China

Sanjiang Plain Longtouqiao Reservoir Construction Project

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Field Survey: November 2005

1. Project Outline and Japan's ODA Loan

Map of project area

Longtouqiao Reservoir

1.1 Background

China had dramatically increased food production by the first half of the 1980s after carrying out reforms and the Open Door Policy. The amount of food produced, which was about 300,000,000 tons in 1978, reached 466,400,000 tons in 1995. In contrast, the unit crop was on a downward trend and registered an all-time low in 1994. Amid continuing concerns about disruption of the balance between food demand and supply in the future, the Government of China stepped up policies designed to increase food production. It set in place such measures as the improvement of medium- and low-productivity rice fields, reclamation of wasteland, forestation by planting trees, grassland improvement, enlargement of available irrigated areas, and control of soil erosion caused by flooding and destruction of the natural environment, aiming to achieve the production of 507,000,000 tons of food in 2000 and 648,000,000 tons in 2010.

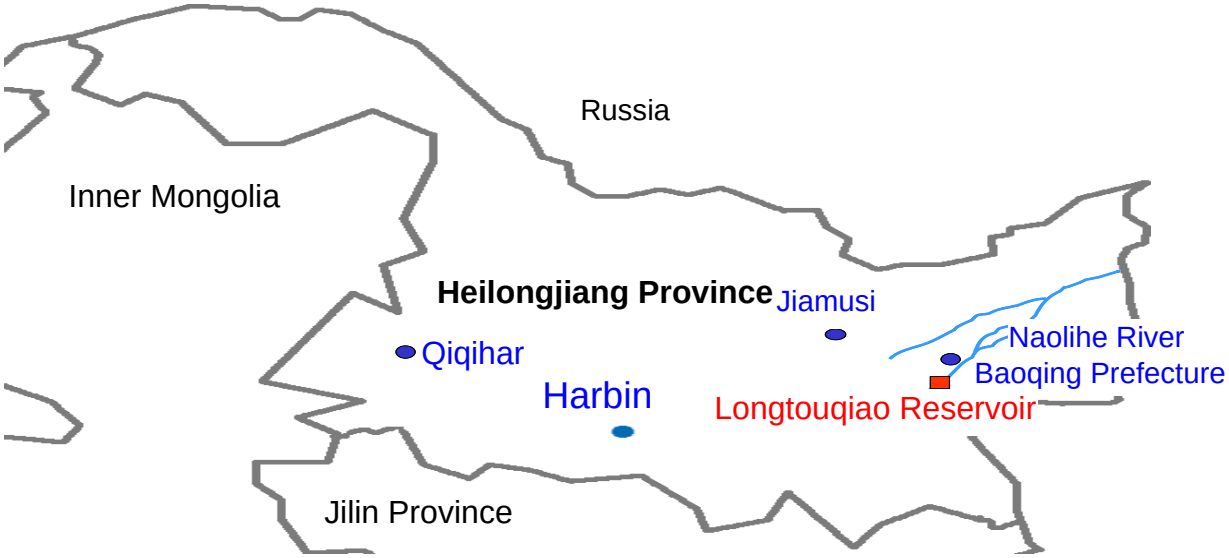
Heilongjiang Province is an important area for food production in China. In 1994, the province had a cultivated area of 8,910,000ha (about 9.4% of the entire cultivated area of the country). The cultivated area per capita was about double the national average and the labor productivity was four and a half times as high as the national average; by contrast, the food production volume was 25,790,000 tons, about 5.8% of national food production. The challenge to Heilongjiang Province in such a situation was to improve land productivity. The alluvial plain known as Sanjiang Plain, which was formed by the three rivers of Heilongjiang, Songhuajiang and Wusulijiang, is the largest plain in the

northeastern region of China and so fertile as to be counted among the three major blacklands of the world. Nevertheless, food production from the swamplands was insufficient because of inadequate agricultural infrastructure. There was plenty of room for improvement in agricultural infrastructure to increase food production, and the need was strongly recognized.

1.2 Objectives

The project's objective was to ensure a stable water supply for the farmland area located downstream of Naolihe River in Baoqing Prefecture, Heilongjiang Province by constructing a multi-purpose reservoir in the river, thereby increasing food production in the area. In addition, it aimed to improve the level of flood-control capabilities from the ten-year probability to the twenty-year, in addition to making electric power generation and fish raising possible, thereby contributing to the improvement of farmers' earnings and living standards and development of the regional economy.

Fig. 1 Site Map of the Longtouqiao Reservoir Construction Project



1.3 Borrower/Executing Agency

Ministry of Foreign Trade and Economic Cooperation[1]/Heilongjiang Province Ministry of Water Use

Specific executing-agency: Heilongjiang Province Ministry of Water Use/Longtouqiao Reservoir Management Office

Operation and maintenance sector: Heilongjiang Province Ministry of Water Use /Longtouqiao Reservoir Management Office

[1] Since 1999, the borrower of ODA for China has been changed to the Government of China (Ministry of Finance).

