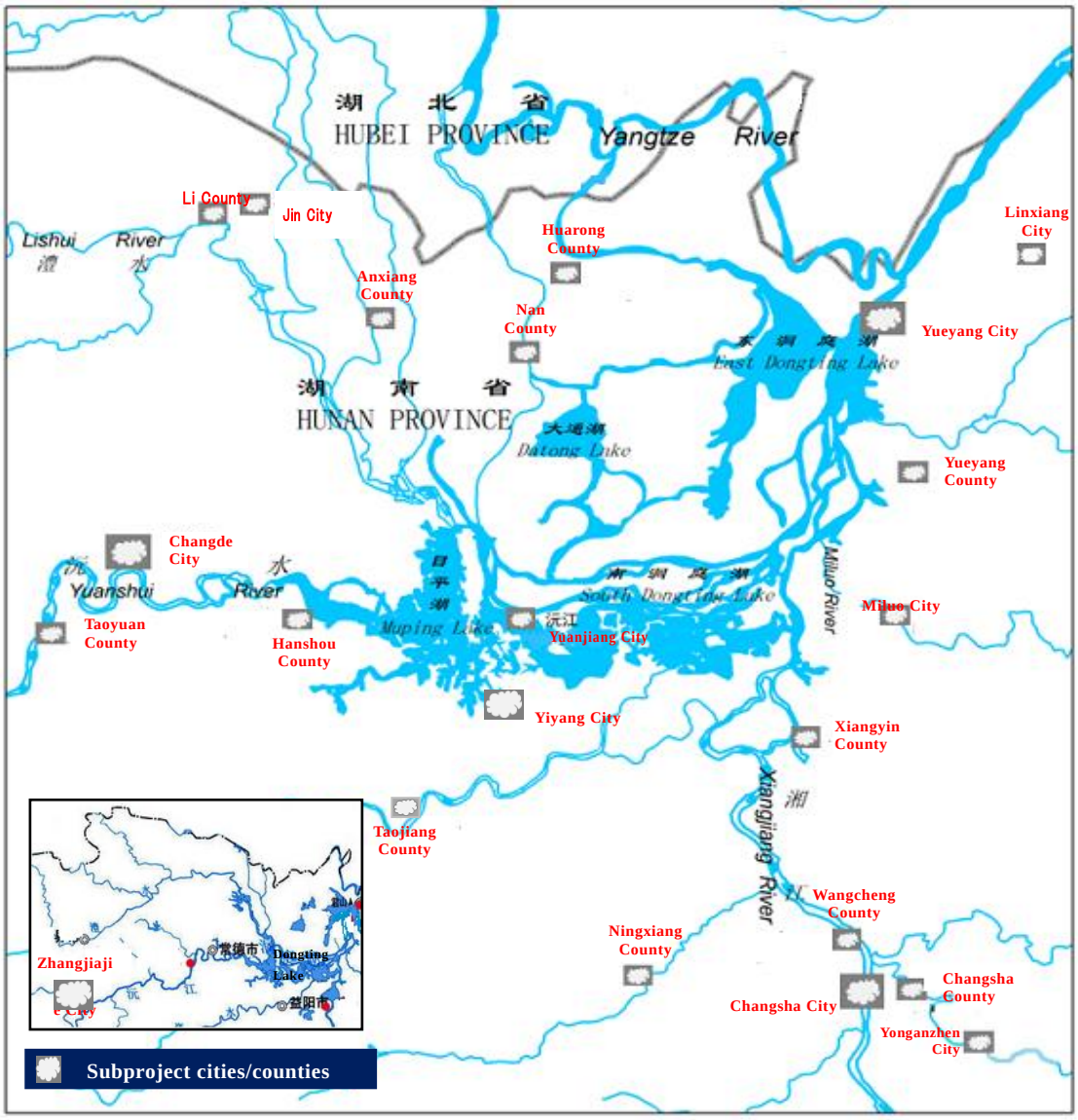


Figure 1: Location of the Project in Relation with the Yangtze River Basin[2]

[2] The Yangtze River can be divided into upper, middle, and lower reaches. The upper reaches extend from the Tanggula Mountains in Qinghai Province to Yichang City, Hubei Province via the Tibetan Plateau, Sichuan Basin, and the Three Gorges. The middle reaches (Jing River) extend from Yichang City, Hubei Province to Hukou County, Jiangxi Province. The lower reaches (Yangzi River) extend from Hukou to the mouth of the river into the East China Sea in Shanghai.

1.2 Project Outline

The objective of this project is to improve the flood control capacity of the cities and counties, through the construction and repair of dikes, water gates, and pumping stations in 22 areas that cover eight cities and 14 counties around Dongting Lake, Hunan Province, thereby contributing to stabilize the local society and economy and to improve the living conditions of the local residents.



Source: Document provided by the Provincial Project Management Office

Figure 2: Dongting Lake, Hubei Province: Distribution of the 22 Subprojects of the Project

Loan Approved Amount / Disbursed Amount	24,000 million yen / 23,963 million yen
Exchange of Notes Date / Loan Agreement Signing Date	March 2000 / March 2000
Terms and Conditions	Interest Rate: 0.75% Repayment Period: 40 years (Grace Period: 10 years) Conditions for Procurement: bilateral tied
Borrower / Executing Agency(ies)	People's Republic of China / People's Government of Hunan Province
Final Disbursement Date	January 2011
Main Contractors	• Changde Huawei Hydropower Engineering Company (China) • Chenzhou City Hydropower Construction Company (China) • China Anneng Construction Corporation (China) • China Water Conservancy & Hydropower 13th Engineering Bureau (China) • Guangzhou Municipal Engineering Corporation of Hydroelectric (China) • Hunan Construction Engineering General Corporation (China) • Hunan Gaoling Construction Group Stock Limited Company (China) • Hunan Huayu Water Conservancy & Hydroelectricity Construction (China) • Hunan Hydraulic And Hydropower Building Company (China) • Hunan Hydraulic And Hydropower Engineering Corporation (China) • Hunan Hydraulic Hydropower Mechanical Construction Corporation (China) • Hunan Kaiyuan Hydropower Construction Co., Ltd. (China) • Hunan Xingyu Water Resources And Hydropower Construction Co. (China) • Shanxi Provincial Bureau Of Water & Electric Engineering (China) • The 9 Bureau Of China Water Conservancy & Hydroelectric Engineering (China) • Xianghua Construction & Engineering (China) • Yiyang Water Conservancy & Hydropower Construction Co., Ltd. (China) • Yueyang City Changjiang Water Resource & Hydropower Construction (China)
Main Consultant	—
Feasibility Studies, etc.	• F/S: Hunan Province Water Resources and Hydropower Planning and Design Institute (August 1998) • "Special Assistance for Project Formation": conducted from June to September 1999
Related projects	[Japanese ODA Loan] • "Hubei Urban Flood Control Project" (Loan Agreement signed in March 2000) • "Jiangxi Urban Flood Control Project" (Loan

	Agreement signed in March 2000) [Technical Cooperation] • "Capacity Development Project for Management Plan of Dam in China" (2009 to 2013) • "Comprehensive Management of Rivers and Dams" (2010) • "Training for Experts on Flood-related Disaster Mitigation" (2009 to 2010) • "Flood Hazard Mapping" (2007) [Grant Aid] • "Provision of Emergency Relief Goods to the Heavily Flooded Middle Reaches of the Yangtze River" (1998) • "Project for the Improvement of Dikes along the Yangtze River" (1999 to 2000) [Other agencies] • World Bank "Yangtze Dike Strengthening Project" (2000 to 2008)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hiromi Suzuki S. (IC Net Limited)

2.2 Duration of the Evaluation Study

Duration of the Study: August, 2012 – November, 2013

Duration of the Field Study: April 15–18, 2013; July 29 – August 3, 2013

3. Results of the Evaluation (Overall Rating: A[3])

3.1 Relevance (Rating: ③[4])

3.1.1 Relevance with the Development Plan of China

1) Relevance with the Development Plan at the time of the appraisal

At the time of the appraisal, China was implementing its "10th Five-Year Plan for National Economic and Social Development (2001–2005)." The priority objectives in relation to flood control development were to ensure safety during floods and against flood damages in the main cities and regions, and to improve the systems for flood prevention and disaster mitigation. In order to achieve these objectives, China aimed to accomplish the state-specified flood prevention standards for the middle and lower reaches of the mainstream reaches of seven major rivers, including the Yangtze River, within the period of the national development plan.

[3] A: Highly satisfactory; B: Satisfactory; C: Partially satisfactory; D: Unsatisfactory

[4] ③: High, ②: Fair, ①: Low

Table 1: 10th Five-Year Plan for National Economic and Social Development (2001–2005): Objectives Related to Flood Control

- The mainstream sections and main branches in the middle and lower reaches of the seven major rivers, such as the Yangtze River and the Yellow River, and the first- and second-class dikes of Taihu Lake, Dongting Lake, and Poyang Lake should reach the following state-specified flood prevention standards:

  Megacity: once every 100 or more years

  Large city: once every 50 to 100 or more years

  Medium-sized city: once every 20 to 50 or more years
- The scale of the 1954 flood should be used as the standard for the Yangtze River and Dongting Lake. Measures for making dikes and other structures resistant to a flood of an equivalent scale, including the raising or reinforcement of dikes along the mainstream sections in the middle or lower reaches, the prevention of water leakage from foundations, the compensation work of insufficient of dikes with insufficient height, and the reinforcement of foundations, water gates, drainage facilities and other structures.
- Flood control measures should be carried out, including the improvements in the main flood control cities such as Wuhan and in the main lakes such as Dongting Lake, the improvement of the main basins and river roads and construction of dikes along the middle or lower reaches of the mainstream sections and main branches of the Yangtze River.
- Flattening work and dredging of sedimentation where the muddy of the river beds have become a serious problem in Dongting Lake and basins of the mainstream and branches of Yangtze River should be done thoroughly.

Source: JICA Appraisal Documents

In addition to the above-described measures, with regard to the development of the basin of the Yangtze River, the "Yangtze River Master Plan" has been implemented by the Ministry of Water Resources since the 1950s, having been revised from time to time. Because of the geographical and economic importance of the Yangtze River, the development of the river, including flood control, has been promoted. Moreover, in response to the heavy flooding that occurred in 1998, the Ministry of Water Resources prepared the "Yangtze River Integrated Flood Prevention Facilities Construction System (approved in 1999)" aiming to strengthen the repair of dikes, improve the flood prevention capacity through the construction of the Three Gorges Dam and dams in the branches of the Yangtze River, and improve the mainstream sections and branches of the Yangtze River and the branches of Dongting Lake and Poyang Lake. As described above, the project was fully consistent with 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

At the time of the ex-post evaluation, China was implementing its "12th Five-Year Plan for National Economic and Social Development (2011–2015)." The Plan aims to further strengthen the flood prevention capacity, and in order to specify this objective concretely, the "National Water Resources Development Plan (2011–2015)" was prepared. With regard to large rivers and lakes, such as the Yangtze River, the Yellow River, the Pearl River, Taihu Lake, Dongting Lake, and Poyang Lake, the Plan specifies the following objectives: (1) to improve the flood prevention capacity by continuing to promote the improvement of large rivers and lakes and constructing reservoirs that temporarily store floodwaters outside the dikes; (2) to accelerate the construction of breakwaters and the comprehensive improvement of river estuaries; and (3) to accelerate the repair and reinforcement of dangerous dams and water gates, secure their safety, and improve their flood prevention capacity. Moreover, based on the Plan, the People's Government of Hunan Province drew up the "Hunan Province Water Resources Development Plan (2011–2015)," which specifies the following objectives: (1) to continue strengthening the construction of the flood prevention system, reinforce 22 flood storage dikes such as those of the Qianliang Lake and others, construct systems for further securing safety, and divert the floodwaters in a "timely and appropriate" way based on a water management and control plan; (2) to construct priority dikes and general dikes at 11 places and; (3) to strengthen flood control measures for Dongting Lake, by prioritizing the renewal and repair of large drainage and irrigation pumping stations, and the gradual promotion of the repair of medium and small-sized drainage facilities.

