Environmental Monitoring Report

Project Number: 33177
June 2008

PRC: Harbin Water Supply Project

Prepared by Harbin Municipal Water Supply Construction Company
With the assistance of Black and Veatch
PRC

For Harbin Municipal Government
Harbin Municipal Water Supply Construction Company

Asian Development Bank

HARBIN MUNICIPAL WATER SUPPLY
CONSTRUCTION COMPANY

ASIAN DEVELOPMENT BANK

HARBIN WATER SUPPLY PROJECT

ADB Loan No. 1995-PRC

ANNUAL ENVIRONMENTAL REPORT 2007

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PREPARED BY:
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WITH ASSISTANCE OF

BLACK & VEATCH

EXECUTIVE SUMMARY

The construction of the Harbin Water Supply Project commenced on 20 April 2003, and the completion was scheduled for December 2007 but substantially realized by end 2006, more 12 months ahead of the appraisal schedule. Commissioning of the Project facilities started in October 2006. The new Mopanshan water treatment plant (WTP) started to provide good quality water to the urban area at a progressively increasing flow that reached the design 450,000 m^3/day capacity by the end of December 2007.

In accordance with the requirements of the consultancy contract dated March 2005 between the Harbin Municipal Water Supply Construction Company (HMWSCC) and Black & Veatch (Asia) Limited (B&V), three annual environmental reports for 2004, 2005 and 2006 had been prepared and submitted to ADB. As the last environmental report produced in the implementation consultancy, this Annual Environmental Report (AER) for 2007 summaries the mitigation measures undertaken and outcomes obtained during the construction phase, analyzes the impacts and benefits of the Project operation, and reports on the water quality situation during the year of commissioning.

This AER for 2007 addresses: (i) the compliance with environmental regulations, (ii) the environmental institutional and performance, (iii) a summary of the mitigation measures undertaken in the construction phase, (iv) temporary land acquisition and restoration, (v) the environmental impacts of the Project operation; (vi) the environmental benefits of the Project operation; (vii) water quality; and (viii) conclusions and recommendations.

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ABBREVIATION

AER	-	annual environmental report
ADB	-	Asian Development Bank
B&V	-	Black & Veatch (Asia) Limited
COD	-	chemical oxygen demand
EIA	-	environmental impact assessment
EMO	-	environmental management office
HMG	-	Harbin Municipal Government
HMWSCC	-	Harbin Municipal Water Supply Construction Company
HWWGC	-	Harbin Water and Wastewater Group Company
LAR	-	land acquisition and resettlement
MoEP	-	Ministry of Environmental Protection
MoC	-	Ministry of Construction
PRC	-	the People's Republic of China
SEIA	-	summary environmental impact assessment
SPEA		the State Environmental Protection Association
SS	-	suspended substance
TOR	-	Terms of Reference
WQMC	-	Water Quality Monitoring Center
WTP	-	water treatment plant

1. Introduction

1.1 General Introduction

This Annual Environmental Report (AER) describes the implementation of the mitigation measures and monitoring recommended in the Environmental Impact Assessment (EIA) and Summary Environmental Impact Assessment (SEIA) for the Project and conducted during the construction phase.

The full EIA report in the Chinese language was prepared by the Northeast China Municipal Engineering Design and Research Institute in association with the Heilongjiang Water Conservancy and Hydroelectric Power Investigation, Design and Research Institute, and submitted to the original State Environmental Protection Administration (SEPA)[1] on 2 February 2002 for approval. The SEIA was prepared in accordance with the requirements of the Government of the People's Republic of China (PRC) and the Asian Development Bank (ADB) by the project preparatory technical assistance (PPTA) Consultants CDM International Inc. (CDM) of the USA in July 2002. These reports described the potential effects of the Project and the measures proposed to mitigate any adverse impacts.

Under a contract in March 2005, Black & Veatch (Asia) Limited (B&V) has been providing consulting services to the Harbin Municipal Water Supply Construction Company (HMWSCC) who is the Executing Agency of the Project.

The Terms of Reference (TOR) for the consultancy services for project implementation, as included in the Request for Proposals include, among other things, the provision of advice on monitoring the environmental impacts of the Project with a view to mitigating the effects of the Project upon the environment. The TOR was reviewed by B&V at consultancy commencement and a course of action to satisfy the requirements of the TOR was proposed in the Inception Report of May 2005.

B&V mobilized the Environmental Expert for the works in Harbin on 31 May 2005. Since then all information related to the environmental issues associated with the Project has been reviewed, an Initial Environmental Review and the AERs for 2004, 2005 and 2006 have been prepared by B&V for HMWSCC's submission to ADB. The Memorandum of Understanding of the loan review mission (1-6 December 2007) required that another environmental monitoring report be submitted to ADB by 31 March 2008. However, due to the delay of data collection, this report was completed in Jun 2008.

This AER for 2007 addresses: (i) the compliance with environmental regulations, (ii) the environmental institutional and performance, (iii) a summary of the mitigation measures undertaken in the construction phase, (iv) temporary land acquisition and restoration, (v) the environmental impacts of the Project operation; (vi) the environmental benefits of the Project operation; (vii) water quality; and (viii) conclusions and recommendations.

1.2 Brief Description of the Project

Harbin is the provincial capital and largest city of Heilongjiang Province, PRC with an urban population of more than 3 million people. Harbin has been forecasted to have a shortage in water supply capacity of at least 450,000m^3/day in 2010, increasing to at least 950,000 m^3/day by 2020. The Songhua River passes through the city, and was the major raw water source for about 1 million m^3/day of water used in Harbin. The Songhua River basin covers about 400,000 km^2 of drainage area upstream from Harbin, and receives pollution from several major upstream cities - Jilin, Changchun, Daqing and Qiqihaer. Major industrial pollution sources include a large scale chemical plant and other petrochemical plants in Jilin, and other industries located in Heilongjiang,

[1] The SEPA has already upgraded to the current Ministry of Environmental Protection (MoEP).

Jilin and Inner Mongolia. The river has experienced deterioration in water quality and the river water quality falls below the required PRC standards. To address the urgent needs of Harbin for increased water supply and improved water quality, a new water source has been developed under the Project.

The general objectives of the Project are to improve the inadequate water supplies to the urban communities of Harbin, and assist towards poverty alleviation, health improvements and economic development of the region as a whole. The Project is being developed in two phases, in order to reduce the initial investment in the earlier phase. The ADB Loan 1995-PRC provides US$ 100 million of the total estimated cost of US$ 399.48 million for the first phase of the Project. The remainder, i.e. US$ 299.48 million equivalent, is being provided from local counterpart funds. The first phase of the Project consists of the construction of the following principal components:

- a multi-purpose dam at Mopanshan on the Lalin River, having a total storage volume of approximately 523 million m^3.
- a raw water pipeline of 2,200 mm diameter and approximately 176 km in length from Mopanshan Dam to Harbin.
- a potable water treatment plant in the suburb of Harbin of approximately 450,000 m^3/day capacity.
- expansion and rehabilitation of some 112 km of the water distribution network.

Phase 2, now being implemented, provides a second parallel raw water pipeline and will increase the water treatment capacity to 900,000 m^3/day, and the distribution system will be improved by installing 53.2 km of trunk mains and 11 km of small diameter water pipes.

1.3 Brief Description of the Environment

Harbin City is located in south-central Heilongjiang Province, southeast of the Songnen Plain. The Mopanshan Reservoir site is located in Wuchang County, which is under the administration of the Harbin Municipal Government. The project location is shown in Figure 1-1.

The reservoir area is mountainous with peaks of 278 m to 1,600 m in height and the ground gradient of 1/3,000 to 1/5,000. The general gradient within the inundated area related to the Project is 0.0036. Soils are 5 cm to 33 cm thick, and in the more fertile agricultural areas they are 40 cm to 60 cm deep. From the dam site the terrain descends northwards towards Harbin. There was an earthquake with an intensity of 5.8 on the Richter scale in 1960, at a site 50 km away from the proposed dam site. According to the latest seismological classification by the State Earthquake Bureau, the project area is classified as 6 on the PRC earthquake intensity scale.

The Lalin River, originating from Changbai Mountain, Zhangguangcai Mountain Range, has a catchment area of 19,200 km^2. Upstream of the proposed dam site, the catchment area is 1,151 km^2, with an annual average stream flow of 561 million m^3 of water. Further downstream from the dam site, there are three major tributaries (Mangniu River, Xilang River and Kacha River) with a total catchment area of 11,800 km^2 that join the Lalin River, which eventually flows to the Songhua River.

