SUMMARY ENVIRONMENTAL IMPACT ASSESSMENT

FUZHOU WATER SUPPLY AND WASTEWATER TREATMENT PROJECT

IN THE

PEOPLE’S REPUBLIC OF CHINA

May 1998
CURRENCY EQUIVALENTS
(as of 30 April 1998)

Currency Unit — Yuan (Y)
Y1.00 = $0.1208
$1.00 = Y8.2781

The exchange rate of the renminbi yuan is determined under a floating exchange rate system. In this Report, a rate of $1.00 = Y8.3, the rate prevailing at the time of appraisal of the Project, is used.

ABBREVIATIONS

AIC - Average Incremental Cost
EIA - Environmental Impact Assessment
EIRR - Economic Internal Rate of Return
FEPB - Fujian Environment Protection Bureau
FIRR - Financial Internal Rate of Return
FMG - Fuzhou Municipal Government
FPEPRI - Fujian Provincial Environment Protection Research Institute
FSWST - Fuzhou Second Water Source and Treatment
MRWDT - Min River Water Diversion and Treatment
NEPA - National Environment Protection Agency
PRC - People’s Republic of China
SEIA - Summary Environmental Impact Assessment
YLWWTP - Yang Li Wastewater Treatment Plan

WEIGHTS AND MEASURES

km² - square kilometer
kPa - kilo pascals
m/sec - meter per second
m³ - cubic meter
m³/day - cubic meter per day
m³/sec - cubic meter per second
mg/l - milligram per liter
Mu - 1/15 hectare
°C - degree Celsius

NOTES

(i) The fiscal year (FY) of the Government ends on 31 December.
(ii) In this Report, the symbol "$" refers to the US dollars.
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I. INTRODUCTION

1. The Environmental Impact Assessment (EIA) for the Fuzhou Water Supply and Wastewater Treatment Project (the Project) was prepared by the Fujian Provincial Environmental Protection Research Institute (FPEPRI) for the Project proponent, the Fuzhou Municipal Government (FMG). The EIAs were submitted to the Fujian Environment Protection Bureau (FEPB) and to the National Environment Protection Agency (NEPA) for review and approval.\(^1\) NEPA approved the EIA for the Fuzhou Second Water Source and Treatment (FSWST) subproject on 25 November 1997, for the Yang Li Wastewater Treatment Plant (YLWWTP) subproject on 5 January 1995, and for the Min River Water Diversion and Treatment (MRWDT) subproject on 22 December 1997. The EIA reports were prepared in accordance with the Government's requirements. Additional information required under the Bank's Environmental Assessment Requirements and Environmental Review Procedures for Summary EIA (SEIA) preparation were attached to the EIAs as appendix. The Bank provided the Government of the People’s Republic of China (PRC) with technical assistance (TA) to help formulate the Project.\(^2\) The TA provided for Bank Consultants to review the EIA and assist the FMG in preparing this SEIA.

2. The EIA and SEIA reports were originally prepared in Mandarin; the English version of the EIA is available through the Bank’s Water Supply, Urban Development and Housing Division (East) upon request. The Bank’s environment and social development specialists visited the Project sites and held discussions in March 1998 with the FMG, FPEPRI, and other experts to verify the procedures, findings, and results of the EIA. The EIA and SEIA documents are prepared by the Project proponent. The Bank’s review and recommendation will be included in the Report and Recommendation to the President.

II. DESCRIPTION OF THE PROJECT

3. The proposed Project has three subprojects: one for development of a new water supply source, water treatment, and distribution facilities from the Ao River to augment water supply capacity in Fuzhou City, the provincial capital of Fujian Province; one for construction of wastewater treatment facilities at Yang Li in Fuzhou City; and one for diversion of water from the Min River, water treatment, and distribution works to increase water supply capacity in Fuqing County of the water from Min River.

A. Fuzhou Second Water Source and Treatment

4. This subproject includes a transfer scheme to bring water from the Ao River to Fuzhou City. It also includes one water treatment plant and the development of new water distribution networks to supply the eastern area of the City. Flow from the Ao River to Fuzhou would be by gravity. The alternative of pumping more water from the Min River upstream of the tidal limit was examined, but rejected. Although the Min River is easily accessible to Fuzhou, the pumping option would involve appreciably higher annual electricity costs for pumping, and was therefore rejected.

\(^1\) A separate EIA was prepared for each of the three subprojects.

\(^2\) TA No. 2770-PRC: Fuzhou Water Supply and Wastewater Treatment Project, for $598,000, approved on 14 March 1997.
5. The Ao River flows through forested hills to the north of Fuzhou City. Upstream from the proposed intake site there is an existing dam (Shanzai) with a hydroelectric power station. A new dam and hydroelectric power station at Tangban will be built to provide water for the subproject.\(^1\) This component will draw up to 800,000 cubic meters per day \((\text{m}^3/\text{day})\) from the Ao River.\(^2\) From the intake, water will be conveyed through tunnel (21.2 kilometers \([\text{km}]\) in length and 3 meters \([\text{m}]\) in diameter) driven through the intervening hills to a new water treatment plant at Yuanzhong, with capacity of 300,000 \(\text{m}^3/\text{day}\). The design of the system will enable easy expansion of capacity when demand increases. This subproject will also include 25 km of new supply mains from the water works to the supply area and additional secondary pipe construction. This subproject will be implemented by the Ao River Water Diversion and Development Company.

B. Yang Li Wastewater Treatment Plant

6. This subproject includes the construction of a wastewater treatment plant at Yang Li, close to the Min River and to the southeast of the main urban area of Fuzhou City. The Yang Li plant will be built in two stages. The first, which will form part of the Project, will have a capacity of 200,000 \(\text{m}^3/\text{day}\). Land acquisition and construction of a pumping house, sedimentation tanks, and buildings will be based on a larger capacity of 300,000 \(\text{m}^3/\text{day}\) to provide for further expansion, while the vertical surface aeration tank, secondary sedimentation tank, and sludge treatment structure will be built for 200,000 \(\text{m}^3/\text{day}\). The subproject also includes the construction of approximately 40 km of trunk sewers and secondary pipes, and of five pump stations, as well as rehabilitation and cleaning of the existing 53 km pipe network.

7. Although up to now there has been no wastewater collection, sewers have been laid under the streets, at the time of road construction. Except in limited areas, connections have not been made to these sewers. Development of the secondary network is included in the Project scope to ensure that, once built, the sewage treatment works will be fully utilized. The part of the construction of the additional network outside the scope of the Project will be carried out by the FMG.\(^3\) The subproject will be implemented by the Yang Li Wastewater Treatment Company.

