People's Republic of China

FY2018 Ex-Post Evaluation of Japanese ODA Loan
"Anhui Water Environmental Improvement Project"

External Evaluator: Hiromi Suzuki S., IC Net Limited

0. Summary

This project was implemented in Bengbu City, Anhui Province, People's Republic of China (urban area, Huaiyuan County, Wuhe County, and Guzhen County), in order to reduce the amount of water pollutants discharged into the Huai River and ensure the stable supply of safe water by developing water supply and sewerage facilities, thereby contributing to improvement of the living environment for the residents in the said area. The project is sufficiently consistent with the development plans, environmental protection plans, and development needs of both China and Bengbu City at the time of the appraisal and the ex-post evaluation, as well as Japan's ODA policy toward China at the time of the appraisal; therefore, its relevance is high. Because the outputs were partly reduced, the project cost remained within the plan although the project was affected by soaring prices. The efficiency of the project is fair because the project period was much longer than initially planned mainly owing to the change of project sites and the various bidding procedures required. The outcome expected as the effect of the project was to reduce the amount of water pollutants discharged into the Huai River and to ensure the stable supply of safe water. The effectiveness of the project is high because both its sewage treatment and water purification plants have achieved or have largely achieved the operation and effect indicators set at the time of the appraisal. It also became clear through group interviews with beneficiaries that the development of the water supply and sewerage facilities contributed to improving the living environment for the residents, which is the expected impact of the project. In addition, the project significantly helped improve two indicators: the percentage of people who can use the improved source of drinking water continuously and the percentage of those who can use the improved sanitation facilities. Furthermore, the water quality of the Huai River is continuing to improve. Land acquisition was carried out appropriately according to the relevant internal procedures in China, and no resettlement of residents occurred. During the construction work and at the time of the ex-post evaluation, impacts on the natural environment were monitored appropriately with environmental measures taken, and no negative impact was confirmed. Based on the foregoing, the effectiveness and impacts of the project is high, because its effect was confirmed as initially planned. No major problems have been observed in the institutional, organizational, technical, financial aspects and current status of the operation and maintenance system of the ten companies that were responsible for the operation of the project. Therefore, sustainability of the project effects is high.

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

1. Project Description

Project Location

Reaction tank at the Bengbu Sewage Treatment Plant No. 2, which was developed in this project

1.1 Background[1]

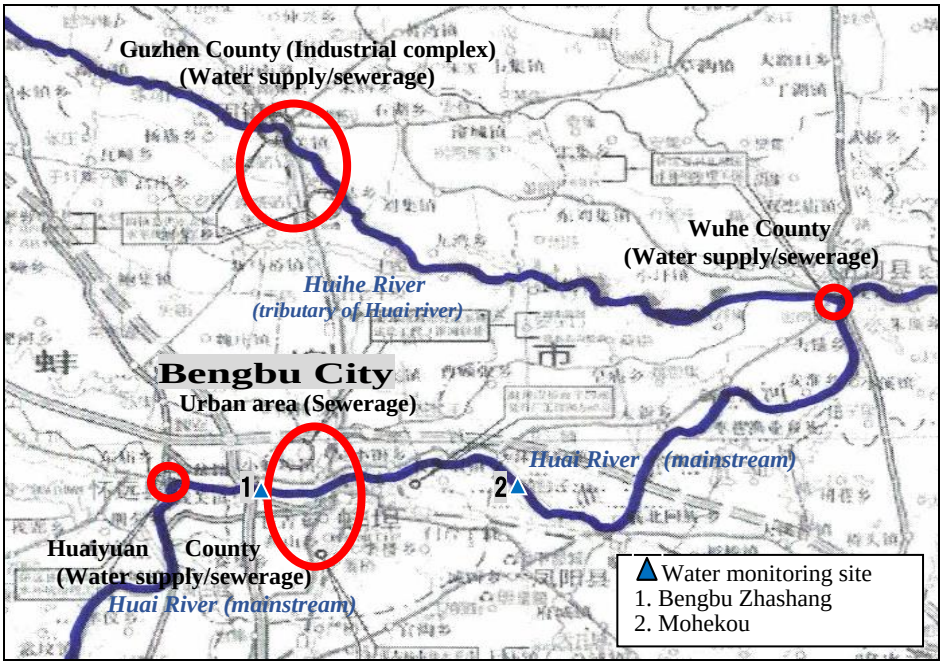
In 2005 the sewage treatment rate in the urban areas of China remained at 48% and problems such as the contamination of river water were becoming increasingly serious. To improve water contamination, the Chinese government announced the goal of achieving a sewage treatment rate of 70% in major cities nationwidely by 2010 by promoting the development of sewage treatment facilities. With regard to water supply systems, a certain level of penetration rate, as much as 89%, had been achieved in urban areas by 2004. However, a number of cities were faced with regional water shortages and problems arising from the taking and supply of water from sources with poor water quality. Under these circumstances, the Chinese government designated major river protection areas and announced the goal of improving water quality mainly by preventing water contamination in these areas, which were also important as sources of drinking water. In particular, in 2004 the government issued a notification to step up efforts for measures to prevent water contamination in the river basin of the Huai River, where Bengbu City, the project site, is located. The goal of the notification was to proceed with the development of water supply and sewage infrastructure, thus raising the level of water quality in the main stream of the river and sources of urban drinking water by the end of 2010 to a level that would be applicable to an area for protection of general fish or a swimming area. Although the Bengbu municipal government had previously moved forward with the construction of sewage treatment plants, it had failed to catch up with the growing amount of sewage as the economy developed rapidly. Given the future growth in sewage, there was concern that the Huai River would see its water contaminated even more seriously. On the other hand, the water supply penetration rate was low and underground water of poor quality was used in many areas. If further growth in demand for tap water due to economic development was taken into consideration, it was indispensable to develop water supply facilities using river water of good quality as the source of water supply to improve the living environment for the residents. Taking this situation into account, the people's government of Bengbu City requested a Japanese ODA loan.[2]