The project area is in the northern temperate continental climate zone. Winter is very cold and dry, while the short summer is hot and humid. The annual average temperature is about 3.5^oC. The ground is frozen from November through March, to a maximum depth of 2 m. The annual average precipitation is about 650 mm, with more than 70 % of which falling in the June to August period. The prevailing wind is southern, with average and maximum speeds of 2.8 m/s and 28 m/s respectively.

The Lalin River plain is mainly used for agriculture purposes. The highland area around the reservoir is mostly covered by forests and used for limited scale timber production. There are no

rare or endangered species within the project construction area. The average annual soil erosion modulus is 30.7tons/km^2 per year.

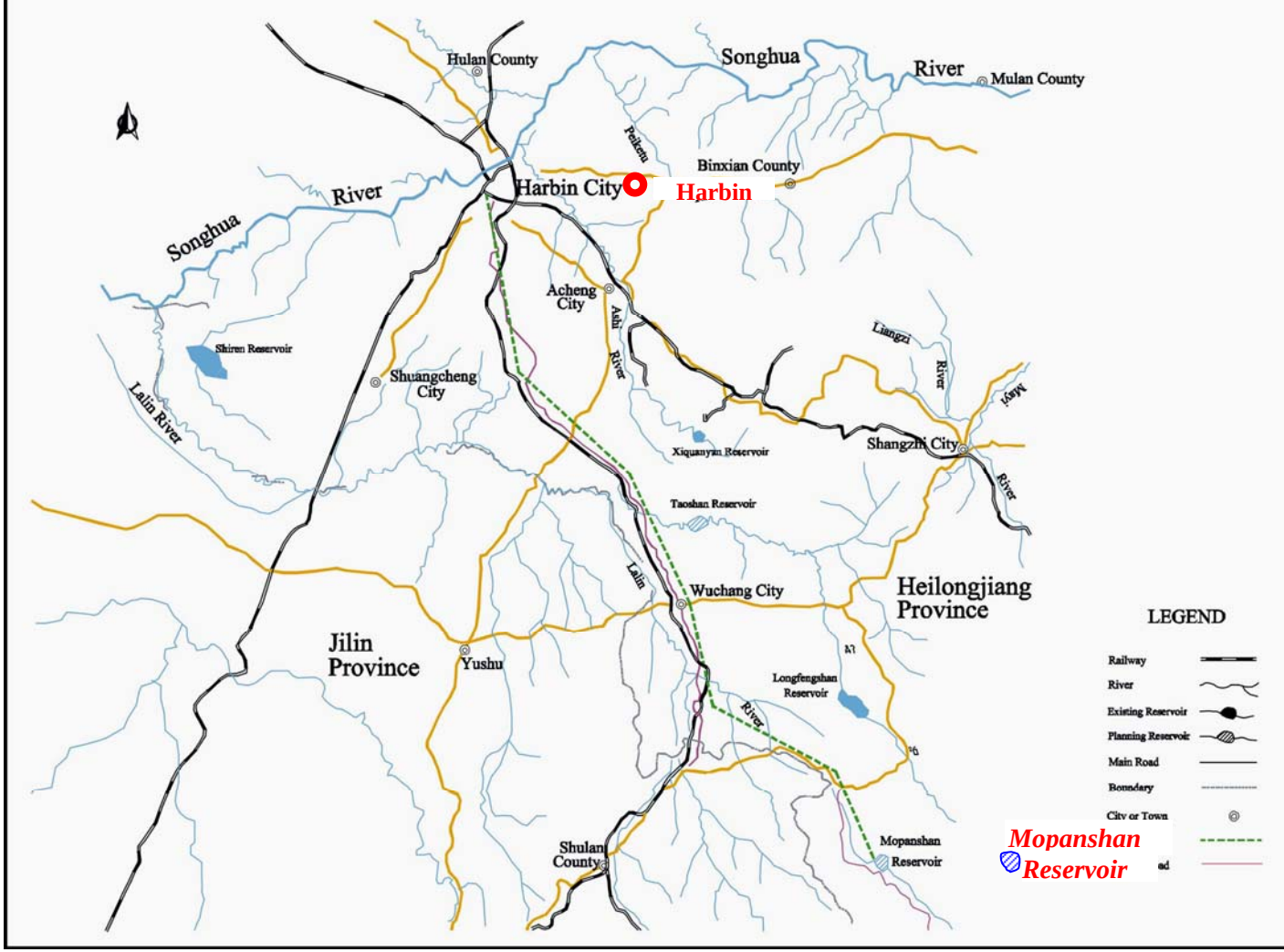


Figure 1-1: The Project Location

2. Project Implementation

As of the end 2007, the Project has been completed and more than 99% of the work was finished by the end of 2006. The implementation progress is presented in Table 2-1.

Table 2-1: Project Progress

Component	by 2004	by 2005	by 2006	by 2007
Mopanshan Dam	45%	85%	100%	100%
Raw Water Pipelines	44%	95%	100%	100%
Water Treatment Plant	41%	70%	95%	100%
Water Distribution System	26%	52%	97%	100%

Construction of the Project (Phase I) commenced on 20 April 2003 and lasted three years and eight months with the physical completion realized in December 2006. The Project started to supply water to some urban areas on 23 December 2006 and the daily water supply has progressively increased to 450,000 m^3 by the end of 2007.

Facilities completed in the Project (Phase I) include: (i) a reservoir with a total storage volume of 523 million m^3 and flood control capacity of 1-in-100-year peak flood flows. It includes five sub-components: a dam with the maximum height of 49.9 m and crest length of 406 m, a spillway, a diversion irrigation tunnel, a water supply tunnel and the hydrological and water environmental monitoring system. Construction of the dam commenced on 21 September 2003, and impoundment took place on 25 September 2005. On 30 September 2006, commencement of water transmission marked the trial run of the complete water supply facilities. (ii) a raw water pipeline of 2,200 mm diameter and approximately 176 km in length, involving 290 chambers and 298 valves for different purposes. (iii) a potable water treatment plant of approximately 450,000 m^3/day capacity; and (iv) 76.2 km of the water distribution network of 100 mm to 1,600 mm diameter and a monitoring and communication system.

3. Environmental Procedure Review

3.1 Legal Requirements

Table 3-1 provides a list of the applicable environmental laws and regulations of the PRC and environmental policies and regulations of ADB with which design, construction, and operation of all project facilities are expected to comply.

Table 3-1: Relevant Environmental Laws, Standards and Regulations

Subject	Environmental Laws, Standards and Regulations
General Environmental Protection	• Environmental Protection Law of the PRC (26 Dec 1989) • Environmental Impact Assessment Law of PRC (1 Sep 2003) • Environmental Protection Management Regulations for Construction Projects (29 Nov 1998) • Notice to Strengthen the Environmental Impact Assessment and Management of Construction Projects Financed by Loan from International Financial Organizations (21 Jun 1993) • Environmental Impact Assessment Technical Guideline (HJ/T2.1-2.3-93, HJ/T2.4-1995, HJ/T19-1997)
Water Resources	• Water Law of the PRC (1 Oct 2002) • Environmental Quality Standards for Surface Water (GB3838-2002) • Water Quality Standards for Drinking Water Sources (CJ3020-1993) • Water Quality Standards for Fine Drinking Water (CJ94-2005) • Water Quality Standards for Urban Water Supply (CJ/T 206-2005) • Sanitation Standard for Drinking Water (GB5749-85)
Forestry Resources	• Forests Law of the PRC (29 Apr 1998)

Subject	Environmental Laws, Standards and Regulations
Protection of Grasslands	• Grassland Law of the PRC (1 Mar 2003)
Protection of Wildlife	• Wildlife Protection Law of the PRC (1 Mar 1989)
General Land Use and Management	• Land Management Law of the PRC (1 Jan 1999)
Soil Erosion Control	• Conservation of Water and Soil Law of the PRC (29 Jun 1991)
Solid Waste Management	• Solid Waste Environmental Pollution Prevention and Control Law of the PRC (1 Apr 2005)
General Water Pollution	• Water Pollution Prevention and Control Law of the PRC (15 May 1996) • Integrated Wastewater Discharge Standard (GB8978-1996)
General Air Pollution	• Air Pollution Prevention and Control Law of the PRC (1 Sep 2000) • Ambient Air Quality Standard (GB3095-1996) • Integrated Emission Standard of Air Pollutants (GB16297-1996)
Noise in Urban Areas	• Standard of Environmental Noise of Urban Areas (GB3096-93) • Standard of Noise at Boundary of Industrial Enterprises (GB12348-90)
ADB guidelines and regulations	• Environmental Assessment Guidelines (ADB, May 2003) • Environmental Policy (ADB, Nov 2002)

3.2 Compliance with Environmental Regulations

It is noted that the implementation of the Project has been in compliance with the relevant environmental laws, regulations and standards. The environmental protection measures and facilities have been designed, constructed and operated during the construction works.