1.4 Outline of Loan Agreement

Loan Amount/ Disbursed Amount	3,000 million yen/2,999,968,935 yen
Exchange of Notes Loan Agreement	December 1996 December 1996
Terms and Conditions - Interest Rate - Repayment Period (Grace Period) - Procurement	 2.3% 30 years 10 years General Untied
Final Disbursement Date	October 2002
Main Contractors	Local companies and others
Consulting Services	—
Feasibility Study (F/S) etc.	March 1984: F/S (JICA) April 1995: F/S (Government of China) March 1998: General planning (Government of China)

2. Evaluation Result

2.1 Relevance

In Ninth Five-Year Plan (1996-2000), the Government of China considered increasing agricultural/food production to be a top-priority issue in order to ensure food security and solve the problems of regional disparity in income levels and other matters. Although the entire cultivated area of Heilongjiang Province is relatively large, the land productivity of the province was low due to inadequate conditions of irrigation and drainage. Therefore, the government aimed to increase food production by concentrating heavily on flood prevention and agricultural infrastructure improvement. The basin of Naolihe River, which is the largest river in Sanjiang Plain in Heilongjiang Province, has been developed as the target area for comprehensive agricultural development since it was designated as a “National Priority Area for Development” by the government in 1988. In the basin, stable water supply was impossible throughout the year because rainfall was concentrated between June and September; furthermore, most of the land was wasteland or had low productivity due to frequent floods. It was thought

that it would be possible to increase food production in the basin if the agricultural infrastructure was improved. The project was posited as a top-level priority in the agricultural infrastructure development plan of Heilongjiang Province on the grounds that increasing food production is essential for long-term food security. The project conforms to the national development plan of China and had high relevance at the time of appraisal.

In 10th Five-Year Plan (2001-2005), stabilizing food production capacity through the improvement of water facilities, introduction of commercial crops and other means while protecting the forest is considered to be a top-priority issue. Heilongjiang Province is considered an important base for food production in China, as in the past. The 10th Five-Year Plan of the province included plans to improve the peasant economy through the development of irrigation facilities and improved food-production efficiency. The Naolihe basin, situated in the center of Sanjiang Plain, is an area of wet-rice production and soybean production, producing one-quarter of the total food production in Sanjiang Plain, while the basin is low-lying and has frequent floods. Therefore, the project has high relevance in terms of the project objectives of flood prevention and irrigation.

2.2 Efficiency

2.2.1 Outputs

The planned and actual outputs are shown in Table 1. Because geological imbalances were found in the construction site of the power station during the course of construction, the site was changed, and the lengths of the tunnels increased and decreased slightly. With this exception, most outputs were realized according to plan. ODA loans extended to the project corresponded to all the loans in foreign currency.

Table 1. Comparison of Planned and Actual Outputs

Item	Plan	Actual
(1) Reservoir main body System: Height: Width: Volume of dam: Total pondage: Maximum water level: Maximum capacity:	 Zone-type earth dam 25.7m 750m 2.52 million m^3 472 million m^3 130.53m 614.6 million m^3	 Zone-type earth dam 25.7m 760m (1.3% increase over the planned figures) 2.52 million m^3 472 million m^3 130.53m 614.6 million m^3
(2) Spillway gate	Width: 8m x 2 gates	Width: 8m x 2 gates

(3) Tunnel Main tunnel length: Irrigation tunnel length: Power generation tunnel length:	290.50m 50m 72.50m	285.8m (1.6% decrease compared to the planned figures) 58.8m (13.8% increase over the planned figures) 56.9m (18.9% decrease compared to the planned figures)
(4) Power station Power output: Electricity generated:	2,500kW (1,250kW x 2) 4,060Mwh (Average over several years)	2,500kW (1,250kW x 2) 4,060Mwh (Average over several years)

Tunnels for power generation (left) and irrigation (right)

Power station

2.2.2 Project period

Although the project period was 49 months from December 1996 to December 2000 in the plan, it in fact took 70 months from December 1996 to October 2002, 143% of the plan. The reasons for the extension of the period were: 1) in the government did not authorize the basic design until March 1998; 2) the ODA loan did not become effective until September 1997; the tendering was therefore also postponed until November 1997 and the start of construction lasted until April 1998. There were no extensions in the construction schedule itself.

2.2.3 Project cost

While the planned cost was 7,080 million yen (of which the ODA loan portion was 3,000 million yen), the actual cost was 7,424 million yen (of which the ODA loan portion was 3,000 million yen). Although the ODA loan portion was according to plan, the project cost was 4.9% increased in total. While the total project cost in yen increased because the yen depreciated by about 25% compared to the time of appraisal, the cost in yuan was 9% decreased due to design improvements in the construction phase and other factors.