In addition, given the geographical and economic importance of the basin of the Yangtze River, the Ministry of Water Resources prepared the first edition of the "Yangtze River Master Plan" in the 1950s and has corrected and revised it from time to time and the development of the river has been conducted based on this Master Plan. As a part of the Master Plan, the Ministry has prepared and carried out the "Yangtze River Integrated Flood Prevention Facilities Construction System" (approved in June 1999) which include river development programs for branches of Dongting Lake, and the "Integrated Plan for the Basin of the Yangtze River" (approved on January 4, 2013), which promotes the strengthening of the general flood prevention capacity of the whole basin of the Yangtze River. The "Yangtze River Integrated Flood Prevention Facilities Construction System" specified the following objectives: (1) construction of dikes, flood control reservoirs, and central flood prevention works, implementation of comprehensive measures for river roads, and the optimization of the control of dams; (2) planting trees and laying grass in the upper reaches, water and land conservation, flood control using banks in the middle and lower reaches, and the restoration of inland lakes; (3) improvement of the mainstream reaches and branches of the Yangtze River and the branches of Dongting Lake and Poyang Lake; and (4) prohibition of deforestation of natural forests and slope cultivation, and promotion of

reforestation.

In addition to this project, the "Hubei Province Urban Flood Control Project" and the "Jiangxi Province Urban Flood Control Project," both of which were Japanese ODA Loan projects, were planned and carried out as a part of the above-mentioned "Yangtze River Integrated Flood Control Facilities Construction System" by the Ministry of Water Resources as projects related to flood control along the middle and lower reaches of the Yangtze River. Moreover, this project had a mainstream-branch relationship with the Yangtze Dike Strengthening Project, which the World Bank implemented from 2000 to 2008. The project was highly consistent with the Integrated Plan as a measure for increasing the overall flood control capacity of the Yangtze River.

In sum, the improvement of the flood control capacity continues to be a priority area of both the national development plan as well as the Hunan Province development plan, thus the project is fully consistent with the country's development plans also at the time of the ex-post evaluation.

3.1.2 Relevance with the Development Needs of China

1) Relevance with the development needs at the time of the appraisal

Dongting Lake, which is located in the northern part of Hunan Province, is one of the main flood control reservoirs for the Yangtze River and is the second largest freshwater lake that controls flood flows. The surrounding Dongting Plain has five prefecture-level cities,[5] such as the provincial capital of Changsha, Yueyang, and Changde, and 18 county-level cities and is studded with important industrial cities and railway as well as water transportation centers. Although it served as an economic and transport center for the middle and lower reaches of the Yangtze River, the construction of flood prevention and drainage facilities was greatly delayed because of lack of funds.

The flood prevention standards in 2000 were especially low taking into consideration the frequency and scale of floods. The standards were "once every 10 to 20 years" for four prefecture-level cities, such as Changsha; "once every five years" for Zhangjiajie; and "once every four to 10 years" for 18 counties and cities, such as Yonganzhen and Jinshi. In many cities, flood prevention areas were either underdeveloped or developed but the dikes were low, poorly constructed, or remained unrepaired. Because of this, problems such as water leakage from the dike slopes or foundations, erosion due to water flow, collapse of embankments, unstable foundations of the dikes, and decrepit culvert and drainage pumping facilities arose, and were becoming serious issues. In addition, the formation of Chenglingji[6]

[5] China has four administrative levels: province, prefecture, county, and townships. The "prefecture level" is the administrative unit for a district, which is smaller than a province and larger than a county. A "prefecture-level city" refers to a city that fulfills certain conditions, such as the ratio of the urban population, gross product, and the proportion of tertiary industries.

[6] "Chenglingji" is a rocky shoal formed at the point where the water from Dongting Lake flows into the Yangtze River.

at the outlet of Dongting Lake caused narrowing of the river width, which in turn raised the water level in the upper reaches and the accumulation of bottom mud was becoming a serious problem. As a result of this worsening of river conditions, the water level when floods occurred gradually rose. Especially the serious floods that happened in 1991, 1994, 1995, 1996, and 1998 caused extremely severe economic losses affecting the safety of the local people's lives and properties. As can be seen, the need for flood control measures was very high.

2) Relevance with the development needs at the time of the ex-post evaluation

At the time of the ex-post evaluation, the importance of Dongting Lake and the surrounding areas as the economic and transport center of the middle reaches of the Yangtze River have increased compared to the time of the appraisal, due to the rapid economic growth experienced in the recent years. Yueyang, Yiyang, and Changde, the most important industrial cities around Dongting Lake, have developed their economy by more than 10% since 2000. Because the current scale of the flood control infrastructure is appropriate, new construction or large-scale repair will be unnecessary for the time being. However, because the population is concentrating in the cities resulting in accelerated urbanization and rapid expansion of the city area, it will be necessary to continue the reconstruction and expansion of drainage facilities etc., in accordance with the growth rate.

Even at present, Hunan Province, Hubei Province, and Jiangxi Province are making efforts to cooperate with each other in flood control measures – concretely, simultaneous construction of water storage and drainage facilities, optimization of dam control, planting of trees and grass in the upper reaches, and flood control through banks in the middle and lower reaches. Through these measures, the comprehensive improvement of the flood control infrastructure for the whole basin has been promoted, and development needs have continued to exist.

As described above, even at the time of the ex-post evaluation, development needs for flood control measures in the middle and lower reaches of the Yangtze River, including Hunan Province, have continued to exist.

With regard to the addition of Zhangjiajie City to this project in 2005, Zhangjiajie City and Yongshun County were originally included in the "F/S Report on the Use of Foreign Funds for Urban Flood Control Facilities in the Dongting Lake District of Hunan Province (1999)," which was the project's feasibility study (F/S) prepared in 1999 by Hunan Province. Although, based on the F/S, the Hunan Province Government reported to the Central Government that the amount of investment in this project was 4,877 million yuan, the China International Engineering Consulting Corporation estimated it to be 4,126 million yuan. This was because there were concerns on the availability of funds from the Chinese side (specifically Zhangjiajie City and Yongshun County Governments), and the city and the

county in question were located in mountainous areas along the upper reaches of the Lishui River and Yuan River respectively, where the possibility of flooding was relatively low. However, because Zhangjiajie City started to grow as a tourist resort since around 2005, the underdevelopment of the flood prevention infrastructure became to be an obstruction to the city's further growth. Since Zhangjiajie City Government's financial condition improved, it was decided that Zhangjiajie City could be added as a subproject for the construction of facilities of the Hunan Urban Flood Control Project, by using part of the surplus project funds. This additional work contributed not only to the improvement the flood prevention and urban drainage standards, but also to the promotion of the development of the local economy and tourism business. In addition, because this flood control works were conducted in the upper reaches of the Lishui River and Yuan River, it also resulted in increasing the benefits of the subprojects located in the lower reaches the said rivers, thus the addition of Zhangjiajie City as a subproject can be regarded as relevant.

3.1.3 Relevance with Japan's ODA Policy

At the time of the appraisal, Japan's ODA policies towards China were the "Economic Cooperation Program for China (established in 2001)" and the "Strategy for Overseas Economic Cooperation Operations (1999-2002)".

The "Economic Cooperation Program for China (established in 2001)" shifted its focus from the traditional development of infrastructure mainly in the coastal areas to the conservation of the environment and ecosystems -because pollution and destruction were becoming serious problems-, the improvement of the people's livelihood and social development in the inland area, the development of human resources, the creation of systems, and technical transfer. The Program set the following six focus areas: (1) cooperation towards resolving environmental and other global issues; (2) assistance for Open and Reform Policy; (3) promotion of mutual understanding; (4) assistance for poverty alleviation; (5) support for private sector activities; and (6) promotion of bilateral cooperation. This project was consistent with focus area (1) which supports measures that deal with air, water, and other pollution problems, the conservation of ecosystems, including forest preservation and reforestation, and the sustainable use of water resources; and to focus area (4) which supports economic and social development towards narrowing the gap between coastal and inland areas in terms of per capital income.

On the other hand, the "Strategy for Overseas Economic Cooperation Operations (1999-2002)" focused its basic policy on making efforts at providing efficient and effective support that places importance on self-help and ownership of developing countries in solving various development issues. The Strategy's three focus areas were (1) support poverty reduction and economic and social development; (2) tackling global problems; and (3) support economic structural reforms. This project is consistent especially with focus area (1).

In light of the above, this project was confirmed to be consistent with Japan's ODA

Policy at the time of the appraisal.

This project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy; therefore its relevance is high.

3.2 Effectiveness[7] (Rating: ③)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

The purpose of this project is to improve flood control capacity, and the reduction of flood damage in particular is regarded as an important effect. Because no operation and effect indicators were established at the time of the appraisal, the ex-post evaluation was based on indicators that are generally used in flood control projects such as flood prevention standards, discharge capacity, annual maximum inundated area by levee breach or overflow, annual maximum number of inundated houses by levee breach or overflow, and annual maximum damage due to levee breach or overflow.

3.2.1.1 Operational Indicators

1) Comparison between the discharge capacity and the annual maximum flow

The discharge capacity (m^3/s) is the maximum volume of water that can be carried safely by a river at the reference point. In all the subprojects, the discharge capacity in 2011[8] increased compared to 2000. The lowest improvement was the 108% of Taojiang County and the biggest improvement was the 227% of Zhangjiajie City. The simple average was 155%, a considerable improvement compared to 2000 (Table 2).

[7] The impact is taken into consideration when rating the effectiveness.
[8] Latest collectable data.