During construction from 2004 to 2007, adverse environmental impacts arising from the construction of the Project facilities had been mitigated by implementing mitigation measures, the environmental monitoring program, and other recommendations presented in the EIA and SEIA for the Project.

According to the regulation of the Ministry of Environmental Protection (MoEP), environmental inspection and acceptance should be conducted at project completion. An environmental investigation report should be prepared during the inspection. However, this has not accomplished for this Project.

4. Environmental Management Organization and Performance

HMWSCC was set up in 2002 for the specific purpose of implementing and managing the Project. Various agencies and departments of the Harbin Municipal Government are also actively involved in the different aspects of project implementation, including the Water, Finance and Environmental Protection Bureaus.

Initially, the Engineering Department was assigned within the HMWSCC to hold part-time position of environmental management, and to be in charge of the overall environmental management related to the Project. In 2005, a project Environmental Management Leading Group and a project Environmental Management Office (EMO) were formally established within the HMWSCC with major responsibilities for implementing the mitigation measures, environmental monitoring program and other recommendations as agreed with ADB, including the planning, coordination, and monitoring of the various activities; reporting to ADB; and ensuring the overall environmental targets are achieved.

Construction of the Project was undertaken by contractors, supervised by construction supervision companies and managed by the HMWSCC. With the cooperation of these parties, the mitigation measures and environmental monitoring have been implemented properly. HMWSCC, construction contractors and supervision companies have satisfactorily fulfilled their environmental responsibilities and obligations.

B&V, being the implementation consultant appointed for the Project, assisted the EMO as well as the

HMWSCC in the past four years in environmental management in accordance with the requirements of the consultancy contract dated March 2005 between the HMWSCC and B&V.

5. Summary of Implementation of Mitigation Measures in Construction

Construction of the four structural components was completed by the end of 2006. During the construction phase, there had been some unfavorable environmental impacts such as wastewater, dust, noise, traffic congestion and dredged sludge etc. produced. However, mitigating measures have been implemented properly by the contractors, and the impacts were minimized to the lowest level. There has been no significant impact on the nearby sensitive areas.

A. Mopanshan Dam Component

Wastewater generated in aggregate processing, concrete processing and workers' camps has been treated properly before discharge, and has had no impact on the local water. Water spray vehicles were used to help suppress dust. Measures including imposing speed limits, restricting horn sounding, transport route selection, provision of construction access roads, good maintenance and proper operation were implemented to minimize noise generated by vehicles. Most of the construction wastes produced from the construction of the dam, spillway and water supply tunnel have been used to backfill the construction pits or reinstate borrow areas or reestablish vegetation. Workers' refuse in living camps was regularly collected and transported to designated areas for incineration or landfilling.

Before reservoir impoundment in September 2005, reservoir bed clearance activities including structure demolition, forest clearance, and disinfection have been carried out. 15 heritage sites were discovered in the impoundment area of the Mopanshan Reservoir. All of the heritage and archaeological sites discovered and excavated have been protected and appropriately handled.

B. Raw Water Transmission Pipelines Component

Wastewater generated in concrete batching plants was settled before discharge. The workers were either local farmers or residents in local farmers' houses nearby, so wastewater generated by the workers was collected and disposed of at existing local facilities. Spraying of water, covering earth during transportation, and good maintenance and operation of vehicles and machineries have protected the environment from being polluted by dust and exhaust emission. Restriction of construction hours, installation of silencers, and disallowing sounding of horns were implemented to reduce noise impact. Excavated earth was backfilled into the trenches for land restoration. Trees and greenbelts temporarily removed during construction were rehabilitated by professional landscaping agencies or urban management agencies.

18 heritage sites were discovered along the raw water transmission pipeline. All of the heritage and archaeological sites discovered and excavated have been protected and appropriately handled.

C. Water Treatment Plant Component

Most of the concrete used on the site was ready mixed and rarely mixed in-situ. As such, only a small amount of wastewater was generated. Oil separating tanks were used to separate oil from water for oily wastewater treatment. There is still no municipal sewerage system in the new water treatment plant (WTP) area and temporary toilets and septic tanks are used to collect the domestic wastewater generated by the workers. The wastewater is then transported away and treated by special agencies. The area surrounding the WTP is very open with the nearest residential area at least 300 m away. The noise created during the construction phase has had little impact on the residents.

No historic cultural relic has been discovered in the construction site of the water treatment plant.

D. Treated Water Distribution Network Component

Spraying water, covering earth during transportation, and good maintenance and operation of vehicles and machineries have prevented the environment from being polluted by dust and exhaust emission. Restriction of construction hours, installation of silencers, and disallowing sounding of horns were implemented to reduce noise impact. A series of safe and civilized construction activities have been carried out at the sites, including setting up safety signs, road blocks, indication lights and barriers, providing first-aid kits and emergency vehicles, and periodical site safety inspection etc.

The excavated earth in the urban areas was reused for other purpose or disposed of as waste at designated locations. While in the rural areas, the excavated earth was backfilled into the trenches after pipe installation with topsoil spread on surface for re-cultivation. The ground surface has become a little higher than before, but this has no impact on farming and has been accepted by the land owners. Trees and greenbelts temporarily removed during construction were rehabilitated by professional landscaping agencies or urban management agencies.

No historic cultural relic has been discovered in the construction sites of the distribution network.

6. Land Acquisition and Resettlement (LAR)

A. Mopanshan Dam Component

The impounded areas within the reservoir affected 1,175 households and 4,658 persons in Wuchang and 652 households and 1,890 persons of the Forestry Department in Shanhetun. The LAR work related to the Forestry Department in Shanhetun, and 1,146 households and 4,444 persons in Wuchang has been satisfactorily completed. Only the land but not houses of the remaining 29 households and 214 persons in Wuchang has been affected.

The total permanent land acquisition is some 2,970 ha for the dam construction, of which 2,893.48 ha results from impoundment. Eight villages of the Shahezi Township and Xianfeng Forest Farm, Sanchahe Railway Station and Hansong Plantation Station of Shanhetun Forestry Bureau have been flooded. A total 786,873 m^2 of farm land were temporarily used during the dam construction, mainly as borrow areas, temperate roads, living camps etc.

B. Raw Water Transmission Pipelines Component

More than 50 villages of 9 townships were affected by the construction of this component. By the end of 2006, resettlement has been completed, and 84 households and 372 persons have been relocated. About 630 ha of land were temporarily used in the construction of the pipelines.

C. Water Treatment Plant Component

No resettlement was involved in this component, and the total permanent land acquisition is some 29.8304 ha. All of the land temporarily used for construction is inside the WTP.

D. Treated Water Distribution Network Component

About 24 households and 96 persons have been relocated to areas close to their original homes. No permanent land acquisition was involved in this component.

E. Others

For detailed information on the LAR activities, please see the relevant documents prepared by the resettlement consultants independently appointed by HMWSCC.

7. Restoration, Condition and Return of Land Temporarily Acquired

A. Mopanshan Dam Component

Land restoration commenced on 1 Oct 2006, and was completed by the end of the same month (Table 7-1). As the land was restored in a timely manner, there was no delay to the local farmers' spring ploughing. As such the work was highly appreciated by the relevant government departments. As to trees and vegetation removal during construction, topsoil was preserved and original vegetation was replanted after construction.