As explained above, the outputs and project cost were virtually according to plan except for the extension of the project period. There are therefore no significant problems in terms of project efficiency.

2.3 Effectiveness

2.3.1 Stable Water Supply to the Benefited Land

2.3.1.1 Water Supply

The purpose of the project was to supply water on a stable basis to the downstream farmland by constructing a multi-purpose dam. Since the completion of the project, the design capacity now allows annual water supply of 213 million m^3. Although the actual volume of supplied water has been increased every year as shown in Figure 2, the volume was 120 million m^3 in 2003, when the full-scale operation started, and 164 million m^3 in 2005; thus, the volume was limited to 56% and 77% of the capacity respectively. This is because the Longtouqiao Reservoir Downstream Area Irrigation Facilities Improvement Project[2], which the Japanese side proposed be constructed in parallel with the project in question from the time of appraisal, was delayed and has yet to be completed; consequently, water cannot be supplied to the planned area for irrigation. It is expected that the volume of water supplied increases as the project progresses and the targeted value of 213 million m^3/year will be achieved.

After water discharged from the reservoir has been used for irrigation in the paddy fields downstream, the surplus water is poured to the downstream area as water for environmental conservation.

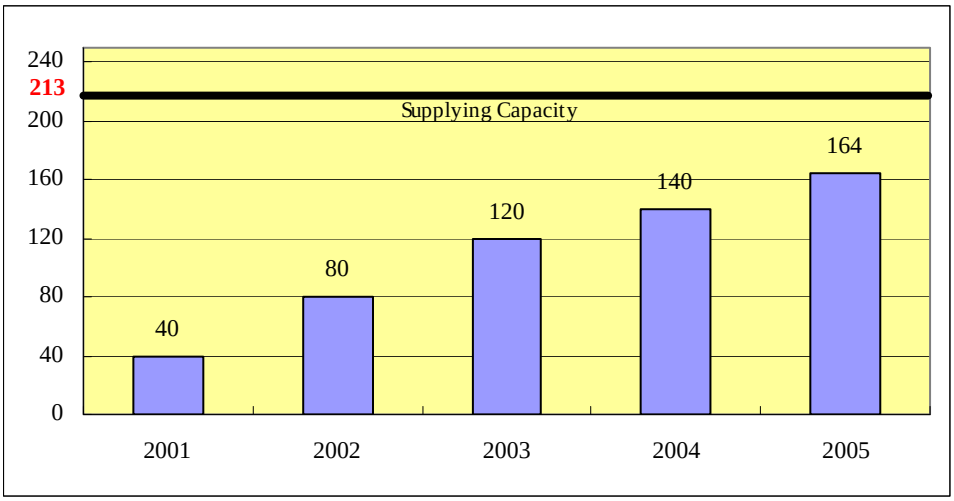
Table 2. Volume of Water Discharged from Longtouqiao Reservoir and the Breakdown

(Unit: Million m^3)

	2001	2002	2003	2004	2005
Volume of discharged water	40	80	120	140	164
Volume for irrigation	40	80	90	90	90
Volume for environmental conservation	0	0	30	50	74

Fig. 2 Volume of Water Supplied from Longtouqiao Reservoir (Unit: Million m^3)

[2] A domestic project amounts to 380 million yuan. The project is to irrigate the downstream area of Longtouqiao Reservoir by constructing head works, a trunk channel for irrigation, and the second and third channels (35km in total length) in Jinshan Channel, downstream of Naolihe River.



Source: Heilongjiang Province Ministry of Water Use

2.3.1.2 Area of land benefiting

Although the initial plan at the appraisal was to irrigate 42,420ha of cultivated fields (wet paddy fields: 20,000 hectares/dry paddy fields: 24,420ha) downstream of Naolihe River, the Government of China changed the plan in 2001 to convert dry paddy fields to wet ones and use all the water supplied from Longtouqiao Reservoir for irrigation of profitable paddy fields. The area of land which benefited in the project was reduced to 28,733ha (already-existing wet paddy fields: 5,200ha/wet paddy fields converted from dry paddy fields: 23,533ha) because more water is required in wet-paddy rice farming than upland farming. Baoqing Prefecture occupies about 76% of the reduced area and 852 and 597 farms under the supervision of Administrative Agency of Heilongjiang State-farms make up the remaining 24%.

Although the actual area of land which benefited from irrigation had been limited to the 5,200ha of already-existing wet paddy fields before the completion of head works in the Downstream Area Irrigation Facilities Improvement Project as shown in Table 3, the area increased slightly to 5,333ha in 2004 and expanded to 6,400ha by the beginning of 2006 after the start of trunk channel construction in May 2005. Nevertheless, this still accounts for only 22% of the planned area, and attention should be directed toward the future progress of the Downstream Area Irrigation Facilities Project. Heilongjiang Province Ministry of Water Use has been advancing the construction of channels to increase the irrigation area by about 4,000 hectares every year, and aims to complete it by the end of 2010.