Table 2: Discharge Capacity (Unit: m^3/s)

Subproject		Appraisal (2000)	Ex-post evaluation (2011)	Comparison with 2000	Subproject		Appraisal (2000)	Ex-post evaluation (2011)	Comparison with 2000
1	Changsha City	15,000	24,000	160%	12	Yueyang County	2,300	5,230	227%
2	Liuyang City	2,500	4,030	161%	13	Huarong County	1,400	1,600	114%
3	Yueyang City	20,000	45,000	225%	14	Xiangyin County	11,000	20,300	185%
4	Linxiang City	550	640	116%	15	Anxiang County	3,500	6,000	171%
5	Miluo City	3,500	4,460	127%	16	Hanshou County	19,000	25,000	132%
6	Changde City	22,000	35,000	159%	17	Lixian County	12,000	20,000	167%
7	Jinshi City	7,000	12,800	183%	18	Taoyuan County	15,000	22,000	147%
8	Yiyang City	9,600	14,500	125%	19	Yuanjiang City	35,000	60,000	171%
9	Changsha County	6,200	7,800	126%	20	Nanxian County	3,600	4,800	133%
10	Wangcheng County	4,000	5,500	138%	21	Taojiang County	12,000	13,000	108%
11	Ningxiang County	2,980	3,430	115%	22	Zhangjiajie City	5,000	10,500	210%

Source: Prepared by the evaluator based on materials provided by the Provincial Project Management Office

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, it means that the floodwater flows down safely (i.e. the increase in river water due to heavy rain or the like is flowing safely), which indicates that the discharge capacity increased by the project is being maintained. Table 3 shows the difference between the discharge capacity and the annual maximum flow from 2003 to 2011. When the engineering works of the project started in 2003, 11 out of the 22 subprojects had a discharge capacity lower than the annual maximum flow, indicating that there was a clear risk of a potential levee breach or overflow. However, as the work progressed, the subprojects for which the discharge capacity was lower than the annual maximum flow were only Taoyuan County and Nan County in 2004. From 2005 to 2011, in all subprojects floodwater was flowing down safely, which indicates that this project has had a considerable effect.

Table 3: Difference between the Discharge Capacity and the Annual Maximum Flow by Subproject (2003-2011)

(Unit: m^3/s)

Subproject		2003 Beginning of the work	2004	2005	2006	2007	2008	2009 Completion of the work	2010	2011
1	Changsha City	-4,500	4,500	6,700	4,300	9,500	10,900	13,600	4,700	14,200
2	Liuyang City	2,146	3,028	3,126	2,720	3,127	3,216	3,499	2,730	3,638
3	Yueyang City	3,400	5,200	23,500	25,100	29,300	30,400	34,900	23,700	31,300
4	Linxiang City	-20	140	120	240	170	210	220	120	40
5	Miluo City	810	398	1,040	1,296	1,279	1,220	1,447	974	1,840
6	Changde City	2,000	4,400	15,600	24,530	13,800	15,600	24,500	18,100	25,820
7	Jinshi City	-9,100	1,940	3,180	4,490	4,780	4,240	5,710	5,110	4,420
8	Yiyang City	-800	100	1,100	2,000	2,500	2,000	2,000	3,200	1,500
9	Changsha County	1,520	1,940	2,680	2,890	3,180	4,240	3,210	4,210	4,520
10	Wangcheng County	-195	981	1,262	2,343	1,001	2,098	3,453	289	3,332
11	Ningxiang County	466	1,213	1,206	1,420	1,444	1,665	1,478	785	1,411
12	Yueyang County	2,611	1,156	3,789	4,289	4,697	4,697	4,253	1,698	4,590
13	Huarong County	270	410	550	280	470	380	250	320	230
14	Xiangyin County	-1,360	1,600	4,880	6,900	8,014	9,614	11,129	7,087	12,289
15	Anxiang County	-2,280	740	1,380	2,690	980	1,440	2,910	1,310	2,620
16	Hanshou County	5,000	3,000	7,000	10,000	9,000	10,000	9,000	9,000	10,000
17	Lixian County	-4,600	3,210	9,280	12,250	4,650	7,080	8,280	3,720	7,410
18	Taoyuan County	-5,400	-5,000	4,600	12,900	1,200	3,600	11,000	4,400	1,000
19	Yuanjiang City	16,400	13,700	12,720	38,700	37,720	38,650	36,900	37,800	47,200
20	Nanxian County	-200	-100	600	1,700	1,350	1,700	1,650	1,200	2,300
21	Taojiang County	6,500	4,000	6,200	7,200	7,100	6,000	10,600	6,200	8,100
22	Zhangjiajie City	-3,540	1,580	3,290	4,010	4,480	3,990	6,460	5,380	7,490

Source: Prepared by the evaluator based on materials provided by the Provincial Project Management Office

2) Comparison between the planned highest safe water level and the annual highest water level at the reference points

If the annual highest water level is less than the planned highest safe water level at a reference point, this means that a safe water level is being maintained. In 2003, when the work began under this project, the annual highest water level exceeded the planned highest safe water level in 16 out of the 22 subprojects (Table 4). Moreover, according to the results

of a comparison with the warning water levels,[9] in 19 out of the 22 subprojects, the annual highest water level exceeded the warning levels, indicating that the situation was highly dangerous.

Table 4: Difference between the Planned Highest Safe Water Level and the Annual Highest Water Level (Unit: m)

Subproject		2002	2003 Beginning of the work	2004	2005	2006	2007	2008	2009 Completion of the work	2010	2011
1	Changsha City	-1.53	-1.25	2.42	1.07	-0.63	0.93	1.74	3.24	0.60	5.90
2	Liuyang City	1.47	2.77	3.47	2.97	2.07	2.57	2.77	3.37	3.94	5.34
3	Yueyang City	-2.91	-1.61	-0.05	0.40	2.30	-0.62	0.72	1.07	0.65	4.56
4	Linxiang City	0.90	-0.10	1.60	1.30	2.30	1.20	1.50	1.60	4.46	3.46
5	Miluo City	-1.56	-1.70	-2.20	-1.25	-0.20	-0.70	-1.55	-0.77	0.54	2.01
6	Changde City	2.89	1.07	1.02	4.32	7.64	2.04	2.65	6.10	4.54	8.78
7	Jinshi City	1.35	-3.67	2.22	4.34	2.33	3.35	4.28	2.14	2.59	3.67
8	Yiyang City	3.43	2.88	2.88	2.38	2.38	1.88	1.88	-0.62	1.34	1.06
9	Changsha County	-1.01	-0.98	-0.06	0.01	-1.00	0.01	-1.08	-1.23	1.44	3.22
10	Wangcheng County	-2.09	-0.94	1.26	0.71	-0.39	0.97	1.82	2.66	0.53	5.65
11	Ningxiang County	-0.32	-1.02	1.78	-0.12	0.18	1.78	2.28	0.48	0.76	1.86
12	Yueyang County	1.62	1.62	0.92	1.68	1.77	1.88	1.68	1.12	3.28	3.26
13	Huarong County	-2.46	-1.16	0.14	0.94	2.84	0.54	0.64	0.74	11.65	2.65
14	Xiangyin County	-3.40	-1.65	-1.07	-0.07	-0.04	-0.37	0.57	1.29	0.51	4.55
15	Anxiang County	-1.45	-3.64	-0.48	0.54	2.53	-1.45	-0.52	1.34	1.27	4.35
16	Hanshou County	0.30	0.20	-2.10	0.00	0.30	0.20	0.30	0.20	1.87	1.97
17	Lixian County	2.46	-3.59	2.22	6.79	8.26	0.68	3.09	4.29	1.42	5.11
18	Taoyuan County	0.22	-2.04	-2.29	1.85	5.68	-1.30	-0.62	3.63	1.58	0.62
19	Yuanjiang City	1.01	-2.56	-1.88	0.86	2.34	-1.14	-0.25	2.07	0.96	5.40
20	Nanxian County	-2.34	-1.52	-1.26	-0.41	2.22	-1.01	0.48	0.47	0.74	3.93
21	Taojiang County	-3.33	0.34	-1.85	-0.19	1.67	1.39	-0.57	3.40	1.25	2.85
22	Zhangjiajie City	-0.06	-3.91	1.08	2.86	0.48	-0.35	-0.95	1.33	2.37	4.14

Source: Prepared by the evaluator based on materials provided by the Provincial Project Management Office

[9] The warning water level is the water level of a river or lake where potential risks of levee breach or overflow are high unless measures are carried out. In China, it is generally calculated by subtracting 1.5 m from the planned highest safe water level. If the actual water level reaches the warning water level, the Flood Prevention Department strengthens the alarm system and makes human and physical preparations so that emergency measures can be carried out to prevent a flood.

With the progress of the project, the situation gradually improved and, as shown in Table 4, since 2010 the annual highest water level was lower than the planned highest safe water level in all the subprojects. According to the results of a comparison with the warning water level, the annual highest water level exceeded the warning level in 13 out of the 22 subprojects in 2010, and two out of the 22 subprojects in 2011. However, because the annual highest water levels were lower than the planned highest safe water level in all cases, no levee breaches or overflows occurred, from which effects of this project are clear.

3.2.1.2 Effect Indicators

1) Flood prevention standards (probability of return)

As shown in Table 5, due to this project, there were considerable improvements in the flood prevention standards of all the subprojects, which enable to recognize the effects brought about by the project.

Table 5: Flood Prevention Standards

Subproject	At the time of appraisal	At the time of ex-post evaluation
Changsha City (provincial capital)	Once every 10 to 20 years	Once every 100 to 200 years
Changde, Yiyang, Yueyang (prefecture-level cities)	Once every 10 to 20 years	Once every 100 years
Zhangjiajie City	Once every 5 years	Once every 50 years
Other 17 county-level cities	Once every 4 to 10 years	Once every 20 years

Source: Prepared by the evaluator based on materials provided by the Provincial Project Management Office

2) The annual maximum inundated area (km^2), the annual maximum number of inundated houses (houses), the annual maximum damage (yuan), the annual maximum inundated time (hours), and the annual human damages (number of persons affected) due to levee breach or overflow (Table 6).

With the exception of Zhangjiajie City, all the indicators in all subprojects improved from the peak years of 2002 to 2003, reaching zero from 2008 onwards. This verifies that the project is yielding effects with respect to flood damage as planned. In Zhangjiajie City, however, no effect indicator has reached zero. According to the results of interviews with the Provincial Project Management Office staff, this is because the bank of one side of the river was repaired by the project, while the opposite bank of the river was repaired using the city's own funds and the work was not completed until 2011.

Table 6: Effect Indicators: Average for 21 Subprojects and Zhangjiajie City

	2000	2001	2002	2003 Beginning of the work	2004	2005	2006	2007	2008	2009 Completion of the work	2010	2011
A. Annual maximum inundated area (km^2) due to levee breach or overflow												
Average for 21 Subprojects	3.1	2.0	4.7	4.8	2.4	1.7	0.8	0.1	0	0	0	0
Zhangjiajie City	2.9	1.9	2.8	3.8	1.4	2.0	1.5	1.5	0.9	0.5	0.2	0.1
B. Annual maximum number of inundated houses (houses) due to levee breach or overflow												
Average for 21 Subprojects	10,075	6,451	15,672	16,492	8,311	5,501	2,098	215	0	0	0	0
Zhangjiajie City	460	298	435	593	215	310	238	243	141	78	30	9
C. Annual maximum inundated time (hours) due to levee breach or overflow*												
Average for 21 Subprojects	38	25	55	54	40	32	23	11	0	0	0	0
Zhangjiajie City	24	24	24	24	24	24	24	24	24	24	24	24
D. Annual human damages (number of persons affected) due to levee breach or overflow												
Average for 21 Subprojects	1,825	1,168	3,031	3,163	1,714	1,088	494	40	0	0	0	0
Zhangjiajie City	1,750	1,136	1,655	2,257	820	1,181	905	926	538	297	116	35

Source: Prepared by the evaluator based on materials provided by the Provincial Project Management Office

*: According to the results of interviews with the Provincial Project Management Office staff, the number of hours of flooding has been recorded on a 24-hour basis. In the case of Zhangjiajie City, therefore, "24" means "24 hours or shorter" and the actual number of flooding hours cannot be ascertained.