8. The Yang Li plant will utilize the extended aeration activated sludge process with a sludge retention period of 18 days to ensure a reasonable degree of stabilization of the activated sludge. In the extended aeration mode, raw sewage will be fed to the biological reactors, where aeration will cause full nitrification. The process proposed is a modern but well-known technology already in use in the PRC.

9. The key process unit is the biological reactor in which a microorganism population is developed and sustained to provide both carbonaceous biological oxygen demand removal and nitrification/denitrification. Design of the reactors will be finalized at the detailed design stage. Waste sludge from the process will be stabilized because of the long sludge age provided in the biological reactors. The sludge will be thickened and then dewatered before being disposed of at the city’s Hong Miao Ling sanitary landfill. Lime is proposed for conditioning the sludge to reduce its moisture content, suppress odors, and provide some

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\(^1\) The dam is outside the scope of the present Project. Its construction has been approved by the FMG, and is financed by FMG.

\(^2\) The effective capacity of this scheme is 700,000 \(\text{m}^3/\text{day}\), which excludes system losses of about 15 percent.

\(^3\) The cost of sewers to be built by the FMG is estimated at Y97 million; the FMG has guaranteed to finance this cost and to undertake timely construction of the sewer network.
disinfection by virtue of its high final alkalinity. These sludge gates are opened at the beginning of the ebb tide to flush the treated effluent at a time that ensures a high dilution ratio.

C. Min River Water Diversion and Treatment

10. This subproject has been designed to draw up to 1.3 million m$^3$/day from the southern branch of the Min River at Xianan, close to the bridge on the Fuzhou-Fuqing main road. A pumping station at the intake with an initial installed pumping capacity of 10 cubic meters per second (m$^3$/sec), with space for later expansion, will lift water from the river to a 23 km-long tunnel (4 m in diameter) driven through a ridge of hills running south from the intake to Xinju, northwest of Fuqing City. A water-regulating reservoir is being built at Xinju. At Jiudian the aqueduct will be channeled into the Longgao branch, composed of five tunnels and conduits for a total length of 34 km, to provide raw water for multiple purposes.\(^1\) This branch will extend from Jiudian to Xuegang. Three water treatment plants, at Liuxia, Longtian, and Xuegang will be built under the Project.\(^2\) The total capacity of the three plants is estimated at 175,000 m$^3$/day, but a reduction in size of the three treatment works is expected to be introduced at loan appraisal, because of revised water demands. This will consequently reduce the Project costs, but changes are not expected to be significant. Substantial construction works have been complete for this subproject, including the intake and main tunnel works, financed through domestic sources and overseas Chinese contributions and are outside the scope of the Bank’s Project. The Bank’s Project includes construction of the Longgao branch between Judian and Xuegang, the water treatment plants, and related distribution work. This component will be implemented by the Min River Water Diversion Company.

III. DESCRIPTION OF THE ENVIRONMENT

A. Project Area

11. Fuzhou is the capital city of Fujian Province, located on the southeast coast of the PRC. The city is located on the Min River about 40 km upstream from the East China Sea. It was designated an autonomous economic zone in 1979 and later declared an open coastal city in 1984. Fuzhou City sprawls northward from the Min River and is surrounded by hills and mountains on three sides. It has an official urban population estimated in 1995 at 1.3 million people. The average population growth rate between 1991 and 1995 was 1.08 percent per annum. The population of Fuzhou Municipality (which includes Fuqing) is estimated at about 5.6 million. Fuzhou has developed into a regional center for business, commerce, and industry. The economy of Fuzhou is buoyant, having achieved a growth in gross product of over 5 percent per annum during the Eighth Five-year Plan. However, the development of urban infrastructure has not kept pace with the urban and industrial growth, resulting in deterioration of the water supply service and urban environment to a point where economic development and the quality of life are at risk.

12. The regional geology is one of Mesozoic era volcanic rocks, intruded in the late “Yannathan” stage during the Cretaceous period by acid and medium-acid intrusive rocks. Quaternary system alluvial, eluvial, and diluvial occur at the foot of the mountain ranges and in the valleys. The region is located in the middle section of the volcanic fault zone in the eastern

\(^{1}\) Contracts for construction work on four of the five tunnels have already been awarded, separate from the Project, and financed by local sources.

\(^{2}\) A treatment plant at Longtian, with capacity of 10,000 m$^3$/day, is under construction with local funds and will start operation at the end of 1998. It will be expanded under the Project.
part of Fujian Province, where the fracture structure is well developed. The strike of the main fractures are all in a northerly direction. The north-northeast fracture is the major fault that controlled volcanic eruption in the later Mesozoic era and the orientation of the intrusive rocks of the Yanshan stage. However, it appears that most of the faults crossing the tunnel line belong to other orientations.

13. Although the region is characteristic of the uplift and downthrust of different blocks and active faults since the Cenozoic era, especially in the Quaternary period, the region has stabilized in recent times, but a slight uplift is still occurring. Earthquakes occur frequently in the region as a whole; a $M_L=5.7$ in Richter scale estimated magnitude event occurred in Fujian-Lianjiang in 1574. Recorded epicenters are mostly outside the Project area. The lithology along the tunnel line is likely to comprise Jurassic volcanics from the intake up to about 16.4 km from the Ao River intake point, beyond which it comprises the younger Yanshan stage intrusive granodiorite. The lower member of the Xiaoxi formation volcanic rock is likely to occur only between approximately, 3 km and 5 km from the intake point, commencing at the deep valley referred to above at the commencement of this section. The faults and earthquakes are considered low risk; the tunnel and structural designs will further reduce the risk.

14. In 1980-1984, a hydrological investigation was conducted on the groundwater resources over a 520 square km area in Fuzhou City. The Min River is regulated by the Shui Kou Hydropower Reservoir, located some 80 km upstream of Fuzhou. The river splits into two branches upstream of Fuzhou. The south branch is known as the Wulong River. The width of the northern branch varies between 500 and 1,000 m, and the maximum flow velocity can be more than one meter per second (m/sec). The flow ratio of north branch to south branch is approximately 7:3 in the dry season, but this ratio reverses in the rainy season. The two branches rejoin a short distance downstream from Mawei, some 10 km downstream from the YLWWTP site. The average flow of the river in the Fuzhou section is reported to be 1,750 m$^3$/sec. The lowest regulated instantaneous flow is set at 308 m$^3$/sec to ensure safe navigation in the river. The minimum average daily flow rate for a 1 in 100 year event is approximately 650 m$^3$/sec. The high flow season occurs during April to September and accounts for 71.5 percent of the total flow. The low-flow season occurs during October to February and accounts for 17.5 percent of the total flow. As the Fuzhou section is close to the sea, the flow is affected by the tide. The duration of the high tide is five hours on average and low tide seven hours.