Table 3. Area of the Land which Benefited Downstream of the Longtouqiao Reservoir

	2000 Start of impoundment	2001 Start of irrigation	2002 Completion of the project	2003 Start of trial running	2004 Completion of head works	2005	2006
Area of benefiting land (ha)	0	5,200	5,200	5,200	5,333	5,333	6,400
Irrigation water (million m^3)	0	40	80	90	90	90	N/A

Source: Heilongjiang Province Ministry of Water Use

Downstream of Naolihe River

Head works constructed in the Naolihe downstream basin

2.3.2 Improvement of flood-control capabilities

In the Naolihe downstream basin, drainage is not good and inundation damage occurs frequently when the rainfall increases, because the land is low and damp. Natural disaster statistics show that during the 46 years before 1994, there are a total of 40 years when droughts or floods occurred; looking at the years when the years when only flood broke out alone, this happened during 28 years, 61% of the entire period. Although there was an embankment with a design flood probability of 10 years in the Naolihe basin at that time of appraisal, its quality was in fact low and did not reach the standard. The project was for flood control as well as irrigation; the flood probability has therefore been raised to 20 years following the completion of the reservoir and the area where flood can be controlled became 54,800ha, covering 29 villages. The riverside farmland in Wanjin, Jianshan and Qingyuan Districts was submerged due to large-scale flooding in August 2002, which caused losses of 139,860,000 yuan. It is believed that there would have been losses of more than double this, if the project had not been implemented.

2.3.3 Other benefits

2.3.3.1 Power generation

The power station of Longtouqiao Reservoir has been operated from April through September in accordance with the period of irrigation since 2003. The power generation output in the first year was favorable at 4,736Mwh (117% of the plan) and since then, performances in excess of planned figures had been achieved. All the remaining electric power after the electricity consumed in the power station and transmission loss is sold to Jiamusi Electric Power Office on the basis of a yearly contract. Longtouqiao Reservoir Power Station is utilized as the reserve power resource although the main power station of Jiamusi Electric Power Office is Shuangyashan Thermal Power Station.

Table 4. Electric Power Outputs Generated in Longtouqiao Reservoir and Electricity Sales Volume

(Unit: Mwh)

	2001	2002	2003	2004	2005
Electricity generated (Plan)	4,060	4,060	4,060	4,060	4,060
Electricity generated (Actual)	0	0	4,736	5,700	4,700
Percentage achievement	0	0	117%	140%	116%
Electricity sold (Plan)	3,869	3,869	3,869	3,869	3,869
Electricity sold (Actual)	0	0	4,200	5,500	4,500
Percentage achievement	0	0	109%	142%	116%

Source: Heilongjiang Province Ministry of Water Use

2.3.3.2 Fish raising

It was planned that a total of 720 tons of fish would be produced in the 3,200ha raising area in the reservoir. The amount of fish raised per year from 2002 to 2005 did not go over 187.5 tons, 26% of the plan, although the actual raising area was 3,180ha (99% of the plan), almost as planned. The main reason was that 60,000,000 fries released in 2001 when the reservoir was completed had not grown large enough to be caught. According to the executing agency, catches are expected to reach the target value of 720 tons in four to five years. It is also possible that the production volume data was not accurately measured.

2.3.4 Recalculation of the Economic Internal Rate of Return (EIRR)

Although EIRR at the time of the appraisal had been 12.83%, it was 4.6% in the results of the recalculation done at the time of the evaluation. The reasons for the

decrease were lower than expected benefits from the increase in rice production due to the delay in the construction of irrigation facilities in the land downstream of the reservoir, the drop in the unit price of raised fish and additional opportunity costs for the areas submerged by the construction of the reservoir, among other things. The conditions assumed for the recalculation of EIRR are as follows:

(Conditions assumed)
Project life: 50 years (including the construction period)
Benefits: Incremental rice production, electricity sales, flood control, production from fish-raising, opportunity costs
Costs: Project cost, operation and maintenance expenses

As the project has been completed according to plan, it is more or less capable of achieving its main objectives of irrigation and flood control. Nevertheless, the project effects are not yet fully realized because the downstream area irrigating project has not been completed.

2.4 Impact

2.4.1. Improvement of agricultural production in Baoqing Prefecture

As mentioned in 2.3.1, the area of land benefiting from irrigation was only 5,333ha as of 2005, which accounts for only 3% of the entire cultivated acreage of Baoqing Prefecture. Therefore, it is difficult to analyze the impact of the project on the targeted area at this time. When the Downstream Area Irrigation Facilities Project is completed, the area of land benefiting from irrigation will expand to about 18% of the entire cultivated area of Baoqing Prefecture. The project will then have a positive impact on the agricultural production volume and unit crop in Baoqing Prefecture. Here we see how agricultural indices were changed by other agricultural infrastructure improvement projects during the period from 1994 through 2004.