3.2.2 Qualitative Effects

Because no concrete qualitative effects were expected at the time of the appraisal, for the ex-post evaluation, the qualitative effects were evaluated together with the effects of the project at the impact level as shown in section "3.3 Impacts" below.

3.3 Impacts

3.3.1 Intended Impacts

The purpose of this project is "to stabilize the local society and economy and to improve the living conditions of the local residents." With regard to "stabilize the economy of the area" an interview survey was carried out covering 20 private companies in four important industrial cities around Dongting Lake (Changsha, Yueyang, Changde, and Yiyang) to gather opinions about improvements in the local economy – especially on the logistics and other infrastructure required for business –, changes in real estate prices, changes in land use, and the degree of satisfaction of the project. With regard to "stabilize the society and to improve the living conditions of the local residents," a beneficiary survey of 100 people was carried out to confirm such matters as changes in their state of minds as well as physical condition, improvements in living conditions, and the degree of satisfaction of the project (Table 7).[10]

[10] [Company survey] sample size: 20 companies / regional distribution: Changsha City 35%; Yueyang City 10%; Changde City 25%; Yiyang City 30% / type of business: agriculture/forestry/fisheries 20%; manufacturing 25%; construction 30%; services 15%; other 10%) / number of employees: 100 or more 35%; 33 to 99 50%; up to 30 15%) / flood damage experience in the past: 10 companies have experienced flood damages; 10 companies have not experienced flood damages.[Residents survey] sample size: 100 residents / regional distribution: Changsha City 26%; Yueyang City 10%, Changde City 33%; Yiyang City 31%) / Gender: male 66%, female 34%) / Age: 20s 5%; 30 to 59 82%; 60 or older 13%) / flood damage experience in the past: 63% do have experience; 37% have no experience. Survey period: mid-May 2013.

Table 7: Project Impact According to the Beneficiary Survey Results

Stabilize the local economy (Company survey results)	1. Impact on the business environment: 100% of the companies surveyed answered that the situation has "Greatly improved" or "Improvements in general terms" when asked to evaluate the items "We are now able to deliver goods on schedule" and "We do not have to think about flood risks anymore when conducting business". With regard to "Overall logistics has improved" and "Work efficiency has improved," 95% and 90% of the companies answered "Greatly improved" or "Improvements in general terms," respectively. 2. Impact on land prices: Compared with land prices before the project i.e. 2000, at the time of ex-post evaluation land prices have increased by 380% - 2,500% and house prices by 300% - 800% (according to the residents survey results, more than 90% of the respondents answered that land prices have increased by 120% - 600% and house prices by 150% - 1,000%). Because the local economy around Dongting Lake grew as China's economy grew, the direct relationship between this project and the increase in land prices is unclear. However, according to the results of the interview survey, it is certain that the elimination of the flood damage risk has influenced the land prices to go up. In addition, compared with 2000, domestic and foreign direct investments (mainly those in manufacturing and service industries) also increased by 30% – 40% and by 20% – 50%, respectively. 3. Degree of achievement of project objectives and degree of satisfaction: With regard to the degree of achievement of project objectives, all the surveyed companies answered that "The project has achieved its goals." With regard to the Government's flood measures including the project, all the companies answered that they are "Satisfied." As for the reason for this high degree of satisfaction with the project, 95% of the companies answered that "Because the number of floods greatly decreased from around 2000." In sum, it became clear that the degree of achievement of the project objectives, as well as the degree of satisfaction with the project were very high.
Stabilize the society and improve the living conditions of the local residents (Results of surveys of residents)	1. Improved Living Environment: 83% of residents said that the incidence of flooding had "Decreased greatly" compared to when the project began in 2000, and 17% said that it had "Decreased somewhat". Their responses clearly show that decreased flooding improved their living environments: 95% said their everyday lives are free of anxiety over flood damage, 83% said they didn't have as many flood-related health problems (mainly respiratory and digestive system illnesses) and 88% said they were able to relax and enjoy themselves in and around rivers again. Especially with reference to the resident's now being able to live a life free of anxiety, many people indicated that they see an improvement in areas related to "difficulties to go work, school, medical facilities and markets" and "frequent stops in electricity, gas and water services" due to floods. 2. Degree of achievement of project objectives and degree of satisfaction: 91% of respondents said the project has achieved its objectives, and 96% said that they were satisfied with project performance. The main reason was that the project was completed; the standard of flood control was improved from 20-year floods to 100-year floods. Moreover, many people indicated that there have been no floods and inundation damages since the project was implemented, and cases of flood damages have decreased significantly. On the other hand, the respondents that are "somewhat dissatisfied" were 4% of the total, and they cited "Protection and management of levees, dams and flood walls are insufficient" as the reason.

Source: Results of surveys of beneficiaries

As indicated above, companies and residents evaluated highly the results of the project with respect to "stabilize the local society and economy and to improve the living conditions of the local residents", and are extremely satisfied with the project. However, they also recognize the need to steadily continue improving flood control and indicated the following

issues as areas that need further improvements and continuous work: rehabilitation of drainage facilities such as pumping stations, increase the information provided to the public during flood seasons, and development of flood control facilities such as dikes and dams.

3.3.2 Other Impacts

3.3.2.1 Impacts on the Natural Environment[11]

No negative impacts on the natural environment were envisioned during the appraisal. Since it was difficult to assess the environmental impact before and after the project in a wide area such as the whole area surrounding Dongting Lake, and moreover, because it was difficult to define the direct causal relationship of the project with the natural environment in the project area, this ex-post evaluation focused on the natural environment monitoring that was implemented during the construction work of the project.

The Provincial Project Management Office (PPMO) was in charge of environmental protection and management activities related to the urban flood prevention work done around Dongting Lake during the project. An environmental protection department was established at the PPMO, and environmental protection groups were established in each of the county and city Subproject Management Offices (SMO). The environmental protection groups were responsible for preparing environmental activity reports and submitting them to the PPMO environmental management department, and for conducting rigorous environmental management and monitoring planning, as well as internal and external coordination and supervision of the sub-project for which they were in charge. Environmental monitoring was carried out for the three areas indicated in Table 8.

[11] The Environmental Impact Assessment Report of the project was approved by the State Environmental Protection Administration in August 1999.

Table 8: Natural Environment Monitoring During Project Implementation

Area	Description of Monitoring
Water quality	• Responsible Entity: Environmental monitoring stations of each subproject • Monitoring period: From start to finish of the whole construction period • Monitoring frequency: Once during each of the three seasons (flood season, dry season, normal season) • Description of monitoring: Monitored water quality during construction in four cross-sections at the confluences of four major tributaries (Xiangjiang, Zijiang, Yuanjiang and Lishui Rivers) one cross-section at the outlet of Chenglingji, two cross-sections at the edges of Muping, South Dongting and East Dongting Lakes, and one cross-section upstream and downstream of the urban areas of Changsha, Yiyang, Changde, Yueyang, Lixiang County, Jinshi City, Miluo, Liuyang, Taojian, Taoyuan, Wangcheng, Ningxiang and Zhangjijie. Took protective measures as necessary.
Air	• Responsible Entity: Environmental monitoring stations of each subproject • Monitoring frequency: Quarterly • Description of monitoring: Selected and set up observation points at three to five locations in focused, representative construction zones at each subproject. Determined items to monitor based on contaminants originating from construction zones.
Noise	• Responsible Entity: Environmental monitoring stations of each sub-project • Monitoring period: From start to finish of the whole construction period • Monitoring frequency: Once every two months • Description of monitoring: Selected and set up sampling points in four to six locations in typical construction zones in prefecture-level city subprojects (two locations for county-level subprojects).

Source: Prepared by the evaluator based on documents provided by each SMO

According to interviews conducted to SMOs, there were concerns about how turbid water, dust and noise which are issues that arise from ordinary construction works would negatively affect the natural environment and the living environment of the residents. These environmental pollution issues did actually arise during the implementation period of the project. However, in order to minimize them, it was confirmed that the measures described in Table 9 were taken.

Table 9: Measures against Environmental Pollution during Project Implementation

Item	Measures
Sewage	Discharge of water containing concrete was conducted in coordination with each subproject's sewage treatment plants and sewage operation and management centers, which treated the polluted water through sedimentation procedures. With respect to water containing oil (mainly water used for repairing and washing construction vehicles) a centralized washing area near the construction sites were set up and the polluted water was collected and treated in oil/water separator tanks.
Dust	Water was sprinkled in and around the construction site and roads were washed frequently, so that during excavation work, the amount of dust originated would remain below the limits set by the standards. In some subprojects, new regulations on the handling conditions and transportation of soil were introduced. These regulations set clear evaluation and permission procedures, transportation time, and standards for the transportation vehicles, in order to minimize pollution due to emission of dust.
Noise	Operating hours of high-noise level equipment was limited (execution of works that require high-noise level equipment were prohibited from 10 PM to 6AM). With respect to the noise produced by construction and transportation vehicles, the main measures were to control overloaded vehicles, prohibit excessive use of horns and put speed limits.

Source: Prepared by the evaluator based on interviews and documents provided by each SMO

In the aforementioned beneficiary survey, questions on the environmental effects of six items, namely, waste disposal, gas emissions, dust, turbid water, noise and vibration during the construction works of the project were included. 50% of respondents said that gas emissions, dust from waste disposal, and turbid water during project implementation were either extremely or somewhat troubling, and 40% said the same about noise and vibrations. As can be seen, there is no denying that the environment was polluted during construction. Residents that actually filed complaints with city and county authorities were 18%, but it is worth noting that they also said that the problems were solved, confirming that the SMOs also made efforts to reduce environmental pollution. On the other hand, 84% of the residents felt that "the project improved environmental protection around the rivers" which provide the basis to conclude that there were some positive impacts on the environment after the project was completed.

3.3.2.2 Land Acquisition and Resettlement

At the time of the appraisal, the project was expected to acquire about 1,900 hectares of land and a large-scale resettlement of 10,000 households (about 36,000 people) was to be conducted. As indicated in Table 10, the actual land acquisition was 1,398.06 hectares which affected 2,821 households (9,628 people) in one hand, and on the other, 7,298 households totaling 25,036 people who were resettled.