15. A series of 15 small streams run through Fuzhou. Their total length is 38.9 km, with six accounting for 26.1 km of this length. Their widths vary from 5 to 50 m and the depths vary from 2.5 to 4.6 m. The flow of these streams is also affected by tides. The Guang Min Harbor abuts the YLWWTP site. The quality of the water in the Min River in the vicinity of Fuzhou and the YLWWTP site is Class VI and worse.$^1$ Downstream at Mawei, predicted concentrations of ammonia can exceed the guideline value for fish toxicity. Min River sediments show moderately elevated contamination by heavy metals. The streams are highly polluted by wastewater of both household and industrial origins. The investigation showed that groundwater resources within the Project area were scarce and contaminated by the streams, making them unsuitable for water supply.

16. The Project area is in the subtropical monsoon zone characterized by warm and humid weather. The average wind speed is 2.4 m/sec, but because it is in a typhoon area, wind speeds can reach 20 m/sec. The dominant wind direction is southeast: northwest at dawn and changing to southeast in the afternoon. The average annual temperature is 19.6 degrees

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$^1$ In the PRC, river water quality is classified between Class I (pristine) and Class VI (highly polluted). The water quality for municipal water supplies should be Class III or better.
Celsius (°C). The warmest month’s average temperature is 28.7°C, and the coldest month’s average temperature is 7.7°C. The highest temperature recorded is 39.8°C, and the coldest is 2.4°C below zero. The average annual rainfall in Fuzhou is 1,303 millimeters (mm), while the highest is 1,837 mm. The wettest months are May and June. The average annual relative humidity is 77 percent, and the highest monthly relative humidity is 84 percent. The average annual barometric pressure is 101.2 kilo pascal (kPa). The highest barometric pressure recorded is 103.4 kPa, and the lowest 97.8 kPa.

1. **Fuzhou Second Water Source and Treatment**

17. The Ao River receives water from Shanzai reservoir, which collects water from the Shangxikang and Rixi rivers. Hydrological data has been collected from a gauging station above Tang Ban from 1957 to 1991.

18. The catchment area of the rivers above the Shanzai reservoir is 1,646 square kilometers (km²). The catchment area has 15,500 hectares (ha) of cultivated area and 180,000 people, but no industries. In Pandu and Chenguan, both townships downstream of Tang Ban, the Ao River water is used for irrigating 3,600 ha of agricultural land. The total water consumption in Lianjiang and Chenguan cities is estimated to reach 80,000 m³/day and in Changan Development District 70,000 m³/day. A minimum 10-day average flow of 9.36 m³/sec in the Ao River at Jiangnan Bridge in Lianjiang City has been recorded in the past, and this figure has been adopted by the FEPB as the flow to be maintained in the river downstream of Tang Ban.

19. The landforms in the area of the proposed water transfer tunnel from the Ao River to Fuzhou comprise low mountains and hills with very well-developed gullies, cut deeply into the terrain by streams.

20. The proposed treatment plant is located in Yuanzhong village, Giu Mountain township in the Jingnan District of Fuzhou. Yuanzhong village is located to the north of the railway line and has a subtropical maritime monsoon climate. Compared with the urban area, it has poorer education, culture, transportation, communication, and urban facilities. There is no sensitive wild animal species within the Project construction site, and no mineral resources have been found.

2. **Yang Li Wastewater Treatment Plant**

21. The Yang Li plant site is close to the western foothills of Gu Shan, which is part of the mountain formation surrounding Fuzhou. Gu Shan is a popular scenic spot that attracts a large number of visitors. The site itself is one km from the Min River, and geotechnical investigations have shown that it is underlain by Quaternary alluvial soils. The surface layers contain mixed fill material, and the limited drilling conducted showed highly weathered granite at a depth of about 50 m. The site is at an elevation varying between 4.7 and 7.5 m (Luo Ling datum), while the 1 in 100 maximum high river level is approximately 5.8 m. The site slopes towards the Min River, and a levee protects it from flooding by water from the Guang Min Harbor.

3. **Min River Water Diversion and Treatment**

22. The total water resources in Fuqing City amount to 11.74 billion m³/annum or 1,043 m³/person, which is 25 percent of the provincial average. The water resources for paddy are 31,200 m³/ha, or 33 percent of the provincial average. These statistics indicate that Fuqing City is relatively poor in water resources. Existing local sources have been fully exploited.
23. The water intake point is tidal, with an average duration of high tide of five hours and a tide subsidence period of approximately seven hours. The average tidal range is 4.5 m, and the highest recorded tidal range is 7.0 m. Although tidal at the intake, the water is not generally saline, but chloride concentrations in excess of 250 milligrams per liter (mg/l) have been reported infrequently, at the Wu Long bridge, generally when high tides combine with low river flows. This concentration does not pose a health problem.

24. The south branch of the Min River provides water for drinking, industrial processes, irrigation, navigation, and fisheries. Approximately one km downstream from the intake point, the major beneficial uses are irrigation and navigation. The water quality of the Min River (northern branch) is affected by pollution from Fuzhou, and some effect can be transferred to the south branch by tidal oscillation, though this is generally not serious at the proposed intake site. The construction of the YLWWTP will help improve the water quality in the Min River’s north branch and reduce the potential impact on the south branch.

B. Biological Environment

1. Fuzhou Second Water Source and Treatment

25. The terrestrial flora and fauna found in the Ao River area are described in the EIA. The area along the river banks has been completely altered from its original habitat by centuries of agriculture. No endangered flora or fauna species are reported to exist in the area. A total of 127 species of algae, classified into six types, and 136 species of zooplankton, classified into five types, were found in the Ao River system. None of these are endangered or rare species.

2. Yang Li Wastewater Treatment Plant

26. The natural vegetation and wildlife in the vicinity of the Yang Li plant have long since been altered by human habitation and cultivation. The algae, zooplankton, benthic fauna and fishes found in the various sections of the Min River are all common, and none are rare or endangered species.

3. Min River Water Diversion and Treatment

27. The vegetation along the alignment of the water transfer line is common, with less than 20 percent of the area covered by forest. Most of the Project sites are thin forest areas. The vegetation consists of over 400 varieties. The wet agricultural land along the water transfer lines are mainly paddy and dry fields, primarily planted to potatoes, melons, and beans. The orchard plantations are growing peaches, plums, and other fruits. The wildlife in the Project areas includes common species, none of which are threatened.