Although the production value of principal farms was 200,230 tons in 1994, it increased about 2.7 times to 533,905 tons in 2004. The increase of the cereals such as rice, soybeans and corn is conspicuous; by contrast, crops such as beets and tobacco decreased substantially. Unit crops of all the main crops improved from 1994 to 2004 as shown in Figure 3. In particular, rice and corn have shown strong growth, more than doubling from 3.3 t/ha and 3 t/ha to 7.52 t/ha and 7.42 t/ha respectively. The fall in 2003 resulted from the first drought in 47 years.

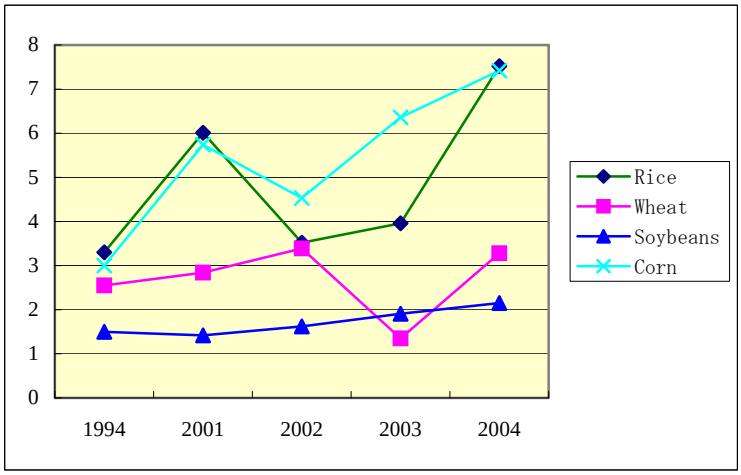
Table 5. Agricultural Indices in Baoqing Prefecture

	1994	2003	2004
Cultivated acreage (ha)	N/A	157,448	157,448
Main farm products turnout (t)	200,230	368,338	533,905
Rice	14,299	36,726	87,990
Wheat	28,846	1,068	3,895
Soybean	20,054	177,213	184,727
Corn	17,025	140,068	224,024
Others (beets, tobacco, etc.)	120,006	13,263	33,269
Amount of rainfall (mm)	N/A	294	474

Source: Baoqing Prefecture Statistical Office

Fig. 3 Unit Crops of Main Crops in Baoqing Prefecture

(Unit: t/ha)



Source: Baoqing Prefecture Statistical Office

2.4.2 Interviews with beneficiaries

We interviewed paddy farmers in Baoshan Village Village, Baoqing Prefecture, irrigated by the project, about the change in income and environment before and after the project. The following are some of their answers.

・ Before Longtouqiao Reservoir was built, water shortages and floods, etc. caused a

great deal of damage, and there was only one good harvest a decade. Now, after the completion of the project, we can secure 100% of the water needed for the paddy fields. As a result, the unit crop harvested has risen from 2 tons to 8 tons per hectare and incomes have increased too. The dam construction has not had any impact such as humidity or river contamination. Because our lives has been significantly improved by the project, we are satisfied. (Farmer who has 3ha of wet paddy fields and 2ha of dry paddy fields)

- Before Longtouqiao Reservoir was produced, we had used well water for irrigation. Three years out of 10, droughts caused damage. Water shortages have disappeared thanks to the reservoir; the drainage situation has also improved, and the unit crop of rice has risen from 4 tons to 7.5 tons per hectare. As a result, incomes have risen by more than 50% rose. There was little water in the rivers in the dry season from May to June before the dam construction, and the river water was contaminated with water from daily living. Now the water quality has improved because the flow of water has increased. (Farmer who has 2.7ha of paddy fields)

2.4.3. Impacts on the environment

2.4.3.1 Resident relocation

The plans and actual results for resident relocation and compensation associated with the project are shown in Table 6. The targets of relocation were 2,037 persons of 597 households in Baoqing Prefecture (8,511 farms), and Qitaihe City (855 farms). This was higher than the 1,295 persons of 278 households planned at the time of appraisal. According to the executing agency, this resulted from the change in the national policy on deforestation. Based on the notification from the State Council (Guo Fa Ming Dian No. 8 [The State Council-Issued Announcement][3]) issued 1998, the Government of Heilongjiang Province changed the initial plan, which was “minimize resident relocation and open up farmland in nearby areas, or open up new areas near the submerged land and relocate residents there,” and decided to call off the new reclamation and relocate residents separately to different sites. The resident relocation was implemented smoothly from 1998 through 2002, based on land management law. Levels of satisfaction among the residents are high, because the housing area of the individual residents grew in size; in addition, infrastructure such as roads, bridges, communication cables and waterworks is upgraded in the new village. Agricultural machines were offered to them. The 53 million yuan for forestland compensation out of the total compensation of 174,480,000, which Baoqing Prefecture, Administrative

[3] The notification from the State Council prohibited all destruction and reclamation of forests, in order to protect of forest resources and improve the living environment.