Table 10: Land Acquisition and Resettlement

Subproject	Land Acquisition			Resettlement	
	Area (ha)	Households	Population	Households	Population
1. Changsha City	400.00	1,120	3,360	2,880	8,640
2. Liuyang City	62.40	166	681	446	1,841
3. Yueyang City	7.40	8	32	22	90
4. Linxiang City	52.77	9	35	27	102
5. Miluo City	92.54	35	140	97	397
6. Changde City	29.53	243	945	657	2,555
7. Jinshi City	57.00	53	240	134	615
8. Yiyang City	124.01	553	1,854	1,353	4,537
9. Changsha County	58.33	95	359	230	876
10. Wangcheng County	57.27	45	218	113	559
11. Ningxiang County	21.00	42	133	110	359
12. Yueyang County	61.00	14	54	37	152
13. Huarong County	12.00	30	122	88	366
14. Xiangyin County	57.98	53	167	150	475
15. Anxiang County	55.00	51	232	135	625
16. Hanshou County	83.00	34	129	86	331
17. Lixian County	40.14	69	286	167	697
18. Taoyuan County	23.33	15	56	39	149
19. Yuanjiang City	9.79	13	53	33	133
20. Nanxian County	9.37	42	146	112	394
21. Taojiang County	22.00	32	91	88	259
22. Zhangjiajie City	62.18	99	295	294	884
Total (Actual)	1,398.06	2,821	9,628	7,298	25,036

Source: Information provided by each SMO and PPMO

In order to implement this large-scale resettlement and land acquisition smoothly, the government of Hunan Province established a Land Expropriation and Resettlement Department under the PPMO so that resettlement procedures and compensations are conducted in a rigorous manner as stipulated in the resettlement regulations, policies and laws set forth by the State Council in each of the subprojects. Under the direction of the said province level Department, a Land Expropriation and Resettlement Department was established at each SMO between 2001 and 2002, who implemented and managed the actual resettlement. The PPMO supervised and regularly monitored the land acquisition and resettlement in each subproject.

Figure 3: "Resettlement Residence" in Changsha City

Land acquisition and resettlement was carried out according to the "Land Administration Law of the People's Republic of China" and the "Regulations on Compensation for Land Expropriation and Resettlement for Large- and Medium-scale Construction Projects for Water Resource and Hydropower Generation" in each of the subprojects. The procedure was as follows: the Land Expropriation and Resettlement Department for each subproject held public hearings in each township, town and village[12] which were targeted for land acquisition and resettlement. At these hearings, the department disclosed the information on the number of people and number of households to be resettled and the amount of land to be acquired. They explained and exchanged opinions on the criteria, methods of calculation and amount of compensation and subsidy. Then residents were informed on the places where they would be resettled, resettling dates and procedures on how to collect their compensation and subsidy money, after which they entered into agreements, which were notarized by registered public notaries.[13] As a representative case, in Changsha City the procedures were as follows: as compensation for resettlement, the local government allocated 70 square meters (including frontage roads, drainage and other public land) of land per resettled resident as the standard, and offered residents two options: (1) for residents who wanted to live in "Resettlement Residences" (new complex housings built by the city government), a temporary housing (existing public housing or private residences) and a monetary compensation of 12 yuan per square meter of their original land per month was paid until the new housing was

[12] China has four administrative divisions (province, prefecture, county and township in order of size from largest to smallest). Townships comprises (in order of population size from largest to smallest) towns (equivalent to "*machi"* (town) in Japan), townships ("*mura"* (village) in Japan) and villages.

[13] The government of Hunan Province wanted all Hunan residents to understand the nature and importance of the Project and the land acquisition and resettlement it would require. The government conducted informational and promotional campaigns via publicity material, round-table discussions and through mass media such as radio and TV.

completely built; or (2) for residents who wanted to search the housing market on their own, a maximum compensation of 1,200 yuan per square meter was paid. Resettled residents spent an average of 31 months to move into temporary housing, with the shortest time being 26 months in Liuyang City and the longest being 45 months in Wangcheng City. The plan was to complete resettlement into "Resettlement Residences" within the project period, but more time was required because it has been necessary to coordinate with the resettlement of other public projects (e.g. road improvements and other infrastructure projects).

On the other hand, the amount of compensation for land acquisition was determined by the size of the city/county and the type of land (permanently owned land or temporarily owned land). While the amount was different for each subproject, the average compensation amount was 27,923.7 yuan per *mu*.[14]

At the time of this ex-post evaluation, an interview to beneficiaries living in temporary housing who were soon to move into Resettlement Residence revealed that the aforementioned process was implemented as planned, and they evaluated the whole procedure as one that took into account their opinions to the extent possible. Given that they were losing their household possessions to floods every time there was one, they emphasized that the most important effect of the project was the sense of security. Although some residents felt that the compensation was not enough, on the whole, the land acquisition and resettlement process of the project was implemented without major problems.

3.3.2.3 Other Impacts

This project not only improved flood control and urban drainage standards, but cities and counties implemented measures on their own to protect sloped areas, greening, beautifying and developing pedestrian walkways. These efforts have resulted in new scenic areas along the rivers as well as new recreation areas for the residents living around Dongting Lake. Similar positive impacts were present in all 22 sub-projects, and many concrete examples were confirmed during the ex-post evaluation field surveys.

In light of the above, the project has largely achieved its objectives. Therefore, its effectiveness and impact is high.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

As shown in Table 11, the project consists of 22 subprojects in five prefecture-level cities and 17 cities and counties. Urban flood control facilities (construction and rehabilitation of new and existing dikes and flood walls, and rehabilitation of existing channels) and urban drainage facilities (construction and rehabilitation of new and existing floodgates, pumping

[14] A unit of land area, one *mu* is one-fifteenth of a hectare.

stations, and rehabilitation of diversion canals) were implemented in each subproject (see Attachments 1-1 and 1-2 for the outputs of each subproject).

Table 11: Subprojects

Prefecture-Level Cities (5)	Cities and Counties (17)
Changsha City, Yueyang City, Changde City, Yiyang City, Zhangjijie City	Liuyang City, Linxiang City, Miluo City, Jinshi City, Changsha County, Wangcheng County, Ningxiang County, Yueyang County, Huarong County, Xiangyin County, Anxiang County, Hanshou County, Lixiang County, Taoyuan County, Yuanjiang City, Nanxian County, Taojian County

Dike and flood wall improvement for Zhangjijie City (including 26.47 kilometers of access roads) were added to the flood control facilities, so the total distance of dikes and flood wall improved was 105% compared to the planned total distance (Table 12).

Table 12: Flood Control Facilities (Planned vs. Actual)

Subproject	Planned (km)				Actual (km)				
	Build new dikes & flood walls	Repair existing dikes & flood walls	Repair existing river channels	Total	Build new dikes & flood walls	Repair Existing dikes & flood walls	Repair existing river channels	Total	Achievement % compared to plan
Total of 21 subprojects	90.029	709.31	139.64	938.979	90.029	709.303	139.64	977.782	100%
Zhangjiajie City	—	—	—	—	—	38.810	—	—	
Total	90.029	709.31	139.64	938.979	90.029	748.113 (105%)	139.64	977.782	104%

Source: Planned figures are from appraisal documents; actual figures are from documents provided by each SMO.

As for urban drainage facilities, Table 13 indicates that the addition of culvert gates, diversion canals and access roads of the Zhangjiajie City subproject, resulted in a 102% increase in the number of culvert gates, in a 162% increase in the length of new diversion canals, and a 108% increase in the total length of diversion canals.

Table 13: Urban Drainage Facilities (Planned vs Actual)

Subproject	Planned						Actual (Pct. of Planned)					
	Culvert gate construction & repair	Pumping station construction & repair		New diversion canal construction	Diversion canal repair	Total diversion canal	Culvert gate construction & repair	Pumping station construction & repair		New diversion canal construction	Diversion canal repair	Total diversion canal
	Locations	kW	Locations	km			Locations	Locations	kW	Locations		
Total of 21 subprojects	365	64,474	146	14.26	97.07	111.33	365	64,474 (100%)	146 (100%)	14.26 (100%)	97.07 (100%)	111.33 (100%)
Zhangjijie City	—	—	—	—	—	—	8	—	—	8.8	—	8.8
Total	365	64,474	146	14.26	97.07	111.33	373 (102%)	64,474 (100%)	146 (100%)	23.06 (162%)	97.07 (100%)	120.13 (108%)

Source: Planned figures are from appraisal documents; actual figures are from documents provided by each SMO.

In sum, the addition of Zhangjiajie City resulted in actual outputs exceeding planned values for some components.

3.4.2 Project Inputs

3.4.2.1 Project Cost

The planned project cost at the time of the appraisal was 68.264 billion yen (foreign currency portion: 24 billion yen / domestic currency portion: 4.298 billion yuan). The actual project cost was 62.285 billion yen (foreign currency portion: 23.939 billion yen, domestic currency portion: 2.852 billion yuan), 91% of the planned value, which was within the budget. If the additional procurement of the Zhangjijie City subproject is excluded, the actual project cost was 52.717 billion yen (foreign currency portion: 19.682 billion yen / domestic currency portion: 2.457 billion yuan), or 77% of the planned project cost (Table 14).

Table 14: Project Cost (Planned vs Actual)

Item	Planned*1			Actual (Comparison with Planned)*2		
	Japanese ODA Loan (million yen)	Domestic currency (million yuan)	Total (million yen)	Japanese ODA Loan (million yen)	Domestic currency (million yuan)	Total (million yen)
Civil engineering works	17,777	2,800	41,998	19,282	1,980	45,909 (109%)
Pump station construction and rehabilitation	3,399	0	3,399	3,443	0	3,443 (101%)
Taxes, administrative costs, etc.	0	1,066	15,992	0	747	10,041 (63%)
Price escalation	640	106	1,632	0	0	0
Contingencies	2,183	326	5,242	1,215	125	2,892
Total (including Zhangjijie)	24,000	4,298	68,264	23,939 (99%)	2,852 (66%)	62,285 (91%)
Total (excluding Zhangjijie)	—	—	—	19,682 (82%)	2,457 (52%)	52,717 (77%)

Source: Planned figures are from Exchange of Notes; actual figures are from documents provided by the PPMO.

*1 : Exchange rate is 1 yuan = 10.3 yen; Price escalation (annual): foreign currency 1.2%, domestic currency 3.3%; Contingencies 10.0% of both foreign and domestic currencies; Costs calculated in October 1999

*2 : Exchange rate: 1 yuan = 13.44502 yen (provided by the PPMO)

Civil engineering work was 109% compared to planned, but other costs were either as planned or within planned. The two factors that contributed to keep project costs were within planned were keeping administrative costs down and because some tax exemptions were granted. With regard to the 9,568 billion yen of additional procurement for Zhangjiajie City, because there was an unused portion in the funds allocated for civil engineering works as well as contingencies, JICA approved to use the Japanese ODA Loan (4,257 billion yen) and the project cost was, on the whole, within budget.