28. The fish farms operating in the Min River downstream from the intake point are of small scale. There are more than 100 varieties of fish in the Min River, of which over 80 are freshwater fish. About 50 percent of the fish have no economical value. The implementation of the Yang Li water treatment plant will also help improve the water quality, thereby enhancing opportunity for fisheries.

C. Socioeconomic Environment

1. Fuzhou Second Water Source and Treatment

29. The intake for the water transfer scheme is situated at the storage pond of the Tang Ban dam, which is not subject to either residential or agricultural activities. The proposed
The treatment plant site is in Yuanzhong village. The socioeconomic survey indicates that the Yuanzhong village has a total land area of 2,260 mu (150 ha). It had 242 households in 1996, of which 735 individuals were involved in agriculture, mostly vegetable and tree farming. The income per capita is Y2,105. The Project will require resettlement of 10 households (46 persons) and compensation for loss of agricultural land.

2. **Yang Li Wastewater Treatment Plant**

The site for the first stage of the YLWWTP subproject is adjacent to Yang Li village comprising about 3,500 people, agricultural lands, fish and duck ponds, and village industry workshops. The treatment plant site will ultimately require the resettlement of about 1,500 people, but the first stage, which is under the Project, will require the resettlement of 15 households (80 persons) and compensation for the loss of agricultural land. The village comprises 937 households, and the majority of the population are agricultural laborers. While the village relies primarily on agriculture, some small-scale industries are located within it. Family size averages around four persons per household, and the growth rate only about 0.78 percent per annum, due to the fact that migration into the village is offset by out-migration. The average net annual income is reported to be Y2,302 per capita. Facilities within the village are not substantial: access is via unpaved gravel roads, bicycle transport predominates, water supply, there are no formal sanitation facilities, and only 8 percent of households surveyed have a private telephone.

3. **Min River Water Diversion and Treatment**

The towns surrounding the intake point include Xianan, Minjian, Qinkou, Shangan, Xiangqian, Nanyu, and Banteng. The total population in these towns was recorded as 263,000 in 1995. The towns are predominantly agricultural with little industry. Fuqing City administers 19 towns, 2 villages, 4 national farms and 1 farm operated by the army. The total population in 1995 was 1.14 million, of which 1.10 million were registered as farmers, although many were working in industries. The total value of industrial and agricultural outputs was Y13.4 billion in 1995, consisting of the following: (i) industries Y11.4 billion, (ii) agriculture Y358 million, (iii) forestry Y150 million, (iv) animal farming Y510 million, (v) fisheries Y1.1 billion, and (vi) subsistence Y2.7 million. At present, the total farmland in Fuqing City is 32,626 ha, of which 17,813 ha are paddy and 14,813 ha are hilly land. The main agricultural products are rice, melons, wheat, and barley. Cash crops include peanut, sugar cane, rape-seed, and soya beans. In 1995, the total agricultural produce amounted to 357,200 tonnes. The Project will require resettlement of six households (36 persons) and compensation for loss of agricultural land.

32. The major industries in Fuqing include chemicals, metals, construction materials, food processing, textiles, tanning, plastics, paper making, power, machinery, electronics, sugar production, and salt production. The total industrial output in 1995 was Y10.67 billion. Three industrial development districts have been developed in Fuqing City, namely: (i) Yuanhong Development District located in the northeast coastal area of Fuqing with a total area of 50 km²; (ii) Rongqiao Development District, located in the Honglu township with a total area of 12 km²; and (iii) Hongquan Development District, located in the Yangxia village with a total area of 10 km². In addition, the Longgao peninsula, which is in the southeast area of Fuqing, is being developed into a trade and light industry center. Jiangyin Island, located in the southern part of Fuqing inside the Xinghua Bay, is being developed into a deep water sea port.

33. The public health facilities in Fuqing City include a treated water supply and a landfill for disposal of solid wastes. No municipal sewage treatment plants are yet constructed, although a number are proposed for the future. Industries are required to provide on-site
treatment prior to discharge of effluents. There are 40 health care facilities: 26 hospitals and 14 clinics.

34. Educational institutes in Fuqing include 1 professional technical college, 66 high schools, 20 agricultural high schools, 1 technical school, and 581 primary schools. There are some tourist spots in Fuqing City including Shizhu mountain, Ruiyun pagoda, and Mila temple.

35. Based on 1995 statistics, the average annual income was Y4,889 per urban dweller and Y2,866 per farmer. The average annual purchasing power of people in Fuqing was reported to be Y2,282 per urban person and Y2,011 per person for farmers.

IV. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Fuzhou Second Water Source and Treatment

1. Physical Environment

36. The construction of the water transfer tunnels will involve excavation of soil, drilling and blasting of rock, removal and storage of spoil in temporary or permanent dump areas, disposing of water pumped out from the tunnels, and transporting of materials into and out of the tunnel sites and adits. There will also be temporary living quarters for workers. All the tunnel adit sites are in hilly areas within 100-1,000 m of access roads.

37. The volume of spoil produced at each adit will range from 30,000 to 50,000 m$^3$. Some 27 percent of the spoil will be crushed for making concrete to line the tunnel, and the balance of the 36,500 m$^3$ will be stored in the area. A plan has been developed to ensure that the spoil is properly disposed of, does not become unsightly, or block drains. Each storage area will be designed to suit the topography and to minimize any impacts on the surrounding areas. The spoil removed from the tunnels will be mainly rock with little or no soil; therefore no erosion of the spoil during heavy rain is anticipated. Similarly, dust from spoil heaps is not expected to be a problem.

38. As some of the spoil would be used for making concrete, good access for trucks to facilitate transportation of the spoil into and out of the storage area will be constructed. Because the spoil is potentially a product with value for other construction projects such as road making, revetment wall work, and concrete works, the spoil stockpiles are expected to be removed over the medium term. When the spoil has been cleared, the storage area will be rehabilitated with vegetation native to the area.

39. For the water treatment plant at Yuanzhong, the following construction and mitigation measures will be implemented: (i) all vehicles used for transporting soil and sand will be designed to prevent leakage, and be covered to prevent dust or saturation during rain; (ii) proper retaining walls will be installed to keep the soil and sand within confined areas; (iii) proper drainage will be constructed to divert the rain water away from excavation and stockpile areas to minimize erosion and avoid turbid stormwater discharges; and (iv) spoiled areas will be rehabilitated with vegetation as soon as they can be spared from further construction activities. Arrangements will be made to collect all solid waste generated on the Project site and to dispose of it with the normal city waste. The solid waste will not be allowed to accumulate on site to cause odor, fly, or rodent problems.