Table 7-1: Land Restoration Work for the Dam

No.	Item		Unit	Work Quantity
1	**Clay borrow area**			
1.1	backfill of humus soil		m^3	21,000
2	**Gravel quarry area**			
2.1	removal		m^3	10,500
2.2	backfill of useless surface oil		m^3	250,000
2.3	backfill of humus soil		m^3	3,880
3	**Temporary living camps**			
3.1	camp 1	removal	m^3	2,064
3.2		backfill of humus soil	m^3	1,238
3.3	camp 2	removal	m^3	42,500
3.4		backfill of humus soil	m^3	10,200
3.5	Reservoir management center	removal	m^3	6,000
3.6		backfill of humus soil	m^3	6,000
4	**Temporary road**			
4.1	removal		m^3	7,900
4.2	backfill of humus soil		m^3	3,960
5	**Waste disposal area**			
5.1	removal		m^3	70,000
5.2	backfill of humus soil		m^3	7,853
6	**Water supply tunnel and shaft**			
6.1	removal		m^3	55,000
6.2	backfill of humus soil		m^3	17,600

B. Raw Water Transmission Pipelines Component

After pipe installation, the original excavated earth was backfilled into the trenches with topsoil spread on surface for re-cultivation. The ground surface has become a little higher than before, but this has no impact on farming and has been accepted by the land owners. To date, the land has all been restored and returned to the owners.

C. Water Treatment Plant Component

The construction works of roads, landscaping and turfing have not only beautified the surroundings, but also controlled soil erosion and protected the ecological environment near the WTP. More than 90,000 m^2 of turf was laid in one go in the spring of 2007.

D. Treated Water Distribution Network Component

Similar to the transmission pipeline component, the temporarily used land along the pipeline has been reinstated after the construction was completed. The restored land has met the owners' requirements and been endorsed and accepted.

8. Soil Erosion Monitoring in Reservoir Construction Area

From commencement in 2004 to completion in 2006, seven soil erosion monitoring exercises in the reservoir construction area have been carried out by the Heilongjiang Provincial Water and Soil Conservation Science Institute (HWSCSI) based on the *Water and Soil Conservation Monitoring Action Plan* prepared by HWSCSI in Jul 2004. The variation of soil erosion in the project area from 2004 to 2006 is presented in Table 8-1 and Figure 8-1.

Table 8-1: Soil Erosion from 2004 to 2006

No.	Monitoring Point	2004	2005	2006
1	Dam construction site	1.24	1.28	1.48
2	Concrete mixing station	0.12	0.17	0.15
3	Temporary stone transfer site	0.26	0.12	0.25
4	Living camp	0.12	0.29	0.12
5	No.1 gravel quarry area	10.6	0	0
6	Management office building	0.14	0.08	0.08
7	Waste disposal area	0.25	0.16	0
8	No.2 gravel quarry area	1.04	8.61	0.6
9	Clay borrow area	2.09	16.53	12.21
10	Outlet of water tunnel	2.82	2.27	0.08
11	Structural elements processing plant	0	0	0
12	Mountain works on right bank	0.51	0.15	0.14
13	Temporary construction road	0.23	0.18	0.33
14	Shaft construction site	0.07	0.08	0.13
	Total	**19.49**	**29.92**	**15.57**

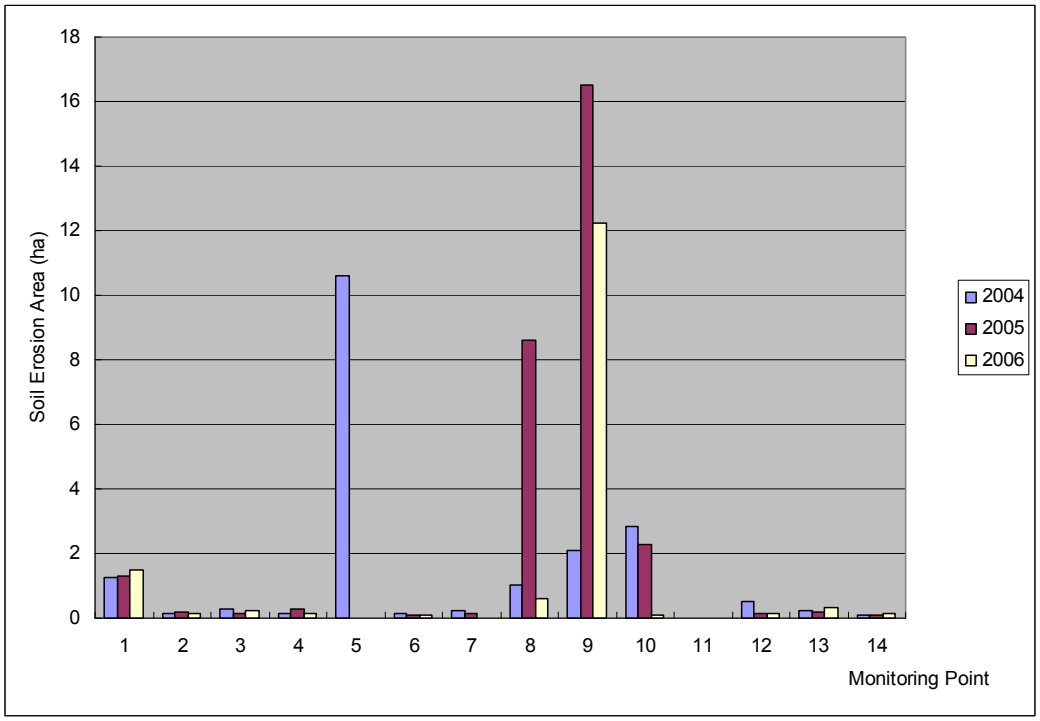


Figure 8-1: Soil Erosion from 2004 to 2006

This indicates that the soil erosion is more severe in the gravel quarry areas and clay borrow area than the other locations. But along with the construction completion, ground disturbance and the soil erosion area have been much reduced.

9. Benefits of the Project Operation

Mopanshan Reservoir has a storage capacity of 523 million m^3. It is utilization multi-purpose dam with the key task to supply potable water to Harbin urban residents and secondary functions of flood control, irrigation water supply, ecological water release etc. It has another long-term task to supply domestic water to Shanhe Township and Wuchang City in 2020.

9.1 Urban Water Supply

In 2006, the municipal water supply in Harbin urban area was 267.84 million m^3 that was equivalent to 733,80m^3/d. At the same time, the city had a shortage in water supply of about 430,00m^3/d that year. On 23 Dec 2006, the new Mopanshan WTP was commissioned and its water supply capacity came up to 450,000m^3/d by the end of 2007. This has greatly addressed the urgent water needs of Harbin. As of the end of 2007, about 1.65 million residents in Daoli, Pingfang, Xiangfang, Daowai and Nangang districts have been supplied with the new source of water.

The Mopanshan Reservoir Management Division prepares yearly water supply program and obtains the provincial Water Resources Bureau's approval before execution. The guaranteed probability (P) of water supply to Harbin is 96%, which ensures 450,000 m^3/d or 158.4 million m^3 a year of water be supplied to Harbin before the Project Phase II is completed.

9.2 Irrigation

In addition to supplying water to Harbin, the Project Phase I also supplies 8,000 m^3 of irrigation water per year to 313,500 mu of farmland in Wuchang. As prescribed in each year's water supply program, the guaranteed probability (P) of irrigation water supply is 76%.

9.3 Ecological Water

The reservoir also supplies ecological water to Lalin River downstream of the dam as per a practical need of 13.1 million m^3 per year with a guaranteed probability (P) of 98%.

9.4 Flood Control

The design flood control capability of the Mopanshan Reservoir is to handle 1-in-100-year peak flood flows, providing flood relief in the downstream areas and protecting Harbin and Wuchang cities, Shanhe, Xiangyang and Shahezi townships, 111 villages and 313,500 mu of farmland. Since the reservoir impoundment in Sep 2006, the highest water level has been up to 317.15 m, and the reservoir storage volume has been 331 million m^3. The reservoir management division prepares a flood control and emergency response scheme and a regulation plan for flood events every year. This ensures the dam safety as well as the fulfillment of the dam's flood control function during flood events.

10. Environmental Impacts of the Project Operation

10.1 Impact on Urban Wastewater

Along with an increased water supply volume it is expected to be an increased flow into urban sewers and the wastewater treatment system. However, according to the information published by the Harbin Environmental Protection Bureau in the recent two years, the volume of the gross wastewater and domestic sewage has not increased as expected with the increased new water supply but has reduced instead (Table 10-1).