3.4.2.2 Project Period

The planned project period at the time of the appraisal was 58 months from March 2000 to December 2004, but it actually took from March 2000 to December 2009 (118 months in total) which was a significant delay of 203% compared to the planned project period (Table 15). The main reasons for this delay were a 35 month delay in launching the project, which in turn affected the rest of the schedule, and a 115% delay in the civil engineering work compared to the planned period.

Table 15: Project Period (Planned vs Actual)

Process	Planned	Actual	Delay in starting[*1]	Comparison with planned
Signing Loan Agreement (L/A) to bidding process	March-September 2000 (7 months)	Civil Engineering and Construction March 2000 to March 2003 (37 months) Facilities March-September 2006 (7 months)	35 months	
Bidding / contracts	July 2000 to June 2001 (12 months)	Civil Engineering and Construction April 2003 to March 2004 (12 months) Facilities July 2006 to January 2007 (7 months)	34 months	
Civil engineering work	October 2000 to December 2004 (39 months)	April 2004 to May 2008 (50 months)	43 months	115%
Purchase, install and test-run of machinery and equipment	October 2000 to December 2004	April 2008 to October 2009 (19 months)	91 months	49%
Completion[*2]	December 2004	December 2009	—	—
Project Total	58 months	130 months	—	224%

Source: Planned figures are from documents at the time of JICA appraisal; actual figures are from documents provided by the PPMO.

[*1]: Indicates the number of months in which the starting of the process in question was actually delayed as compared to the planned schedule.

[*2]: Project Completion is defined as completion of test runs of all subprojects.

The main reasons for taking 35 months from the signing of L/A to start the bidding process were as follows: (1) The National Development and Reform Commission requested revisions to part of the initial Detailed Design report, which was supposed to be evaluated and approved before signing of the L/A. The revised version needed to be re-evaluated and time was needed to complete this procedure. The report was eventually approved in June 2001; (2) Although the loan agreement was signed in March 2000, the sub-loan agreement between the Export-Import Bank of China and the Hunan Finance Department was not concluded until January 2001, thus the government of Hunan Province was not able to start working on the project full-fledged until February 2001; (3) In addition to the executing agency's lack of experience with JICA procurement guidelines -which resulted in insufficient procedures-, the large number of subprojects, and the fact that they were spread

over a wide area, made it quite difficult to align the schedule of all the subprojects. Moreover the conditions for each subproject in terms of procurement of own funds, planning for the invitation of bids, status of land acquisition and resettlement differed from each other, and significant amount of time was needed to get all cities and counties on board.

Two extensions of the disbursement period were approved in 2008 and 2009 respectively. The documents requesting the extensions mention the reasons indicated in Table 16, in addition to those already stated above.

Table 16: Details of the Two Extensions of the Disbursement Period

	Extension period / final disbursement date after extension / reasons for extension
First extension (2008)	Extension period: One year Final disbursement date after extension: January 22, 2009 Reasons for extension: 1. The SARS outbreak that happened during the project implementation period, delayed the procurement procedures, and caused delays in the progress of civil engineering works. 2. Due to the flood that happened in June 2005, civil engineering works had to be interrupted and restoration works had to be conducted.
Second extension (2009)	Extension period: Two years Final disbursement date after extension: January 22, 2011 Reasons for extension: 1. Due to the appreciation of the yen against the yuan and the sudden increase in the cost of the materials, negotiations on the package related to water intake works required more time than originally planned. 2. Even after an agreement was reached, the installation work and inspection procedures took longer than planned. 3. The unexpected freezing of the rivers in the winter of 2008–2009 and the subsequent flooding when the ice melted interrupted and delayed the construction schedule.

Source: JICA internal documents

It is worth noting that the bidding procedures for the purchase, installation and test-running of machinery took only 49% of the planned period, mainly because, according to the PPMO, the Hunan Province Japanese ODA Loan Management Office and the SMOs improved and strengthened their management plans to install and test-run the machinery. They asked machinery manufacturers to provide three times the number of technicians that were originally planned, who worked on the installation and coordination for 24 straight hours. In addition, the people from each sub-project who would actually be the ones to operate and manage the machinery were requested to actively participate in the installation and coordination of the machinery. These measures helped to increase understanding of the project and improved the efficiency of the test runs, which in turn resulted in a significant shortening of the schedule required for installation and test-running of the machinery and

equipment.

For the aforementioned reasons, the project period was significantly longer than planned.

3.4.3 Results of Calculations of Internal Rates of Return (IRR) (Reference Value)

At the time of the appraisal, only the economic internal rate of return (EIRR) was calculated resulting in 16.4%. At the time of the ex-post evaluation, it was not possible to obtain the method that was originally used to calculate the EIRR at the time of the appraisal, so it was recalculated to the using the same information on costs and benefits as was used during the appraisal to the extent possible as shown in Table 17. The EIRR at the time of the ex-post evaluation was 10.6%, which is slightly higher than the social discount rate of 8% used in China. It is also in the range of 10% -12% which is the social discount rate used by most international organizations, proving the project implemented did have a social significance. Also, considering that the EIRR of water resource projects in China is generally between 6% and 7%, the project's EIRR was relatively high.

Table 17: Economic Internal Rate of Return (EIRR) (Appraisal vs Ex-Post Evaluation)

Appraisal	Ex-Post Evaluation
• EIRR: 16.4% • Costs: construction costs, maintenance costs • Benefits: expected total damage (for a 50-year event) • Project life: 50 years	• EIRR: 10.6% • Costs: initial investment, management and maintenance costs • Benefits: expected total damage • Project life: 50 years

Source: Appraisal value was from F/S, and ex-post evaluation value was recalculated at time of the ex-post evaluation.

In light of the above, although the project cost was within the plan, the project period was significantly exceeded, therefore efficiency of the project is fair.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

1) Operation during Project Implementation

As planned at the time of the appraisal, the Project Leading Group (PLG) was in charge of managing and overseeing the entire project while it was being implemented. The PLG was headed by the vice governor of Hunan Province and consisted of seven members. The PLG had the authority to make decisions on important matters such as securing budget for the project, and provided comprehensive guidance and supervision.

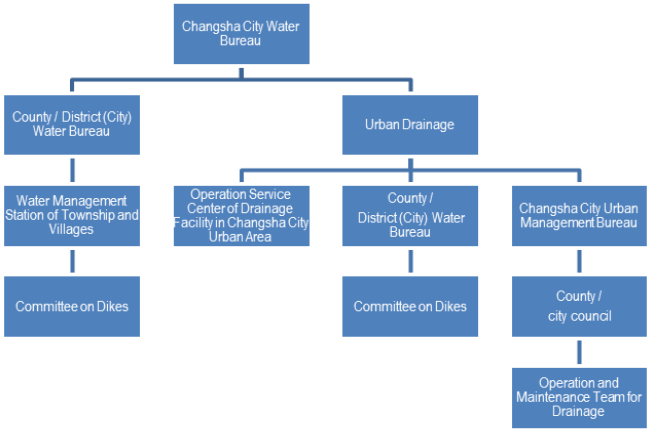
The PPMO was established under the PLG as the entity responsible in managing the implementation of the project and was headed by the vice director of the Hunan Province Financial Department. The PPMO did the communication and coordination with each city/county government as well as with JICA. The PPMO consisted of seven departments

(general affairs, financial affairs, water resources, planning, construction, management, and environment and resettling) and was staffed mainly with employees from the province Financial Department and the Department of Water Resources.

An identical PLG and PMO system was also set up under each subproject city and county governments. The mayors of each city and county headed the Subproject PLGs for better communication and coordination with the provincial government, and the SPMOs essentially functioned as implementing agencies in charge of the specific operation, management and construction of the projects in their respective cities and counties.

2) Operation and Maintenance after Project Completion

As planned at the time of the appraisal, city and county governments are in charge of operation and maintenance after the completion of the project. For all 22 subprojects, city and county water bureaus or water management boards are handling the operation and maintenance of flood control, as well as urban drainage facilities. Figure 4 is the organization chart of Changsha City Water Bureau to show an example of a specific system and chain of command.



Organization	Role
Changsha City Water Bureau	Administrative management regarding flood control of the city and drainage of urban and rural areas
County / District (City) Water Bureau	Administrative management regarding flood control and drainage in the jurisdiction
Water Management Stations of Township and Villages	Administrative management regarding flood control and drainage in the jurisdiction
Committees on Dikes	Maintenance and operation of drainage and main drainage canal dikes; maintenance of floodgate and drainage channels
Changsha City Urban Management Bureau	As commissioned by the city water bureau, manages the city drainage networks which are laid under the roads of the municipal government. Actual management work is conducted by the county or the city council.
Operation Service Center of Drainage Facility in Changsha City Urban Area	Second-class agency under direct control of the city water bureau, which operates drainage pump stations and sewage pump stations in the main urban areas.

Source: Changsha City Water Bureau

Figure 4: Operation and Maintenance System of the Flood Control and Urban Wastewater in Changsha City

The same institutional structure exists in each city and county, and the chain of command is clear as well. There were no major problems identified in the institutional structure of the operation and maintenance of the project.

3.5.2 Technical Aspects of Operation and Maintenance

1) Operation and Maintenance Expertise

The size of operation and maintenance staffs differ among cities and counties and also on the degree of risk during floods. For example, Yueyang City, located along the Yangtze River, has a specialized unit called "Yueyang City Yangtze River Repair and Prevention Center" in charge of the city's flood control and urban drainage operation and maintenance. The number of staff specialized in flood control are 32 technicians and 48 clerical workers (80 people in total), and the number of staff specialize in urban drainage are 12 technicians and clerical workers (60 people in total), making it one of the largest organizations among the subprojects. On the other hand, for example, the flood control staff in Ningxiang County consists of four technicians and three clerical workers (seven people in total) and its urban drainage staff is six technicians and two clerical workers (eight people in total). On the whole, each city and county has more or less the number of people required for the job.

As for training and licensing systems, although training such as the ones indicated in Table 15 are being conducted, but the content, frequency and number of people eligible for the training varies widely between subprojects. For example, Linxiang City indicated that they "do not conduct any trainings at all", while Changde City has special technician certification examinations and a total of 800 people including eight top-level engineers, 15 engineers and the flood control team are all licensed. As for Changsha City, it invites flood control experts, and trainings are provided to 480 people in related lines of work every year before the flood season. With respect to training completion examinations these are administered only in 11 out of the 22 subprojects (50%). As for certification systems, although there is the "Electrical work and operation certification" only three subprojects answered that they have personnel qualified with this certification.

Table 18: Training and Licensing Systems for Flood Control and Urban Drainage

	Training	Frequency	Eligible Trainees
Flood Control	• Flood Protection/Emergency Repair Techniques	Once a year or once every other year	Technical Department employees
	• Specialized Training	Once a year	Specialized technicians
	• Water Facilities Management and Maintenance	Once a year	Specialized technicians in water resource projects
	• Knowledge on Dike Protection	Vary	Levee protection workers
	• Water Facilities Construction and Management Education	Once a year	Technical staff in water resources
Urban Drainage	• Electrical Machinery and Equipment Operation and Maintenance	Once a year	Technicians in related posts (technicians specialized in each process and facility operators)
	• Basic Electrical Engineering	Once a year	
	• Urban Drainage Machinery and Equipment Operation and Maintenance	Twice a year	
	• Automated Machinery Control	Twice a year	

Source: Prepared by the evaluator based on documents provided by the SMOs.