40. Wastewater will be affected by workers on site, concrete production, and lubricating oil and diesel oil. The wastewater generated by the Project workers on site will be collected and treated in a septic tank to minimize pollution in local drains. Good work practices
will be enforced to avoid contaminating the tunnel water and the discarded engine cooling water with the lubricating oil and diesel oil used on site. Workers will be given basic training on pollution control so that they can make efforts to minimize pollution on site. The wastewater generated from the concrete production operation will contain mainly suspended solids, and an appropriate sedimentation tank or lagoon will be used to treat the wastewater before discharge off site. Wherever possible, the treated wastewater will be reused for dust suppression and irrigation.

41. The tunneling work, the water intake point, and the water treatment plant site are not adjacent to residential areas; therefore noise will have little effect on residents. Workers in noisy situations will be issued hearing protection equipment.

42. Dust will be the major air pollutant generated during the construction phase, mainly by the excavation work, production of concrete materials, and by traffic. For the tunneling operation, dust emission associated with the spoil is expected to be mild because the spoil is mainly rock, and the drilling will be carried out with dust suppression equipment. Access roads to the Project sites will be constructed with good material and maintained properly. Dusty areas will be sprayed with water periodically to suppress the dust. Exhaust from engines in the enclosed tunnels will be maintained at acceptable levels. At all times, workers’ health and safety will be ensured by safe work practices and by the issue and enforced wearing of safety equipment.

43. The water treatment plant at Yuanzhong will produce waste sludge, estimated at 350 m$^3$/day, after dewatering. The sludge will be stored in a pond with a storage capacity of 260,000 m$^3$. The waste sludge produced by the water treatment works is not toxic, and as long as it is contained in the pond, it will not cause any environmental concern. The discharge of the decanted water from the pond to the Min River is considered to be environmentally acceptable. Water treatment plant chemicals will be properly stored, with emphasis on containment of any leaks.

44. The cost of mitigating the various environmental impacts of FSWST is estimated to be $0.59 million equivalent. This cost does not include the various water treatment plant sludge dewatering and disposal facilities included under the Project.

2. Biological Environment

45. Adverse impacts on flora or fauna at the Project sites will be minimal and short term.

3. Socioeconomic Environment

46. The provision of additional good quality raw water for Fuzhou will improve the general living environment for its residents. The benefits of a good quality raw water will be realized in less treatment quality risk compared with the alternative: increased use of the more polluted water from the north branch of the Min River. There will be greater security for the water supply of Fuzhou by the use of a second water source.

47. The impact associated with the resettlement of people currently living at the Yuanzhong water treatment plant site will be mitigated through compensation packages, as detailed in the Summary Resettlement Action Plan.

48. The Ao River currently provides water for Lianjian County, irrigation for agriculture, water to villages for drinking, to fish farms, animal farms, and industries. Before the construction of the Shanzai dam the dry season flow in the Ao River at the water works at downstream Lianjian County has fallen so low (to 8.5m$^3$/sec) that it was necessary to limit the
water intake rate to the water works. At this point, the river is close to the sea, and there are fears of saline intrusion if the river flows drop too low. Therefore, a minimum environmental flow for the Ao River has been set by the Environment Protection Bureau at 9.36 m$^3$/sec (lowest 10-day average). The expected dry season release from the proposed Shanzai dam is estimated at 85 m$^3$/sec, which, even with the Project, will maintain a minimum flow of 68 m$^3$/sec at Lianjian County.

49. The Ao River component necessitates the acquisition and borrowing of land from small and scattered sites on urbanizing fringe areas of Fuzhou City. Approximately 158 mu (11 ha) of land will be acquired for the water treatment plant impacting about 293 persons, 53 persons will require relocation, while 240 with agricultural status will be offered urban resident status. The Ao River subproject has a budget of $5.6 million equivalent to relocate the residents and compensate the affected land users. The resettlement strategy is twofold. First, demolished housing will be replaced with new housing. Second, the Project will help those people losing agricultural land, fish ponds, and other income-generating assets to restore their livelihoods. Some of these people will be transferred to nonagricultural status and provided with training and assistance in finding jobs, based on the opportunities presented by the rapid development of the local economy.

50. Laws and regulations of the State, provincial, and local governments determine policies and entitlements for the Resettlement Plan. The PRC Land Administration Law of 1988 stipulates the conditions under which land is acquired for public interest projects and sets the compensation standards for land acquisition and compensation. The Fujian Provincial People’s Congress formulated specific measures to implement this law in a 1994 document that sets out the conditions for transfer of agricultural workers to become nonagricultural workers. Surplus labor from land acquisition for construction should be re-employed through the development of agricultural by-product production and setting up of township and village enterprises.

51. The State Council Document 1990 No. 28 Notice of Improving Employment Work and the Fujian Provincial Government Document 1991 No. 5 for implementing this in Fujian entrust the employment service department with finding employment for people, giving priority to local residents. The FMG issued regulations governing urban house relocation in 1991 based on the State Council’s Regulations of Management of Urban House Relocation (1991), specifying that replacement housing, of at least equal floor space, is to be arranged before relocation begins.

B. Yang Li Wastewater Treatment Plant

1. Physical Environment

52. Some increases in the turbidity of stormwater discharges from the site during the construction period may be expected to occur. However, they will be controlled and discharged to Guang Min Harbor through settling ponds built for that purpose. No impacts are anticipated on the Min River.

53. The site will be stripped of the topsoil, which is humus rich and unsuitable for general fill on-site. This soil will be transported off-site for use in other agricultural areas. Failing reuse, the material will be stored at the landfill site. A total volume of approximately 260,000 m$^3$ has been estimated. No adverse impacts are anticipated with the disposal. Excavation impacts can be limited by noise control on equipment, and the noise level is not expected to exceed that of other excavation equipment commonly used in Fuzhou.

54. In order to bring the site to the design elevation, approximately 500,000 m$^3$ of fill will be required. The fill will be sand and spoil from tunnel construction from associated
components. The fill will be imported to the site progressively, a process that will increase traffic density over the filling period. The impact of dust should be minimized by the application of simple controls such as water spraying, which is a normal part of compaction quality control to ensure that the fill was at its optimum compaction moisture content.

55. Noise will result from construction traffic and compaction equipment, but noise and its impacts can be mitigated by proper construction techniques, operation within reasonable hours, and the use of well-maintained equipment.

56. Permanent access roads will be developed for plant access and for use during construction. The roads will generally follow existing rights of way to Yang Li. The main impacts will be from drainage, erosion during construction and before sealing of road surfaces, construction noise, and aesthetic impairment. These will be short-term impacts and will be mitigated by proper construction techniques and careful design.