Agency of Heilongjiang State-farms has responsibility to pay, has not been paid to Longtouqiao Reservoir Construction Management Office yet due to lack of funds, so the final settlement has not been finished. The Government of Heilongjiang Province is currently adjusting its share of the unpaid compensation and is considering undertaking part of the burden.

Table 6. Planned and Actual Number of Relocated Residents and Amount of Compensation Associated with the Longtouqiao Reservoir Construction

	Plan	Actual
Relocated households	278 households	597 households
Relocated residents	1295 persons	2037 persons
Area of submerged land (ha)	5,039	5,163
Submerged farmland	3,292	3,155
Submerged forestland	1,642	1,299
Submerged grassland	77.87	71.72
Submerged inhabited area	27.07	29.58
Houses	20,765m^2	40,060m^2
Roads	22.5km	26.51km
Electric cables	22.9km	24.75km
Communication cable	13km	31.2km
Compensation amount (million yuan)	141.6	174.48

Relocation Destination (Yingshan Village)

Tractor Offered (in Baoshan Village)

2.4.3.2 Others: environment

Sanjiang Plain is known as the habitat of cranes. Surveys were carried out by China and Japan about what impact the project may have had on the swamp ecosystem, and it was assumed at the time of appraisal that there would be no significant impact on the environment. However, because it is very difficult to predict the impact, the two countries agreed that hydrological and environmental monitoring would be carried out by Longtouqiao Reservoir Construction Management Office and Administrative Agency of Heilongjiang State-farm after the completion of the project and that the offices would take appropriate response to circumstances. In the survey on this occasion, no progress had be made in creating a system for environmental monitoring, apart from the fact that Baoqing Prefecture, Administrative Agency of Heilongjiang measured dam water levels, water levels in the observation site, etc. for the water volume control by the automatic hydrological monitoring system that was introduced in June 2002 and for the safe operation of the dam. The following are some of the results of interviews with relevant agencies.

(1) Impact on the dam site

The submerged land is in the mountainous land of Wandashan. There are no habitats of rare birds or cranes and no impact on fauna. Also, no significant problems occurred with regard to the atmosphere, noise or water quality throughout the construction period. In addition to decreasing the deforestation for the reservoir construction as much as possible, we forested 1,332ha around the periphery of the reservoir. As the result of the Government of Heilongjiang Province's having stepped up its protection of the forest around the reservoir since 2005, the forest area of Baoqing Prefecture increased from 97,155ha in 1997 to 98,495ha in 2005.

(2) Impact on the benefiting land

The benefiting land is land that is already cultivated, and there is no newly-reclaimed land in the area. There is no impact on rare birds, which build their nests only in damp areas, and cranes, which do not fly into the land in question.

(3) Impact on the habitat environment in the downstream area

There are swamps in and around the Qixinghe, Changlindao, Yanyandao, and Dongsheng, famous as landing places for cranes, in the Naolihe downstream basin 70km or more from the Longtouqiao Reservoir. At the time of appraisal, the dam operation had changed the inflow volume to Naolihe River, and there was concern about the impact on the water levels of the swamps and the ecosystem. According to the Forestry Office, which is managing the swamps of Baoqing Prefecture, the swamp area of Sanjiang Plain in Baoqing Prefecture has increased in total 1.6 times since 1996 through the establishment of a nature preserve, although the entire area of the plain has been decreasing due to large-scale paddy field development and agriculture infrastructure improvement. On the other hand, the water level of the swamps has fallen off a little, because the water of Naolihe River is used for industry and power generation.

As of now, no significant problems have occurred related to water use, because irrigation water that is drained from Longtouqiao Reservoir is sufficient. In the future, however, in the event that the water for agriculture is increasingly required when irrigation facilities are completed in the downstream area could mean that sufficient amounts of water for environmental use cannot be ensured; therefore, it is important to release the water for environmental use in a planned way. In particular, it is necessary to strengthen the coordination between Management Office of Swamp Preserves and Longtouqiao Reservoir Management Office in monitoring the water levels in the swamp reserve and conducting planned discharge in the spawning season of the crane in April and May every year.