As indicated above, there are large disparities in the training and licensing systems among subprojects. In order to secure the flood control and prevention of the whole Dongting Lake area, and to secure the technical levels and further improve them so that sustainability of the effects yielded by the project are secured, it is necessary that all subprojects achieve and maintain a certain technical level. In order to do this, the provincial government should implement a rigorous, uniform system of human resources development by clearly laying out the training, testing and licensing needed at each type of facility as well as procedures.

In their self-assessment, SMOs of 13 out of the 22 subprojects said that "the current technical level is average, and sufficient to fulfill the maintenance needs for the time being, but further improvements of their technical levels are necessary" and that "under the leadership of the top-level official of the provincial government, it is necessary to enhance their training systems". This shows that their current technical levels are just enough to sustain the project effects but further improvements in the operation and management techniques are necessary for the future.

2) Operation and Maintenance Manuals and Inspection Records

Each subproject keeps detailed maintenance manuals and different types of inspections are being conducted at different frequencies: ordinary inspections are conducted once a week, periodical inspections are conducted once a month, and flood prevention inspections are conducted once every day before flood season. In addition, detailed inspections are conducted on all facilities and equipment right before (April–May) and after (September–October) the rainy season. In order to prepare for the annual flood season, a "Flood Prevention and Emergency Procedure Manual" have been prepared in addition to the

normal operation and maintenance manuals. The said Manual contains very specific and detailed information on the organizational systems, frequency and time frames for patrol inspections, preparation of regular stock and evacuation plans. However, a site visit to a floodgate and a pumping station revealed that even though inspections records are kept, rust was causing progressing corrosion; there were trash scattered in the management and operation building of the floodgate, and many safety issues regarding machinery, equipment and on-site workers were seen. A more thorough cleaning and organization is required to be maintained in the facilities. In order to secure the sustainability of the project effects, it is necessary to rigorously apply the procedures indicated in the manuals, especially of floodgates and pumping stations.

3) Coordination with Related Projects

JICA has conducted the following trainings for China: "Comprehensive Management of River and Dam (2010)", "Training for Expert on Flood-related Disaster Mitigation (2009–2010)" and "Flood Hazard Map Making (2007)". However despite the relevancy of these trainings to this project, it was found that the PPMO was not aware of these trainings. Since these trainings are a way to maximize the effects and sustainability of Japanese ODA Loan projects, it would have been effective to incorporate a technical cooperation (training in Japan) during project implementation.

3.5.3 Financial Aspects of Operation and Maintenance

Operation and maintenance costs for each SMO are covered come mainly from three income sources: the "City Construction and Maintenance Taxes"[15], "Water Resource Funds"[16], and "Flood Prevention and Security Funds.[17] Worker wages, benefits and administrative costs are determined based on the workers' circumstances and paid with funds allocated from the regional financial administration. If this allocation is not enough, the remainder is paid from the business revenue of each SMO. After gathering basic financial information from 2004 to 2012, the average labor cost (staff involved in operation and maintenance on flood control and urban drainage facilities) made up for 39% of operation and maintenance costs,

[15] The City Construction and Maintenance Taxes is a tax calculated and collected based on the amount of value added taxes, consumption taxes and business taxes charged by the state and paid for by entities and individuals, levied on those entities and individuals. These taxes are mainly used on urban planning and construction, maintenance and projects related to disaster management.

[16] Water Resource Funds is a special fund established by the State Council and used for flood control construction. The sources of the fund are the Central Water Resource Construction Funds and Local Water Resource Construction Funds. The former are mainly used for maintenance and construction mostly on large river projects addressing all aspects of the nation's economy and social development. The latter is used on locally focused water resource projects, maintenance of local, small and mid-sized rivers and lakes, locally focused soil erosion prevention work, flood prevention maintenance and construction in urban areas targeted for flood prevention, maintenance of local flood control projects, and other water construction projects ratified by provincial-level administrations.

[17] Flood Prevention and Security Funds are collected from corporations in Hunan Province that use independent accounting systems and business entities that have production and/or sales income and are used to fund flood prevention and security work, at-risk dam repair and other flood control maintenance work, as well as expenses to do the administrative work of collecting the funds themselves. The funds can only be used toward these ends; and any if any funds are left at the end of the fiscal year, it can be carried over into the following fiscal year.

and the remaining 61% was spent on operation and maintenance costs other than the cost of labor. Furthermore, as shown in Attachment 2, all subprojects are in the black. At the moment, income sources are sufficient to cover the expenses, daily operational requirements are being met, and a certain level of financial sustainability has been secured.

3.5.4 Current Status of Operation and Maintenance

The current status of operation and maintenance of flood control projects (dikes, flood walls, channels) is generally good. As for the urban drainage facilities, the status is good for channels, but corrosion from rust in floodgates was discovered in two places in Yueyang City and in one place in each of Linxiang City, Anxiang County, Zhangjijie City and Yuanjiang City. According to the PPMO, these six floodgates have already been sprayed with zinc to prevent further rusting, and they will conduct rigorous maintenance such as regular inspections every year and zinc spraying every three years. Also, during the site visits, some pumping stations revealed insufficient cleaning and organization that represented potential safety risks to both the equipment as well as the on-site workers. Improvements are required in these aspects. Although the issues were not as severe as to threaten the sustainability of the project, especially for the infrastructure and facilities for urban drainage, it is required to conduct a rigorous maintenance based on systems and manuals in order for the facilities to constantly maintain the capacity to perform their functions.

As for spare parts and other aspects of the maintenance environment, most machinery and equipment was manufactured in China, thus spare parts can be obtained if needed. Surveys and interviews with each SMO also indicated that there have been no particular problems with spare parts thus far.

No major problems have been observed in the operation and maintenance system, therefore sustainability of the project effect is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The project aims to construct or repair dikes, floodgates, and pumping stations in 22 cities around Dongting Lake in Hunan Province to improve each city's flood control capacity.

This project is highly relevant to China's development policies and needs at the national, provincial, and municipal levels and to Japan's ODA policy towards China during the appraisal and the ex-post evaluation. After the completion of this project, the discharge capacity has exceeded the annual maximum flow volume at the reference points for flood control in all the subprojects and the planned highest water level has also exceeded the annual highest water level at the reference points, which generally indicates that the floodwaters flowed down safely. Especially, the main effect of this project can be said to be the improvements in flood control standards (probability of return). The flood control standard of the cities where it was predicted

that a flood would occur “once every 10 to 20 years” has greatly improved to “once every 100 to 200 years.” That of the cities with the standard of “once every five years” and “once every four to 10 years” has also greatly improved to “once every 50 years” and “once every 20 years” respectively. In addition, the effect indicators of inundation area and duration, as well as annual maximum damages by levee breach or overflow have become zero after the completion of this project for almost all the subprojects, even though the trends in precipitation have not changed much before and after the project. Thus the status in which the project is yielding its effects can be evaluated as good. Moreover, the impact on the living environment of people and the business environment of companies can also be recognized, thus the level of achievement in terms of effectiveness and impact is high. Although the project costs were lower than planned, due to the considerable delay in the completion of the project, the efficiency is fair. In general, no major problems have been observed in the organization, technical level and financial status of the operation and maintenance the project, thus the sustainability is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) From the beneficiary surveys it became clear that residents want more timely news on the probability of rainfall and flooding. The provincial Department of Water Resources should take the initiative to coordinate with all subprojects in order to improve and enhance the information to be provided to the public, such as creating hazard maps and disclosing them to the residents.

(2) The water bureaus of most of the subprojects (13 of the 22) consider that the current technical levels of operation and maintenance are only average and are enough only to meet the current maintenance needs. However, they consider that these levels need to improve. Since the flood control capacity around Dongting Lake needs to be strengthened in a comprehensive and uniform manner, it is recommended that training systems and licensing examinations are organized and thoroughly implemented by the provincial government. Specifically, the provincial government should make an inventory of the current training and licensing examination systems, revise and update their content, implement them with the improved content more frequently and make them mandatory throughout the province. It is also necessary to link these trainings with on-site maintenance systems and build an on-the-job training (OJT) system. Through these efforts it is necessary to secure a uniform technical level of the operation and maintenance in all 22 subprojects and to further enhance the sustainability of the project.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

(1) In this project there was a delay of over two years in the beginning. A realistic schedule that takes into account the current status of each implementing agency needs to be included in project management. Such a schedule should include the time required for procedures that need to be cleared before the implementing agencies can begin the project (an example for this project would be the signing of the sub-loan agreement between The Export-Import Bank of China and the Hunan Finance Department), the extent to which implementing agencies understand JICA procurement guidelines, and whether or not they can implement them efficiently. Also, for projects like this that are made up of a large number of subprojects, and that are spread across a wide geographical area, it is necessary to consider enhancing project management not only by the implementing agencies but also by JICA (increase monitoring content and frequency, make sure that implementing agencies submit progress reports, etc.)

(2) Since there are cases that prove that the incorporation of technical cooperation (trainings in Japan) into Japanese ODA Loan projects improve the effects and sustainability of the projects, if there are clear needs in the implementing agency, JICA should widely disclose the information on such trainings and coordinate properly with the executing agencies. In this project for example, since there was an increasing need from the residents for more appropriate and timely flood information availability, it would have been effective to coordinate with the training course on “Flood Hazard Mapping”.