57. The provision of sewage collection and treatment will improve the present water quality in the harbor and in the streams due to sewerage of the city. The Project’s positive impact on the Min River will be significant, by improvement in its downstream water quality.

58. The proposed process will produce a reasonably stabilized sludge, which will be disposed to landfill after dewatering. The generation of odors during sludge treatment and disposal will be mitigated by the addition of lime as a conditioning agent and the use of a centrifuge (an enclosed machine) to dewater the sludge. Dewatering and lime conditioning will significantly reduce the volume of sludge cake requiring disposal. Disposal at the existing landfill at Hong Miao Shan will not result in additional environmental impacts, as the landfill has a leachate collection and treatment facility. Potential adverse impacts will be mitigated by the use of enclosed sludge trucks. The stockpiling of sludge at the treatment plant site will be minimized to avoid adverse impacts from odor, flies, and rodents. Stormwater drainage from the stockpile area will be isolated, separately collected, and pumped back to the head of the plant for treatment with the incoming sewage.

59. The cost of mitigating the various environmental impacts is estimated at $0.69 million, exclusive of the sludge management costs already included in the treatment plant.

2. Biological Environment

60. The construction of the YLWWTP will not affect any endangered or threatened species of vegetation, animal, or bird. The site is currently used for farming purposes. The surrounding area is developed, and the railway line runs along the eastern plant boundary, so construction traffic and activities will pose no additional adverse impact on any native flora and fauna that may live in the wider area. The site is comparatively remote from human residence.

61. The cost of the various environmental mitigation measures is estimated at $6.95 million equivalent.

3. Socioeconomic Environment

62. There will be significant positive environmental impacts for Fuzhou and its urban environment generated by the provision of sewage collection and treatment. These benefits will directly and indirectly improve the quality of life of the urban residents and the environment of the streams and, ultimately, the Min River by the collection and treatment of the raw wastewater, which currently is discharged untreated over a wide area.

63. Direct impacts of the subproject are limited to the loss of farm land, fish farms, farm outbuildings, an electroplating business, some old storage warehouse, and a few houses
scattered on the southern and western boundary. A total of 221 persons will be affected by this Project, of which 111 will require relocation to other agricultural areas, and 110 will be given urban resident status.

64. Compensation for land acquisition and resettlement for construction of the YLWWTP has been included in the Project cost estimates, in accordance with the relevant national laws and regulations and local government land acquisition and resettlement stipulations. The total cost is estimated to be $1.4 million for land acquisition and compensation, and $6.6 million for resettlement, compensation, and related costs. The conditions and guidelines for resettlement are similar to those for the Ao River subproject. No cultural or historical relics have been reported at the site.

C. Min River Water Diversion and Treatment

1. Physical Environment

65. The construction of the water transfer tunnels will involve excavation of soil, drilling and blasting of rock, removal and storage of spoil in temporary dump areas, disposing of water pumped out from the tunnels, and transporting of materials into and out of the Project sites or adits. There will also be temporary living quarters for workers on Project sites. The impacts of all these activities and operations will be mitigated to various degrees depending on site conditions. The estimated total volume of surplus spoil is approximately 770,000 m$^3$. The major portion of the spoil will be used for backfill, access roads, and other building sites, with any remaining volumes being stored in an appropriate manner. For most sites, noise will have little impact on the residents in the site area. Workers on the Project sites will wear protective gear.¹

66. Currently there is no treatment of wastewater in Fuqing County and sewage is discharged untreated to local rivers. Industries have on-site treatment for their industrial effluent before discharge to the environment. The increase in water supply resulting from the Project will raise wastewater volumes. Industrial wastewater will be treated to meet the discharge requirements, as all new factories are required to install treatment plants. A master plan for proposed wastewater treatment plants in the various development districts of Fuqing has been prepared and is expected to be implemented in the Tenth Five-year Plan (2001-2005).

67. The cost of the various environmental mitigation measures is estimated at $1.09 million equivalent, excluding of the costs of filter waste treatment and sludge dewatering at the water treatment plants.

2. Biological Environment

68. The subproject will not have a significant impact on flora or fauna, as the construction activities all take place in existing agricultural or urban areas.

69. All the subproject sites will be revegetated with native species as soon as the construction activities are complete. For the intake work site, the area will be landscaped when the construction work is completed.

¹ The construction of the main water transfer tunnel is almost complete and is outside the scope of the Project.
3. **Socioeconomic Environment**

70. The provision of additional water for Fuqing and the surrounding area will improve the general living environment by reducing water shortages. It will also permit increased economic development in the area, which is currently limited by a lack of water. There will be greater security for the water supply of Fuqing County by the use of a second water source.

71. The impacts of the extraction of water from the south branch of the Min River will be negligible because of the large flow capacity of the Min River and the relatively small amount being extracted. The Project will have no impact on the fishery, transport, or flushing capacity of the river.

72. Permanent land requirements for the Min River subproject will be about 150 mu (10 ha), and 900 mu (60 ha) of land will be borrowed primarily for the intake area, pipeline rights of way, and the water treatment plant sites. Resettlement is planned as relocation within the same villages, minimizing problems of social dislocation. The total cost of land acquisition and resettlement is estimated at $1.8 million equivalent. The resettlement will be managed by the Min River Water Diversion and Treatment Company and Fuqing Municipal Resettlement Office following applicable laws and regulations.

V. **ALTERNATIVES**

A. **Fuzhou Second Water Source and Treatment**

73. As an alternative to the transfer of water from the Ao River to Fuzhou, expanded use of the Min River water was considered. However, the costs of pumping from the Min River made the FSWST, which is by gravity flow, the more economically viable option; it also provides significant benefits in the form of much better raw water quality and a second raw water source, it provides security of supply in the event that the Min River should suffer an extreme pollution event because of conditions upstream, outside the authority of Fuzhou City.

B. **Yang Li Wastewater Treatment Plant**

74. Failure to act will result in increased pollutant discharge to the Min River. The Min River downstream from Fuzhou urban center is used for water supply by other towns, villages, and irrigation districts. The Min River subproject for Fuqing could also be affected, as the increasing pollution without the treatment plant could be transported to the south branch of the Min River by tidal movement.

75. The location of the wastewater treatment plant at Yang Li is detailed by the topography of the service area and the availability of marginal land. Yang Li is a seasonally flooded area, and because it is at the lowest point of the service area, there will be less need for pumping stations. Computer model studies indicated that the most environmentally beneficial point of discharge for the treated effluent was into Guang Min Harbor, where it would be held behind existing flood gates for release on each ebb tide, thereby ensuring large dilution and minimal impact on water quality. The Yang Li location is therefore considered optimal, with minimum environmental impact.