Table 10-1: Harbin Urban Area Historical Wastewater

Item		2004	2005	2006	2007
Gross	Million m^3 per year	350.4	345.29	154.77	154.2

Wastewater, incl.:	Thousand m^3 per day	960	946	424	422
Industrial WW	Million m^3 per year	71.7	72.17	21.53	20.18
	Thousand m^3 per day	196	198	59	55
Domestic WW	Million m^3 per year	278.7	273.12	133.24	134.02
	Thousand m^3 per day	764	748	365	367

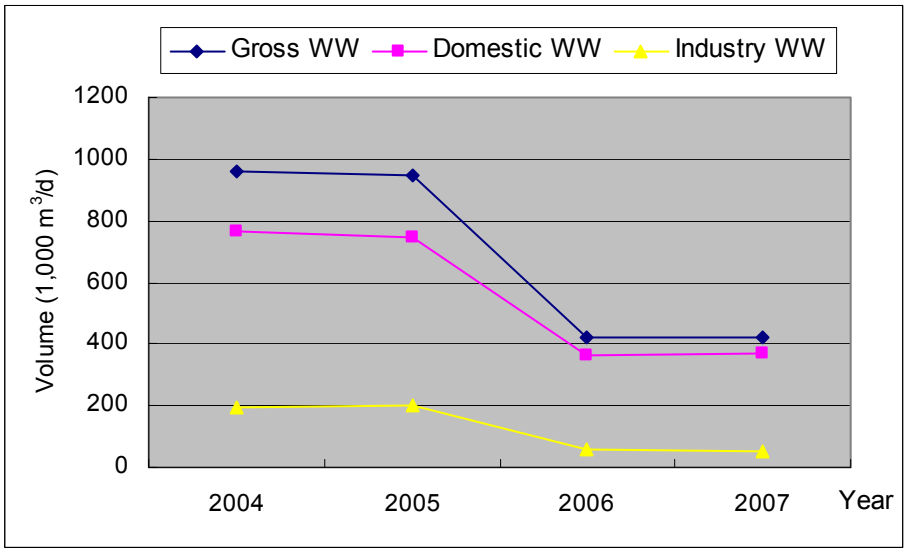


Figure 10-1: Historical Wastewater Harbin Urban Area

To date, the total length of the municipal sewers is 987 km in Harbin urban area, and it is expected to grow after the completion of the Project Phase II. There are 22 drainage pumping stations with a total design capacity of 124.61 m^3/s, and two WWTPs in operation. The Wenchang WWTP has a primary treatment capacity of 160,000m^3/d and secondary treatment capacity of 325,000m^3/d. The Taiping WWTP has a secondary treatment capacity of 325,000m^3/d. However, the municipal wastewater treatment rate was only 44% in 2006. Currently, Wenchang Phase III, and Hejiagou, Qunli and Songbei WWTPs are in construction, and expected to start commissioning by the end of 2009. Moreover, HMG is now implementing relevant programs with a target to increase the urban wastewater treatment rate to 90% by 2010. Therefore, the urban sewers and wastewater treatment system will be able to overcome the possible issues caused by the increase water supply.

10.2 Impacts on Water Environment of Lalin River Downstream the Dam

With the dam impounding most of the river flow, there is a significant change to the downstream flow. Currently, the ecological water release to the downstream is 13.1 million m^3 per year with a stable flow of about 0.4m^3/s through out the year. Under the condition without the dam, the average dry season flow was 0.485 m^3/s with a guaranteed probability (P) of 90% downstream the dam. This indicates that the current ecological water release is almost equivalent to the original dry weather flow. However, in wet and normal seasons, although there is irrigation water release, the downstream flow is still much lower than before especially for the 2.25 km long river reach before the confluence of the first tributary. There are two villages along this river reach, but the villagers pump groundwater for their domestic use. As such, the dam has little impacts on the villagers' water use, but has some influences on the water ecological environment.

10.3 Dam Safety

Risks of dam failure and earthquake induced by the dam are probable after impoundment. Adequate technical design and emergency procedures against these risks have been prepared for the Project.

To date after more than two years of impoundment, there is no evidence that these accidents would occur.

10.4 Raw Water Source Pollution Risks

The Mopanshan Reservoir is now the principal water source for Harbin. Any water pollution in the reservoir will threaten the safety of more than 3 million Harbin people. It has been found that the Mopanshan Reservoir had some potential risks on water quality, mainly coming from the impacts of local residents' activities such as the use of fertilizer and pesticide, tourism development, and felling trees for water conservation purposes within the reservoir reserve area. However, it should be noted that there is no industrial pollution source around the reservoir to date. Hence, policy and enforcement should be strengthened to disallow any industrial development around the reservoir in the future. It is suggested that the government enforces effective measures to eliminate the pollution risks to the Mopanshan Reservoir.

10.5 WTP Pollution and Control

Wastewater

Wastewater generated in the WTP operation comprises filter backwash, clarifier sludge and domestic wastewater generated by the staff working in the plant.

The filter backwash is collected, settled and recycled back to the plant for retreatment. Wastewater from the living quarters or administration building is discharged directly into sewers. The clarifier sludge is of a rather large volume. It is treated in the sludge treatment system, and the supernatant is recycled, as in the case of the filter backwash.

This is no municipal sewerage system in the area where the WTP is located. A package plant with the MMBR membrane biological reactor process has been installed within the WTP. The treated effluent is discharged into the Pingfang sewers by gravity after treatment at a rate of about 24m^3/d. After the municipal sewers are construction in that area, the domestic wastewater generated in the WTP can be discharged into the sewers and treated by the municipal wastewater treatment plants.

Boilers Fume Emission

Both the coal boilers and their auxiliary facilities are qualified products with high burning efficiency that meet national standards. Additionally, two sets of humid desulfuration dust removal system with an efficiency of 95% have been installed in the boiler house of the WTP. Regular examination and maintenance have been implemented to avoid the equipment from failure which would result in fume emission exceeding standard and air pollution.

Noise

Noise generated in the water treatment operation comes from the running of pumps and blowers, and is usually contained within the plant. Some high noise equipment is located in special indoor sound proof chambers. This efficiently insulates the noise. There are not many residents living around the WTP and most of them are far away from the equipment houses. The noise created during the operation phase has little impact on the local residents.

Solid Waste

Solid waste generated in the WTP includes the coal boiler slag, dewatered sludge cakes and a small amount of refuse generated by the staff working in the plant.

The amount of slag is about 945 ton per year generated by the WTP Phase I works. The slag is normally reused in local brick production industry or for road construction. The sludge generated from

the sedimentation tanks come from the suspended solids (SS) contained in the reservoir raw water. The sludge is mainly composed of mineral with some organic substances, and becomes sludge cake through gravity thickening and then dewatering to 20% dry solids. Calculated on the basis of 50 mg/L of SS contained in the raw water, there is about 93.60 m^3 of sludge cake generated in the WTP Phase I. They are also recycled in local brick production industry or disposed of at designated landfill sites outside the plant. The staff's refuse is regularly collected and transported to designated landfills.

11. Water Quality

11.1 Raw Water

The reservoir water quality information used in this report is the monitoring data in 2007 obtained from the online monitoring system of Mopanshan Reservoir. Assessment and analysis are conducted to observe the standard compliance and variation trend of pH, NH_3-N, turbidity and COD in accordance with the *Water Quality Standards for Drinking Water Sources* (CJ3020-1993) released by the Ministry of Construction (MoC) and the *Environmental Quality Standards of Surface Water* (GB3838-2002) released by MoEP. The relevant standards are reproduced in Appendix 1. The monitoring data and assessment is presented in Appendix 2.

The assessment results show that except for turbidity, all the other parameters contained in the reservoir raw water meet national standards. The slightly high level of turbidity is reduced when the raw water arrives at the WTP, and turbidity in the WTP raw water can definitely meet the national standard. The raw water for the Project is therefore good and has no significant problems.

11.2 Treated Water

The WQMC under the HWWGC conducts weekly monitoring to both the raw water and treated water of the new Mopanshan WTP. In this report, assessment and analysis are conducted to pH, NH_3-N, turbidity and COD for both the raw water and the treated water monitored in 2007 in accordance with the *Water Quality Standards for Urban Water Supply* (CJ/T206-2005) issued by the MoC (Appendix 1). The monitoring data and assessment is presented in Appendix 2.

The assessment results show that both the raw water and treated water are of good quality. The pollutants in the raw water are significantly reduced after going through treatment at the WTP. Except for aluminum, all the other parameters contained in the treated water generally meet relevant national standards. The WTP is fine tuning its alum doses to minimize the high aluminum problem.