(4) Water quality of Naolihe River

It has been pointed out that water could become polluted by pesticide and agricultural chemicals etc. because irrigation water returns to the mainstream of Naolihe River after the use for agriculture. The water quality test conducted by Jiamusi Water Environment Observation Center in 2005 showed that the value of nitric acid nitrogen falls substantially below the standard value and the containment rate of chemical manure is low. As for chlorine, sulfuric acid ion, carbonic acid ion, heavy carbonic acid ion etc., they all are within the scope of the fishing industry water quality standard <GB1107-89>, and no problems have occurred. Adequate surveys and monitoring should be continuously conducted,

given that problems related to water quality could occur when the irrigation facilities are completed and irrigated agriculture is started in the future.

2.5 Sustainability

2.5.1 Executing agencies

2.5.1.1 Technical capacity

The operation and maintenance of the project is conducted by Longtouqiao Reservoir Management Office. Twenty-five out of 33 full-time members of staff are engineers and 12 persons have the qualification of high-class engineers. There are no problems in terms of their experience or technical levels, because most members of the staff had experience on the construction work of the project in Dam Construction Affairs Office before moving to the office. Seventeen power station staff members have been working for an average of 14 years, and three members of staff are engineers. The operation of the power station is conducted by three groups under the under the guidance of engineers, and there are no technical problems. The long- and short-term staff training regarding the operation and maintenance of dams in areas such as “the operation and maintenance of the power station,” “the power station knowledge and theory,” “specialized water technology,” “specialized automation work,” “the hydrological observation system,” etc., was conducted among a total number of 260 people from 1997 to 2005. Thus, there are no problems in technical sustainability, because the staff have adequate working experiences and technical levels and sufficient training opportunities are offered to them.

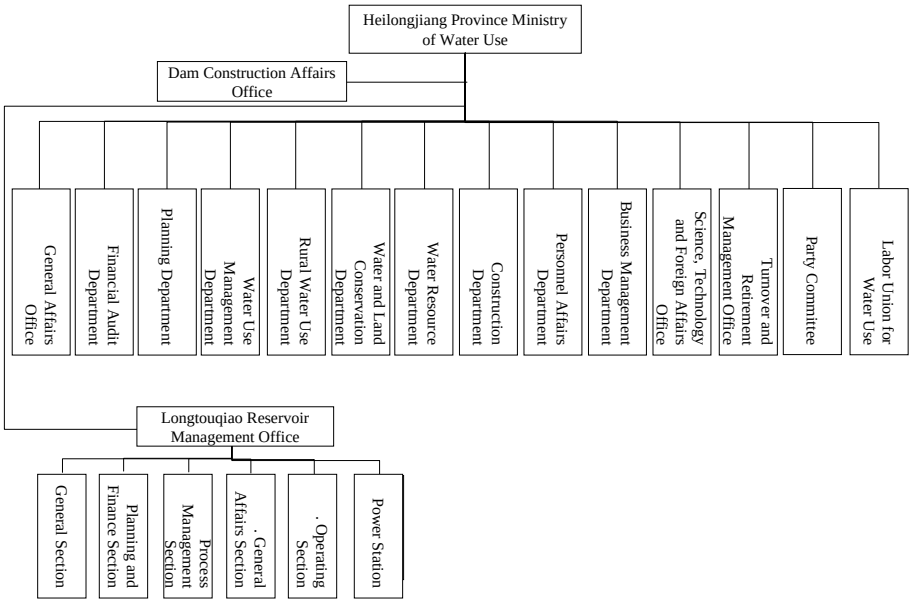
2.5.1.2 Structure

The executing agency of the project was Heilongjiang Province Ministry of Water Use, and Dam Construction Affairs Office took charge of the construction work of the project. Since the time of the completion and up until now, two persons have been engaged in re-alignment work such as in the area of unpaid compensation for land. Longtouqiao Reservoir Management Office, under the supervision of Ministry of Water, carries out the operation and maintenance of the reservoir and power station and the Government of Baoqing Prefecture and Administrative Agency of Heilongjiang State-farms conduct the management related to the benefiting areas downstream, including resident relocation and compensation.

Longtouqiao Reservoir Management Office consists of Comprehensive Department, Financial Planning Department, Process Control Department, General Affairs Department, Management Department and the power station, and there are 33 workers (a lower figure than the 55 planned). Process Control Department takes charge of the

dam water level, water volume measurement, hydrological information, flood prediction etc.

Fig. 4 Organizational Chart of Heilongjiang Province Ministry of Water Use



2.5.1.3 Financial status

Longtouqiao Reservoir Management Office has sources of income from electricity sales, irrigation water use rates, water control rates for fish raising, sightseeing hotels etc., in addition to annual 550,000 yuan subsidies from Heilongjiang Province. The operating revenue in 2003 and 2004 was 2,060,000 yuan and 2,630,000 yuan respectively; gross profits were 1,490,000 yuan and 2,360,000 yuan, exhibiting strong growth. According to the executing agency, it is expected that the income will increase further because the sales of raised fish is to be transferred to the reservoir management office from the fiscal year 2006 (currently it is entrusted to Heilongjiang Province Economic Department). It is believed that the stability of the operation and maintenance is due to the fact that net profits are on an upward trend, despite the continuation of government subsidies in 2005. There is also a structure in place which can deal with special operation and maintenance because a budget for this can be obtained by applying for in Ministry of Water Use.