C. **Min River Water Diversion and Treatment**

76. The Fujian Provincial Research Institute of Water Conservancy and Hydropower Investigation and Design investigated the availability of viable alternative sources of water
supply for Fuqing. The resulting report concluded that no viable alternatives to the Min River Diversion Scheme were available.

VI. BENEFIT-COST ANALYSIS

A. Project Costs

The estimated cost of the Project is $263 million equivalent as detailed in Table 1.

Table 1: Summary of Project Costs ($ million)

<table>
<thead>
<tr>
<th>Component</th>
<th>Foreign Exchange</th>
<th>Local Currency</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Physical Infrastructure and Equipment</td>
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<tr>
<td>1. Civil Works</td>
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<tr>
<td>2. Equipment and Materials</td>
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<td>44</td>
</tr>
<tr>
<td>3. Vehicle</td>
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<td>-</td>
<td>1</td>
</tr>
<tr>
<td>4. Land</td>
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<td>6</td>
<td>6</td>
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<tr>
<td>5. Resettlement</td>
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<td>10</td>
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<tr>
<td><strong>Subtotal A</strong></td>
<td><strong>107</strong></td>
<td><strong>92</strong></td>
<td><strong>199</strong></td>
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<td>B. Project Management and Consulting Services</td>
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<tr>
<td>1. Project Management</td>
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<td>3</td>
</tr>
<tr>
<td>2. Survey and Design</td>
<td>1</td>
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<td>3. Consulting and Training</td>
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<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Subtotal B</strong></td>
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<tr>
<td><strong>Total Base Costs (A+B)</strong></td>
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<td><strong>101</strong></td>
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<td>C. Contingencies</td>
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<tr>
<td>1. Physical</td>
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<tr>
<td>2. Price</td>
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<td><strong>Subtotal C</strong></td>
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<td>D. Other Charges</td>
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</tr>
<tr>
<td>2. Interest During Construction</td>
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<td>2</td>
<td>15</td>
</tr>
<tr>
<td><strong>Subtotal D</strong></td>
<td><strong>16</strong></td>
<td><strong>2</strong></td>
<td><strong>18</strong></td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>140</strong></td>
<td><strong>123</strong></td>
<td><strong>263</strong></td>
</tr>
</tbody>
</table>

*Inclusive of taxes and duties amounting to $12.3 million equivalent.

b Includes 5 percent on equipment and 10 percent on civil works.

c Seven percent per annum until 2000 and 6 percent thereafter on local costs; 2.4 percent per annum on foreign exchange.

B. Financial Analysis

The financial internal rate of return (FIRR) for the Project is 7.1 percent, which is well above the weighted average cost of capital of 4.9 percent. Similarly, the FIRRs and corresponding weighted average cost of capital for each of the three subprojects are (i) FSWST - 7.8 percent and 4.5 percent; (ii) YLWWTP - 6.4 percent and 4.8 percent; and (iii) MRWDT - 7.2 percent and 5.3 percent.
The average incremental cost (AIC) of the water was calculated based on the opportunity cost of equity in the PRC, the present value of incremental investments, and operation and maintenance expenditures in water supply divided by the present value of additional water sales arising from the Project investments. The financial AIC was assessed to approximate the long-run marginal cost of water production. The AICs of the FSWST, YLWWTP, and MRWDT are ¥0.8/m³, ¥0.9/m³, and ¥1.2/m³, respectively. These values of AIC along with the actual Project cost recovery requirements were used to establish the new water and wastewater tariffs. Tariffs have been set taking into account Project sustainability, consumer demand, and affordability.

C. Benefits

The major benefits of the Project include (i) additional water supply of 300,000 m³/day for the 1.5 million permanent and “floating” residents of Fuzhou City and 175,000 m³/day for the 1.1 million residents of Fuqing County; (ii) wastewater treatment capacity of 200,000 m³/day for Fuzhou, increasing the city’s wastewater treatment capacity by 50 percent; and (iii) irrigation water. The economic analysis was based upon these benefits. Enhanced water resources management resulting from the Project will benefit consumers through the provision of clean water supply. Benefits are valued using cost savings in the production of treated water by the water supply enterprises from the incremental water produced by the Project.

An incremental increase in the production of raw water is expected to raise consumption of drinking water and output of wastewater. The benefits from improved water supply and quality will accrue to households and industrial/commercial users. The gross economic benefit from the water supply components is made up of two parts: (i) benefits deriving from resource cost savings due to reduction of water consumed from alternate supplies because of switching to the water supply system resulting from the Project; and (ii) the willingness to pay, estimated on the basis of average demand price, for incremental water consumed. The incremental economic benefits of the wastewater component are derived from the household willingness to pay and from the reduction in the cost of water supply treatment for Fuzhou. The data on the willingness to pay were obtained through household surveys conducted in Fuzhou during preparation of the Project. On average households are willing to contribute ¥10 per month in Fuzhou for the control and clean up of wastewater discharges in their surroundings. This is equivalent to about ¥0.74/m³. This willingness-to-pay figure is about five times the present wastewater plus drainage tariffs in Fuzhou.

D. Economic Internal Rate of Return

The total Project costs were deducted from the incremental benefits of the Project, both expressed in economic terms. The economic internal rate of return (EIRR) for the Project is estimated at 17.9 percent. The EIRR for the FSWST, YLWWTP and MRWDT subprojects are 19.7, 16.5, and 17.9 percent, respectively. As is often the case with water supply infrastructure, individual demand for water services is below the level considered optimal from the society's point of view, due to the existence of considerable positive externalities. Given the large amount of unquantified environmental benefits and other related social improvements associated with the Project, the EIRR is considered a conservative estimate, and the use of society’s resources on water supply in the Project area is fully justified.

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1 The floating population represents residents who work in the city but do not have residency status. There are an estimated 300,000 persons in this category in Fuzhou City.
E. Unquantified Benefits

83. A number of benefits due to the Project were not included in the calculation of the EIRR. The most important are listed below.

(i) **Increase in property value.** The benefits of improved water supply and the consequent improvement in the environment may be reflected in the amount people are willing to pay for property, either in terms of rent or the lease price.

(ii) **Recreation.** No information was available on how water quality improvements or a reservoir might affect recreational activities in the Project areas. If water quality is improved, there may be two important impacts: (a) the value of a recreational outing to existing users may increase, and (b) recreation levels (number of user days) may increase.

(iii) **Health Impacts.** Health improvement is one of the major benefits associated with water supply. The removal of pathogens or toxic pollutants from waters to which humans are exposed, mainly through ingestion, improves human health. Typical impacts on health from pathogen-laden waters include morbidity and infant mortality from diarrhea and cholera. Mortality and morbidity as a result of cancer and or other chronic diseases can also stem from drinking water contaminated with such substances as lead and mercury.