12. Water Source Protection

Mopanshan Reservoir is the water source of the Harbin Water Supply Project. The objective of implementing the Project is to provide safe water to the Harbin residents, and improve local people's health and living standards. There are a series of laws and regulations in place on water source protection issued by the state or local governments, for protection of the Mopanshan water source.

It is understood that the Harbin Municipal Government (HMG) has listed the Mopanshan water source protection into legislation planning early in 2004. A special legislation investigation and research group has been established with the Harbin Legislation Office, Harbin Environmental Protection Bureau, Harbin Water Resources Bureau, Harbin Forestry Bureau and HMWSCC as its members. The *Draft Regulations of Mopanshan Reservoir Water Source Protection (Draft Regulations)* have been prepared. However, the location of the Mopanshan Reservoir is not under the jurisdiction of HMG but belongs to the forestry sector. This has necessitated a process of definition of the water source protection areas and caused a delay in the establishment of the relevant policies.

It is understood that the above *Draft Regulations* define the Level 1, Level 2 and Level 3 protection areas as below:

- Level 1: The area is 37.7 km^2. There are two villages and one forest farm with 1,116 households, 3,882 residents and 13,577 mu of cultivated land. The nearest village is only about 100 m away from the reservoir.
- Level 2: The area is 244.4km^2.There are one village and three forest farms with 1,826 households, 6,488 residents and 23,11mu of cultivated land.
- Level 3: The area is 868.9 km^2. There are three forest farms with 1,124 households, 3,783 residents and 11,475 mu of cultivated land.

Relevant protection and restricting provisions would be established against each protection area. Additionally, automatic water quality monitoring facilities have been set up at some locations such as river mouth of each tributary flowing into the reservoir, middle of the reservoir and water intake for online data collection. Additionally, a set of portable water quality monitoring instrument was equipped at the reservoir management center to monitor water quality at sections of the tributaries entering the reservoir.

13. Problems Encountered

During the implementation period from 2004 to 2007, there have been no environmental issues or problems caused by the project construction.

A major event of significance to the Project, which occurred in late 2005, was a pollution incident in the Songhua River. This incident caused the Water Supply Company to close down the piped supply system in Harbin and supply water on an emergency basis. The event was significant in that it confirmed the need for the Mopanshan supply to be developed as soon as possible. It also resulted in discussions being held with Central Government officials. As a result, Phase II of the Mopanshan Project has been brought forward and the work given the highest priority.

14. Data Collection

In order to obtain enough information on the environmental activities during the construction period, various relevant documents have been collected and reviewed. These documents include the national environmental laws and regulations on environmental impacts, mitigation measures and environmental plans, and records and reports prepared by the implementation agencies, the contractors and other related agencies on environmental protection activities carried out during the construction phase. The documents already received include:

- the Loan Agreement and the Project Administration Memorandum
- the Report and Recommendations by the President
- EIA report dated March 2002
- approval comments on EIA report issued by the SPEA on July 19, 2002
- the SEIA dated July 2002
- Preliminary Design Report
- samples of construction tender document, bidding document and contract
- project construction management monthly reports, jointly prepared by the China International Engineering Consultancy Company and the project management division of the HMWSCC
- the Inception Report, Quarterly Reports and Annual Reports by B&V
- Initial Environmental Examination by B&V
- Annual Environmental Report for 2004 by B&V (Dec 2005)
- Annual Environmental Report for 2005 by B&V (Feb 2006)
- Environmental Impact and Sanitation Evaluation Report (Nov 2003)
- Reservoir Area Sanitation Clearance Working Scheme
- Reservoir Bed Clearance and Sanitation Audit Certificates (Aug 2004)
- Reservoir Bed Clearance and Sanitation Report (Nov 2005)
- Cultural Heritages Protection Plan (Jun 2003)

- Water and Soil Conservation Monitoring Action Plan (Jul 2004)
- Water and Soil Conservation Monitoring Report (No.1, Sep 2004)
- Water and Soil Conservation Monitoring Report (No.2, Oct 2004)
- Water and Soil Conservation Monitoring Report (No.3, Jun 2005)
- Water and Soil Conservation Monitoring Report (No.4, Sep 2005)
- Water and Soil Conservation Monitoring Report (No.5, Oct 2005)
- Water and Soil Conservation Monitoring Report (No.6, Jul 2006)
- Water and Soil Conservation Monitoring Report (No.7, Sep 2006)
- 2004 Water Quality Monitoring Report (Mar-Sep 2004)
- 2005 Water Quality Monitoring Report (May-Nov 2005)
- 2006 Water Quality Monitoring Report (for raw water and treated water)
- Wastewater Treatment of Harbin City in 2007
- 2007 raw water quality data of Mopanshan Reservoir
- 2007 raw water quality data of the Mopanshan WTP
- 2007 treated water quality data of the Mopanshan WTP

15. Conclusions and Recommendation

By the end of this reporting period, the Project facilities have been in operation for one year after construction completion. During the construction phase, mitigation measures have been implemented properly to minimize the environmental impacts. During the year of commissioning and operation, the Project has demonstrated its benefits in terms of domestic water supply, irrigation water supply and flood control etc., and its operation has not produced any significant unfavorable impacts on the environment.

- The implementation of the Project has been in compliance with the relevant environmental laws, regulations and standards. The environmental protection measures or facilities had been designed, constructed and operated during the main construction works. However, the required environmental inspection and acceptance at completion has not commenced yet.

- The HMWSCC, construction contractors and supervision companies have satisfactorily fullfilled their environmental responsibilities and obligations.

- The noise, dust and wastewater generated during construction have been mitigated by implementing relevant measures and there has been no significant impact on the sensitive areas in the vicinity.

- The persons affected by the LAR have been relocated and compensated properly, and all of the land temporarily occupied has been restored and returned to the owners.

- Along with the construction completion and site restoration, the areas susceptible to soil erosion arereducing in the reservoir construction area.

- The water supply capacity of the new Mopanshan WTP has gone up to 450,000m^3/d by the end of 2007. This has greatly addressed the urgent water needs of Harbin. About 1.65 million residents in five districts have been supplied with the new water now.

- The reservoir supplies 8,000 m^3/annum of irrigation water to 313,500 mu of farmland downstream in Wuchang, and also releases 13.1 million m^3 of ecological water per year.

- The reservoir is designed to handle 1-in-100-year peak flood flows, providing flood relief in the downstream areas and protecting 2 cities, 3 townships, 111 villages and 313,500 mu of farmland.

- In recent years, the wastewater volume in the Harbin urban area has not increased as expected with the increased new water supply. Along with the gradual implementation of the Harbin Social and Economic Development Plan, the urban sewers and wastewater treatment system will be able to overcome the possible issues incurred by the increase water supply.

- The wastewater, boilers fume emission, noise and solid wastes generated in operation of the WTP have been mitigated and controlled by implementing proper measures.

- Except for turbidity, all the other parameters contained in the reservoir raw water meet the national standards. The slightly high level of turbidity has gone down when the raw water arrives at the WTP, and turbidity of the raw water of the WTP can definitely meet national standard. The quality of the Project raw water is good and has no significant problems.

- The pollutants in the WTP raw water have been reduced greatly after treatment. Except for aluminum, all the other parameters in the treated water generally meet the relevant national standards. The WTP is fine tuning its alum doses to minimize the high aluminum problem.

- The dam impounds most inflow and causes the downstream flow to be much lower than before. This has some influences on the water ecological environment of downstream river reach. The ecological release of 13.1 million m^3 ecological water aims at reducing this impact.

- Mopanshan Reservoir had some potential risks on water quality. It is suggested that the government enforce effective measures to eliminate the pollution risks of the Mopanshan Reservoir.

APPENDIX 1
ENVIRONMENTAL STANDARDS

Table A1-1: Environmental Quality Standards of Surface Water
(GB3838-2002)

Unit: mg/l (excluding pH)

NO.	CLASSIFICATION STANDARD VALUE PARAMETER		CLASS I	CLASS II	CLASS III	CLASS IV	CLASS V
1	pH				6～9		
2	CODcr	≤	15	15	20	30	40
3	Ammonia nitrogen (NH_3-N)	≤	0.15	0.5	1.0	1.5	2.0

Table A1-2: Water Quality Standards for Drinking Water Sources
(CJ3020-1993)

NO.	PARAMETERS	UNIT	LIMITS	
			CLASS 1	CLASS 2
1	Color	degree	<=15 and no other color	no obvious other color
2	Turbidity	NTU	<=3	
3	pH value	-	6.5 to 8.5	6.5 to 8.5
4	NH_3-N	mg/L	<=0.5	<=1.0
5	COD ($KMnO_4$)	mg/L	<=3	<=6

Notes:

Class 1 - The water quality is good and before the water is supplied for drinking it only needs disinfection for groundwater source and simple purification for surface water source.