2.5.2 Operation and maintenance

The operation and maintenance of the power station is determined in “the Implementing Rules for the Operation and Maintenance of Longtouqiao Power Station” issued in 2002, in terms of duties, systems, regulations, models etc., and has been carried out since 2003 on the basis of these rules. In order to generate power safely, and step up the safety of the power station operation and safety awareness among the staff, regular inspections are conducted on the strict execution and control of “the engineering tables” and “the operation tables.” Safety control is ensured by conducting safety tests every month for securing the safe operation of the reservoir. Also, the operation and maintenance inspections, flood inspections and administrative guidance are conducted by Ministry of Water Use twice a year.

2.5.3 Downstream Area Irrigation Facilities Project

Although the project was completed, the objectives of the project have not been fully achieved yet because of the delay in the Downstream Area Irrigation Facilities Project, which is not part of the project in question. The completion of the Downstream Area Irrigation Facilities Project is indispensable in consideration of cost-benefit performance and durability in the future of the project, and must be dealt with urgently.

As explained above, although there is no problem related to technical capacity, structures, financial status or operation and maintenance, some concerns remain related to the delay in the progress of the Downstream Area Irrigation Facilities Project.

3. Feedback

3.1 Lessons Learned

<u>To JBIC and the Government of China</u>

The project was to construct a large multi-purpose dam for irrigation and flood control and was completed without significant problems. There were also no problems in the process of implementation. However, because the Downstream Area Irrigation Facilities Project has not been finished, some of the original functions of the project are not being utilized effectively. The delay is causing a significant loss in benefits. The Downstream Area Irrigation Facilities Project should have been taken on as part of the project and managed with the aim of being completed at the same time as this project, given that it is basically an irrigation project. Even if the Downstream Area Irrigation Facilities Project had not been integrated into the same project for whatever reasons, the project still should have been carried out on the basis of scrupulous progress control and

mutual adjustment.

3.2 Recommendations

To JBIC and the Government of China

Although concerns have been raised in relation to the impact on to the swamp ecosystem of the Naolihe downstream basin caused by the operation of Longtouqiao Reservoir, as of now there has been insufficient cooperation between Longtouqiao Reservoir Management Office of Heilongjiang Province Ministry of Water Use and the Government of Baoqing Prefecture and Administrative Agency of Heilongjiang State-farms, which manages the swamps. Although there is no significant impact on the swamps at present, the possibilities of low water levels and contamination will increase when the downstream irrigation facilities are completed and water use for irrigation increases in the future. There is an urgent need to organize the monitoring system and team consisting of relevant staff regularly engaged in the dam water level, water flow, swamp water level and ecosystem.

Comparison of Original and Actual Scope

Item	Plan	Actual
(1) Project Scope		
1) Reservoir main body		
System:	Zone-type earth dam	According to plan
Height:	25.7m	According to plan
Width:	750m	760m
Volume of dam:	2.52 million m^3	According to plan
Total pondage:	472 million m^3	According to plan
Maximum water level:	130.53m	According to plan
Maximum capacity:	614.6 million m^3	According to plan
2) Spillway gate	Width: 8m x 2 gates	According to plan
3) Tunnel		
Main tunnel length:	290.50m	285.8m
Irrigation tunnel length:	50m	58.8m
Power generation tunnel length:	72.50m	56.9m
4) Power station		
Power output:	2,500kW (1,250kW x 2)	According to plan
Electricity generated:	4,060Mwh (Multi-year average)	According to plan
(2) Project Period	December 1996-December 2000 (49 months)	December 1996-October 2002 (70 months)
Basic design	April 1996-March 1997	June 1997-November 1997
Machinery/facility procurement:	April 1997-September 1999	December 1997-December 1999
Preliminary work:	October 1996-March 1999	June 1997-November 1997
Civil work:	April 1997-September 2000	April 1998-June 2001
Mechanical and electrical installation:	January 1999-December 2000	May 1999-April 2002
Related equipment work:	July 1997-December 1999	May 1998-September 2001
Metalwork:	April 1998-September 1999	June 2000-September 2001
Project Cost		
Foreign currency	3,000 million yen	3,000 million yen
Local currency	4,080 million yen (Local currency: 340 million yuan)	4,424 million yen (Local currency: 304 million yuan)
Total	7,080 million yen	7,424 million yen
ODA Loan Portion	3,000 million yen	3,000 million yen
Exchange rate	1 yuan = 12.00 yen	1 yuan = 14.55 yen