End

Comparison of the Original and Actual Scope of the Project

Item	Planned	Actual
(1) Output		
a. Output for 21 sub-projects		
[Flood Control Facilities]		
Construction of new dikes and flood walls	90.029km	As planned
Rehabilitation of existing dikes and flood walls	709.310km	As planned
Rehabilitation of existing river channels	139.640km	As planned
[Urban Drainage Facilities]		
Rehabilitation and construction of culvert gates	365 locations	As planned
Rehabilitation and construction of pumping stations	64,474kW/146 locations	As planned
Construction of diversion canals	14.26km	As planned
Rehabilitation of diversion canals	97.07km	As planned
b. Zhangjiajie City sub-project		
[Flood Protection Project]		
Rehabilitation of dikes and flood walls	—	38.810km
[Urban Wastewater Project]		
Rehabilitation and construction of culvert gates	—	8 locations
Construction of diversion canals	—	8.8km
Access roads	—	26.47km
(2) Period	March 2000 to December 2004 (58 months)	March 2000 to December 2009 (118 months)
(3) Project Cost		
Foreign currency	24,000 million yen	23,939 million yen
Chinese currency	4,426 million yen (4,298 million yuan)	38,446 million yen (2,852 million yuan)
Total	68,264 million yen	62,385 million yen
Japanese ODA Loan portion	24,000 million yen	23,939 million yen
Exchange rate	1 yuan = 10.3 yen (As of October 1999)	1 yuan = 13.44502 yen (provided by the implementing agency)

End

Annex 1-1

Subproject		Flood Control Facilities								
		Plan (km)				Actual (km)				Compared to plan
		Construction of new dykes and flood walls	Rehabilitation of existing dykes and flood walls	Improvement of existing river channels	Total	Construction of new dykes and flood walls	Rehabilitation of existing dykes and flood walls	Improvement of existing river channels	Total	
1	Changsha City (Province Capital)	7.18	103.31	7.44	117.93	7.18	103.31	7.44	117.93	100%
2	Liuyang City	20.07	2.074	24.6	46.744	20.07	2.074	24.6	46.744	100%
3	Yueyang City (Prefecture-level city)	1.484	20.03	–	21.514	1.484	20.03	–	21.514	100%
4	Linxiang City	3	3.6	–	6.6	3	3.6	–	6.6	100%
5	Miluo City	1.64	9.11	3.7	14.45	1.64	9.11	3.7	14.45	100%
6	Changde City (Prefecture-level city)	7.03	62.35	16	85.38	7.03	62.35	16	85.38	100%
7	Jinshi City	0.8	18.3	2	21.1	0.8	18.3	2	21.1	100%
8	Yiyang City (Prefecture-level city)	16.025	29.52	79.2	124.75	16.025	29.52	79.2	124.75	100%
9	Changsha County	–	11.4	–	11.4		11.4	–	11.4	100%
10	Wangcheng County	–	22.86	–	22.86		22.86	–	22.86	100%
11	Ningxiang County	7.7	8.8	–	16.5	7.7	8.8	–	16.5	100%
12	Yueyang County	0.8	14.98	–	15.78	0.8	14.98	–	15.78	100%
13	Huarong County	4.98	5	–	9.98	4.98	5	–	9.98	100%
14	Xiangyin Country	1.5	12.9	–	14.4	1.5	12.9	–	14.4	100%
15	Anxiang County	–	32.45	1.9	34.35		32.45	1.9	34.35	100%
16	Hanshou County	2.6	16.2	–	18.8	2.6	16.2	–	18.8	100%
17	Lixian County	–	17.372	–	17.372		17.365	–	17.365	99%
18	Taoyuan County	–	15.33	4.8	20.13		15.33	4.8	20.13	100%
19	Yuanjiang County	14.82	25.98	–	40.8	14.82	25.98	–	40.8	100%
20	Nanxian County	–	262.624	–	262.62		262.624	–	262.62	100%
21	Taojian County	0.4	15.12	–	15.52	0.4	15.12	–	15.52	100%
22	Zhangjiajie City (Prefecture-level city)					–	38.81	–	–	–
Total		90.029	709.31	139.64	938.98	90.029	748.113 (105%)	139.64	977.78	104%

Annex 1-2

Subproject		Urban Drainage Facilities												
		Plan						Actual						Compared to plan
		Construction of new culvert gates	Construction of new punping statoins		Construction of new diversion canals	Rehabilitation of existing diversion canals	Total Improvement of diversion canals	Construction of new culvert gates	Construction of new punping statoins		Construction of new diversion canals	Rehabilitation of existing diversion canals	Total Improvement of diversion canals	
		places	kW	places	km			places	kW	places	km			
1	Changsha City (Province Capital)	86	21,185	39	1.75	60.99	62.74	86	21,185	39	1.75	60.99	62.74	10% for all items
2	Liuyang City	12	1,925	7	7.09	–	7.09	12	1,925	7	7.09	–	7.09	
3	Yueyang City (Prefecture-level city)	8	3,180	16	–	–	0	8	3,180	16	–	–	0	
4	Linxiang City	9	930	2	–	1.5	1.5	9	930	2	–	1.5	1.5	
5	Miluo City	4	1,550	2	5.12	–	5.12	4	1,550	2	5.12	–	5.12	
6	Changde City (Prefecture-level city)	26	5,110	10	–	3.24	3.24	26	5,110	10	–	3.24	3.24	
7	Jinshi City	10	310	1	–	2	2	10	310	1	–	2	2	
8	Yiyang City (Prefecture-level city)	40	5,080	12	–	–	0	40	5,080	12	–	–	0	
9	Changsha County	14	530	4	–	11.25	11.25	14	530	4	–	11.25	11.25	
10	Wangcheng County	44	2,300	13	–	11.09	11.09	44	2,300	13	–	11.09	11.09	
11	Ningxiang County	29	1,550	4	–	3.5	3.5	29	1,550	4	–	3.5	3.5	
12	Yueyang County	18	2,015	5	–	–	0	18	2,015	5	–	–	0	
13	Huarong County	2	1,850	3	0.3	3.5	3.8	2	1,850	3	0.3	3.5	3.8	
14	Xiangyin Country	11	1,240	1	–	–	0	11	1,240	1	–	–	0	
15	Anxiang County	–	725	3	–	–	0	–	725	3	–	–	0	
16	Hanshou County	14	1,600	1	–	–	0	14	1,600	1	–	–	0	
17	Lixian County	8	2,300	7	–	–	0	8	2,300	7	–	–	0	
18	Taoyuan County	13	2,265	4	–	–	0	13	2,265	4	–	–	0	
19	Yuanjiang County	8	1,600	1	–	–	0	8	1,600	1	–	–	0	
20	Nanxian County	2	4,000	2	–	–	0	2	4,000	2	–	–	0	
21	Taojian County	7	3,229	9	–	–	0	7	3,229	9	–	–	0	
22	Zhangjiajie City (Prefecture-level city)							8	–	–	8.8	–	8.8	–
Total		365	64,474	146	14.26	97.07	111.33	373 (102%) Compared to plan	64,474	146	23.06 (162%) Compared to plan	97.07	120.13 (102%) Compared to plan	

Annex 2

Basic Financial Information by Subproject Unit: Million yuan

Subproject		Item	2004	2005	2006	2007	2008	2009	2010	2011	2012
1	Changsha City (Province Capital)	Income*	2,300	2,450	2,550	2,700	2,850	2,900	3,000	3,000	3,100
		Operation & Mainenance Cost	2,259	2,397	2,528	2,664	2,819	2,856	2,904	2,964	3,000
		Balance	41	53	22	36	31	44	96	36	100
2	Liuyang City	Income*	250	250	260	270	285	290	295	300	300
		Operation & Mainenance Cost	224	239	252	265	280	283	287	293	295
		Balance	26	11	8	5	5	7	8	7	5
3	Yueyang City (Prefecture-level city)	Income*	620	680	720	760	820	850	860	900	900
		Operation & Mainenance Cost	613	665	708	753	809	824	849	884	899
		Balance	7	15	12	7	11	26	11	16	1
4	Linxiang City	Income*	145	160	180	180	210	210	210	220	220
		Operation & Mainenance Cost	145	157	167	179	194	197	203	213	217
		Balance	1	3	13	1	17	13	7	7	3
5	Miluo City	Income*	200	210	225	240	260	260	270	280	280
		Operation & Mainenance Cost	192	209	222	235	253	257	264	275	278
		Balance	8	1	3	5	7	3	6	5	2
6	Changde City (Prefecture-level city)	Income*	1,650	1,750	1,850	1,950	2,050	2,100	2,100	2,150	2,200
		Operation & Mainenance Cost	1,625	1,721	1,814	1,912	2,021	2,046	2,078	2,118	2,144
		Balance	26	29	36	38	30	54	22	32	56
7	Jinshi City	Income*	340	375	400	450	460	470	490	520	530
		Operation & Mainenance Cost	335	370	396	422	458	468	487	513	523
		Balance	5	5	4	28	2	2	3	7	7
8	Yiyang City (Prefecture-level city)	Income*	800	850	850	900	950	1,000	1,000	1,050	1,050
		Operation & Mainenance Cost	757	805	850	896	950	962	979	1,002	1,015
		Balance	44	45	0	4	1	38	21	48	35
9	Changsha County	Income*	150	155	165	175	185	195	200	205	210
		Operation & Mainenance Cost	138	151	161	171	184	187	194	204	208
		Balance	12	4	4	4	1	8	6	1	2
10	Wangcheng County	Income*	250	250	280	300	330	340	350	380	400
		Operation & Mainenance Cost	220	249	270	291	320	328	344	368	376
		Balance	30	1	10	9	10	12	6	12	24
11	Ningxiang County	Income*	165	175	185	195	205	205	205	210	220
		Operation & Mainenance Cost	161	171	180	189	201	202	205	210	211
		Balance	5	4	5	6	5	3	0	1	9
12	Yueyang County	Income*	280	310	325	350	380	390	400	410	420
		Operation & Mainenance Cost	279	303	324	345	371	377	389	406	413
		Balance	1	7	1	5	9	13	11	4	7
13	Huarong County	Income*	300	320	350	370	400	420	420	440	450
		Operation & Mainenance Cost	292	320	343	366	396	404	418	439	446
		Balance	8	0	7	4	4	16	2	1	4
14	Xiangyin Country	Income*	285	310	330	350	380	390	400	420	420
		Operation & Mainenance Cost	282	307	328	349	376	383	395	413	419
		Balance	3	3	2	1	4	7	5	7	1
15	Anxiang County	Income*	300	325	350	350	400	400	425	450	450
		Operation & Mainenance Cost	271	302	325	348	381	390	408	433	442
		Balance	29	23	25	2	19	10	17	17	8
16	Hanshou County	Income*	400	400	420	450	480	490	500	520	530
		Operation & Mainenance Cost	350	382	408	435	469	478	494	517	526
		Balance	50	18	12	15	11	12	6	3	4
17	Lixian County	Income*	350	350	380	400	450	450	460	480	490
		Operation & Mainenance Cost	317	347	370	394	426	434	450	472	480
		Balance	34	3	10	6	25	16	10	8	10
18	Taoyuan County	Income*	210	210	230	240	260	270	280	290	300
		Operation & Mainenance Cost	188	207	221	235	255	259	269	283	287
		Balance	23	3	9	5	6	11	11	7	13
19	Yuanjiang County	Income*	300	310	330	350	400	410	420	440	450
		Operation & Mainenance Cost	270	302	326	350	384	392	410	437	446
		Balance	31	8	4	0	17	18	10	3	4
20	Nanxian County	Income*	210	210	210	230	250	250	250	260	270
		Operation & Mainenance Cost	182	196	208	221	236	240	246	256	260
		Balance	28	14	2	9	14	10	4	4	10
21	Taojian County	Income*	320	320	330	350	380	380	390	400	410
		Operation & Mainenance Cost	285	307	326	345	369	375	385	399	405
		Balance	35	13	4	5	11	5	5	1	5
22	Zhangjiajie City (Prefecture-level city)	Income*	2,000	2,050	2,150	2,255	2,400	2,450	2,475	2,550	2,575
		Operation & Mainenance Cost	1,902	2,024	2,139	2,257	2,392	2,424	2,469	2,526	2,559
		Balance	98	26	11	-2	8	26	6	24	16

* Total of Subsidies, Urban Construction and Maintenance Tax, Water Resource Fund, Flood Prevention and Security Fund