Class 2 - The water has been slightly polluted and needs purification treatment processes such as flocculation, sedimentation, filtration and disinfection and the treated water should reach GB5749 before supplied for drinking.

Table A1-3: Water Quality Standards for Urban Water Supply
(CJ/T 206-2005)

No.	Parameter	Limitary Values
1	Total bacteria	≤80 CFU/mL
2	Total coliform group	0/100mL
3	Turbidity	1NTU (≤3NTU for special case ①)
4	Al	0.2 mg/L
5	COD_{Mn} (byO_2)	3 mg/L (≤5 mg/L for special case ②)

Note:

① condition is restricted by either raw water quality or water treatment technology.

② the raw water quality exceeds Class III, namely COD>6 mg/L.

APPENDIX 2
WATER QUALITY ASSESSMENT AND ANALYSIS

1. Mopanshan Reservoir

1.1 Monitoring Data

The reservoir water quality information used in this report is the monitoring data in 2007 obtained from the online monitoring system of Mopanshan Reservoir (Table A2-1).

Table A2-1: Water Quality of Mopanshan Reservoir in 2007

项目	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Standard*
pH	6.96	6.90	6.88	6.89	6.96	6.87	6.76	6.68	6.74	7.14	6.90	6.90	6.5~8.5
NH_3-N (mg/L)	0.18	0.14	0.08	0.07	0.09	0.1	0.09	0.09	0.08	0.08	-	-	0.5
Turbididty (NTU)	0.3	1.6	0.3	2	1.4	1	0.9	3.15	3	4.8	15.1	12.45	3
CODcr (mg/L)	13.56	13.53	13.53	13.48	11.99	10.47	9.84	9.84	10.31	-	-	-	15

* CODcr applies the GB3838-2002, and others apply the CJ3020-1993.

1.2 Analysis

Assessment and analysis are conducted to the standard compliance and variation trend of pH, NH_3-N, turbidity and CODcr in accordance with CJ3020-1993 and GB3838-2002.

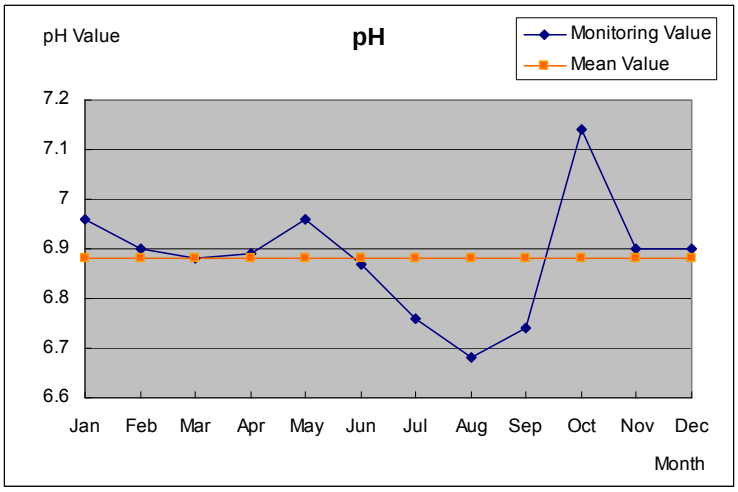


Figure A2-1: pH Monthly Variation of the Reservoir in 2007

pH value

The pH value remained stable in the first half of 2007, and then changed from slightly acidic to slightly alkalin in the second half of the year. The mean value was 6.88 throughout the year. In general, the pH level has always been within the standard scope between 6 and 9.

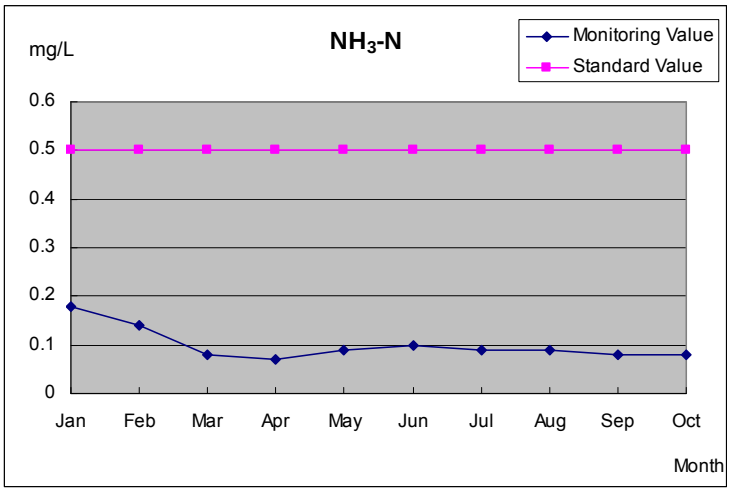


Figure A2-2: NH_3-N Monthly Variation of the Reservoir in 2007

NH_3-N

The reservoir water's NH_3-N level was stable throughout the year of 2007, and far lower than the national standard.

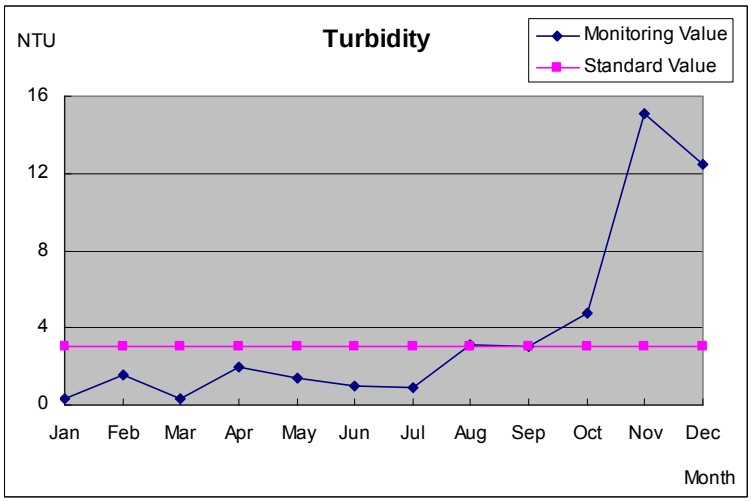


Figure A2-3: Turbidity Monthly Variation of the Reservoir in 2007

Turbidity

The turbidity level showed a growing trend in 2007, and exceeded standard in the last 3 months of 2007.

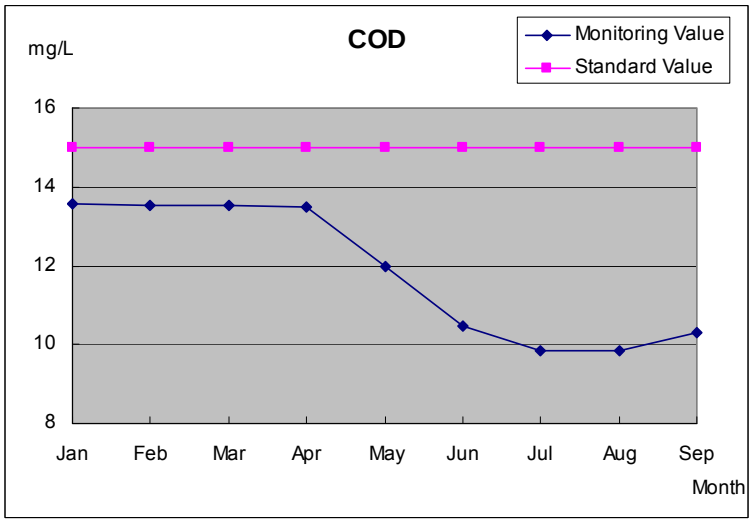


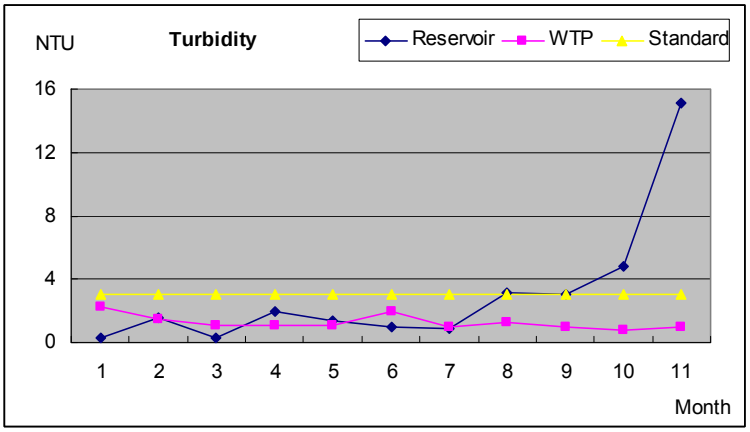
Figure A2-4: CODcr Monthly Variation of the Reservoir in 2007

CODcr

The concentration of CODcr maintained stable level in the first three months of 2007, and reduced subsequently. In general, the CODcr level was far lower than Class II standard of GB3838-2002.