(iv) **Environmental impact.** Reduced pollution in local receiving streams and in the Min River is one of the major benefits associated with the YLWWTP subproject.

VII. INSTITUTIONAL REQUIREMENTS, RESETTLEMENT AND ENVIRONMENTAL MONITORING PROGRAM

84. The Project Management Office and the Municipal Resettlement Office are responsible for monitoring and evaluating resettlement, and affected persons can approach them with grievances. By law, the Municipal People’s Congress and the People’s Political Consultation Conference are entrusted to supervise and ensure that each organization follows the policies and regulations of resettlement. Civil mediation committees and groups have been formed in the village or neighborhood, and mass mail appeal offices have been set up at various municipal and district levels of government to hear grievances and handle appeals. The Administrative Procedural Law, Article 37, also can be invoked by claimants.

A. Fuzhou Second Water Source and Treatment

85. During the construction period, two environmental engineers will be employed to supervise and enforce the implementation of the recommended environmental mitigation measures at the various Project sites.

86. When the construction phase is over, one of the two engineers will be retained to continue monitoring the environment of the affected areas. Engineers will (i) inspect each of the spoil storage sites once every three months; (ii) obtain water quality and water flow data from the management of the water treatment works of Lianjian County; (iii) obtain flow data of the Ao River at Lianjian County from the Fujian Provincial Hydrology Department to monitor the effect of water diversion from the Tang Ban Reservoir on the quality and quantity of downstream water; (iv) obtain water quality and intake water volume data from the Yuanzhong water treatment plant; (v) visit resettled families twice a year to monitor the effects of resettlement; (vi) evaluate all the information collected and compile it into a report for submission to the relevant authorities, such as FEPB, for their information and necessary action; and (viii) obtain water
quality data on Shanzai Reservoir and Tang Ban Dam from the FEPB. The water treatment plant at Yuanzhong will have a chemical and biological laboratory that will be staffed with qualified professionals and necessary equipment to conduct routine analysis of water samples. If required, additional water sample analyses can be carried out by other laboratories on a contract basis.

B. Yang Li Wastewater Treatment Plant

87. During the construction period, an environmental engineer will supervise the implementation of the mitigation and monitoring measures discussed above. The program will include monitoring of wastewater effluent, water quality in Guang Min Harbor and the Min River, air and odor, as well as other plant parameters. The program will also be a source of information for improving the public’s awareness of the benefits of wastewater treatment and of related environmental issues.

C. Min River Water Diversion and Treatment

88. During the construction period, environmental engineers will be employed by the Project Management Office to supervise and monitor the implementation of the recommended mitigation measures in the various project sites. They will evaluate the analytical data and take action to solve environmental problems detected by them or reported to them. When the construction phase is over, two of the engineers will be retained to continue monitoring the environment of the affected areas. The environmental monitoring program will be the same as for the Ao River component. In addition, an operational monitoring program and physical system will be implemented as part of the Project to measure the water quality, particularly salinity, at the intake. During periods of high tide and low river flow, the intake pumps may have to be shut down.

VIII. PUBLIC PARTICIPATION

89. Public meetings at the village level will explain the policies and guidelines that will apply in implementing the resettlement strategy. A land acquisition and resettlement certificate will be issued to each affected household. Personnel responsible for resettlement will conduct regular follow-up visits to the affected households, to assist in resolving any problems for at least six months after relocation.

A. Fuzhou Second Water Source and Treatment

90. Surveys and questionnaires were carried out to gauge public opinions and to seek residents’ views and suggestions regarding the Project. Most people surveyed supported the Project, and the majority considered that the Project would be good for socioeconomic development and would also improve the quality of life. The EIA reported that preliminary opinion surveys of the households directly impacted by the Project indicated general support for the Project and satisfaction with the proposed compensation and relocation arrangements. Further planning and preparation is in progress, in consultation with the affected parties.

B. Yang Li Wastewater Treatment Plant

91. The implementation of the Project will involve resettlement of residents currently living on the plant site. The new plant will also have an impact on surrounding townships and businesses. Of 50 questionnaires sent to social organizations representing local residents in the surrounding areas, 30 were returned with answers. The EIA records that the majority of
responses were in favor of the Project. The main concerns expressed by local governments and social bodies were in regard to improved water quality, odors, aesthetic impacts, and potential high operational cost. Sixty questionnaires were sent to the affected residents at the Yang Li site, and 53 responses were received. The majority of responses indicated agreement with the Project and a willingness to move to allow it to proceed, as long as proper compensation was made.

C. Min River Water Diversion and Treatment

92. A number of surveys were conducted to gauge public opinions and to seek views and suggestions regarding the Project. The findings indicated most people were aware of the Project through newspaper articles, radio, and television. Most people surveyed supported the Project, and the majority considered that the Project would be good for industrial and agricultural development and would also improve the quality of life.

93. The major concerns of respondents related to dust and noise problems associated with the construction phase of the Project. Preliminary opinion surveys of the few households to be directly impacted by the Project indicated general support for the Project and satisfaction with the proposed compensation and relocation arrangements. Further planning and preparation is in progress, in consultation with the affected parties.

IX. CONCLUSIONS

94. The Project will reliably meet the rapidly increasing water supply demands of Fuzhou City, Fuqing County, and the periurban areas that will be serviced by the new water supply facilities. The Project will directly benefit 2.4 million people and indirectly benefit all of the almost six million residents in Fuzhou Municipality. It will encourage economic development through the availability of a good quality water supply. In addition, the Project will help reduce the discharge of untreated wastewater to the Min River through construction of the YLWWTP. The associated sewage collection system will improve the urban environment in Fuzhou City and help reduce the threat of untreated sewage to public health.

95. The Project's impact on the physical environment will be minimal, mostly short-term construction-related impacts, which will be mitigated. The incremental wastewater associated with the increased water supply will be collected and treated through the YLWWTP subproject and further investments in sewerage through ongoing urban renewal projects, and the future expansion of the Plant, and construction of other new wastewater treatment plants in both cities during the Tenth and Eleventh Five-year plans.

96. The Project's impact on residents living on Project sites will be mitigated through full compensation and relocation as provided for under the Project. None of the resettlers have to leave their families or communities and will benefit from the Project in terms of more modern housing and retraining, thereby improving their economic prospects.

97. Given that the environmental impacts, including resettlement, will be fully addressed under the Project, and considering the Project's strong economic justification, the Project satisfactorily meets environmental protection requirements provided that the mitigation, monitoring, and reporting programs are carried out.