1.3 Raw water quality comparison between the reservoir and the WTP

Although different approaches have been adopted in the monitoring exercises of the reservoir raw water and the WTP raw water, the turbidity level in the two groups of monitoring results was compared (Table A2-2 and Figure A2-5).



It can be seen that the turbidity level of the reservoir went up and exceeded national standard in late 2007. However as the raw water flowed to the WTP, the turbidity level dropped below the national standard 3 NTU and remained stable between 1 and 2 NTU.

Figure A2-5: Raw Water Quality Comparison between the Reservoir and WTP (2007)

Table A2-2: Raw Water Quality Comparison between the Reservoir and WTP
(2007)

Parameter	Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Standard*
Turbidity (NTU)	Reservoir RW	0.3	1.6	0.3	2	1.4	1	0.9	3.15	3	4.8	15.1	3
	WTP RW	2.26	1.45	1.05	1.08	1.06	1.92	1.03	1.32	0.94	0.79	1.01	3

* CJ3020-1993

1.4 Conclusions

The above assessment shows that except for turbidity, all of the other parameters of the raw water for each monitoring exercise can meet national standards. The slightly high level of turbidity has gone down when the raw water arrives at the WTP, and turbidity of the raw water of the WTP can definitely meet national standard. Therefore, the quality of the Project raw water is good and there are no significant issues.

2. Mopanshan WTP

2.1 Monitoring Data

The water quality data for the period from Jan to Nov 2007 on both the raw water and the treated water of the new Mopanshan WTP was provided by the WQMC under the HWWGC (Table A2-3).

Table A2-3: Water Quality of Mopanshan WTP in 2007

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Standard
Raw Water												
Turbididty (NTU)	2.26	1.45	1.05	1.08	1.06	1.92	1.03	1.32	0.94	0.79	1.01	3*
Al (mg/L)	0.176	0.141	0.185	0.086	0.238	0.002	1.598	0.13	0.27	0.384	0.143	0.2*
COD_{Mn}	6.1	5.68	5.68	5.17	4.69	4.4	4.56	4.4	4.4	3.92	3.76	6*

(mg/L)												
Treated Water												
Turbididty (NTU)	0.4	0.36	0.33	0.22	0.59	0.24	0.33	1.14	0.54	0.3	0.09	1
Al (mg/L)	0.049	0.163	0.478	0.076	0.12	0.002	0.183	0.023	0.239	0.256	0.183	0.2
COD_{Mn} (mg/L)	1.7	1.52	1.44	1.62	2.96	1.52	2.16	1.92	1.2	1.68	0.96	3

* CJ3020-1993; ** CJ/T 206-2005.

2.2 Analysis

In this report, assessment and analysis are conducted to the standard compliance and variation trend of turbidity, aluminum and COD_{Mn} for both the raw water and treated water monitored in 2007 in accordance with CJ/T206-2005.

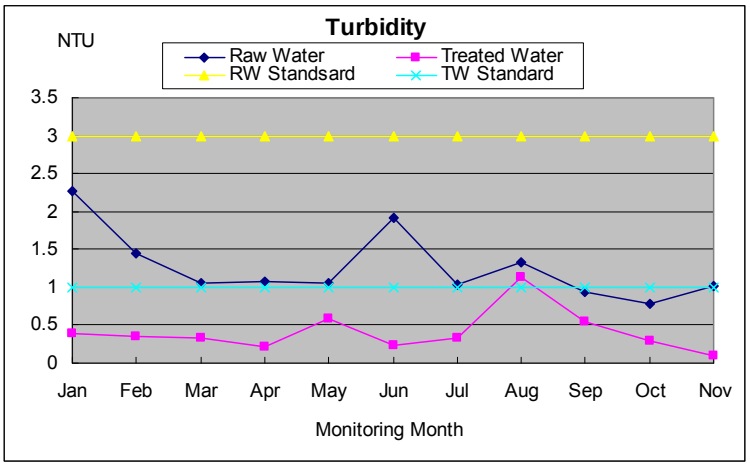


Figure A2-6: Variation and Comparison of Turbidity for Raw Water and Treated Water of the WTP in 2007

Turbidity

The turbidity level was stable in 2007. For the WTP raw water turbidity met the relevant standard. After treatment, the turbidity level further reduced, but there was one time of exceeding standard occurring in August. However, in general, there is no significant issue.

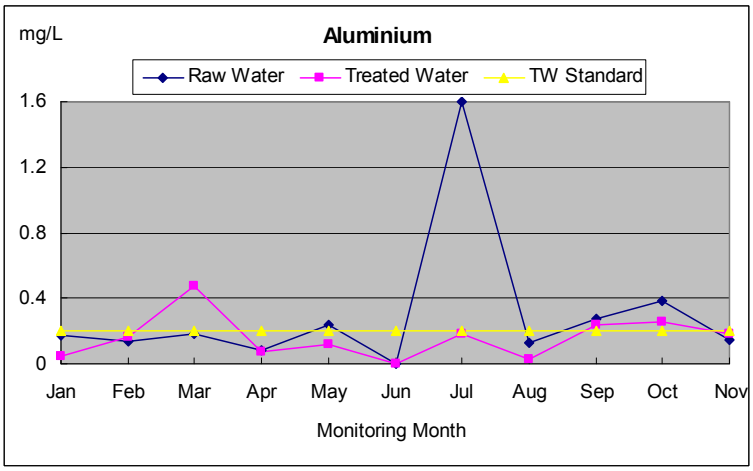


Figure A2-7: Variation and Comparison of Aluminum for Raw Water and Treated Water of the WTP in 2007

Aluminum

At times, the aluminum concentration in the treated water was higher than that in the raw water. For the both water, there were occasions of exceeding standards. The past raw water monitoring in 2004 and 2005 at the dam section had recorded some exceedance of aluminum. In addition, aluminum sulfate is used in the WTP as the coagulant. Therefore, there are two sources of aluminum contained in the treated water: being carried by the reservoir raw water, and being residual in the water purification process.

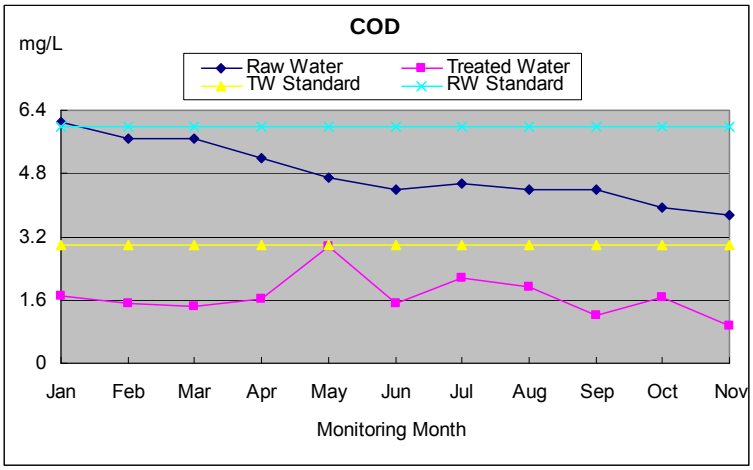


Figure A2-8: Variation and Comparison of COD_{Mn} for Raw Water and Treated Water of the WTP in 2007

COD_{Mn}

The COD_{Mn} level of the WTP raw water demonstrated a downward trend in 2007, and met the CJ3020-1993 standard. The concentration of COD_{Mn} was consistently reduced after treatment and met the CJ/T206-2005 standard for treated water.

2.3 Conclusions

The assessment results show that except for some exceedance of aluminum, all other parameters for each monitoring exercise generally met the relevant national standards. The WTP is fine tuning its alum doses to minimize the high aluminum problem.