1.2 Project Outline

The objective of this project is to reduce the amount of water pollutants discharged into the Huai River and ensure the stable supply of safe water by developing water supply and sewerage facilities in Bengbu City, Anhui Province, People's Republic of China (urban area, Huaiyuan County, Wuhe County, and Guzhen County), thereby contributing to improvement of the living environment for the residents in this area.

[1] This section is based on the ex-ante evaluation.

[2] The World Bank has also provided assistance to improve the water quality of the Huai River. In particular the Huai River Pollution Control Project (2001–2009) and the Bengbu Integrated Environment Improvement Project (2007–2015) developed sewerage infrastructure (e.g., sewage treatment plants, sewer and rainwater pipe networks, and pump stations). These World Bank projects and this project complemented each other.



Source: Materials provided by the executing agency

Figure 1: Map of Project Sites in Bengbu City
(Urban Area, Huaiyuan County, Wuhe County, and Guzhen County)

Loan Approved Amount/ Distributed Amount	8,400 million yen/7,725 million yen	
Exchange of Notes Date / Loan Agreement Signing Date	March 2007/March 2007	
Terms and Conditions	Interest rate	Sewerage project/training: 0.75% Water supply project: 1.5%
	Repayment Period (Grace Period)	Sewerage project/training: 40 years Water supply project: 30 years (10 years)
	Conditions for Procurement	General untied
Borrower/Executing agency	People's Republic of China/People's Government of Bengbu City	
Project Completion	May 2016	
Target Area	Bengbu City, Anhui Province	
Main Contractor (Over 1 billion yen)	Beijing Zhonghui United Environmental Engineering Co., Ltd. (People's Republic of China)	
Related Studies (Feasibility Studies, etc.)	F/S: Southwest Municipal Engineering Design & Research Institute of China; prepared in 2007	
Related Projects	World Bank: Huai River Pollution Control Project (2001–2009) and the Bengbu Integrated Environment Improvement Project (2007–2015)	

2. Outline of the Evaluation Study

2.1 External Evaluator

Hiromi Suzuki S. (IC Net Limited)

2.2 Duration of the Evaluation Study

This ex-post evaluation study was conducted with the following schedule.
Duration of the Study: February 2019 to January 2020
Duration of the Field Study: April 8–20 and August 12–17, 2019

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

3.1 Relevance (Rating:③[4])

3.1.1. Consistency with the Development Plan

In its *11th Five-Year Plan (2006–2010)*, China's national development plan at the time of the appraisal, the Chinese government set the goal of continuing to step up its environmental improvement efforts because it had failed to achieve the urban environmental development goals which it had started to work on in its *10th Five-Year Plan*. It announced the goal of achieving a 70% sewage treatment rate in urban areas, and in addition to infrastructure development, it pushed forward with the introduction of market principles, including the establishment of a system to collect pollutant discharge fees, the implementation of sewerage charge reforms, and the introduction of private capital in the environmental industry. On the other hand, it announced the goal of achieving objectives such as enhancing water supply capabilities, maintaining safe drinking water, and saving water resources by reducing water leakage rates through the construction of new water supply facilities and renewal of deteriorating equipment in urban areas. Local areas also stepped up their efforts to secure capital investment funds by reforming water charges and collecting rates more effectively, by encouraging users to save water, and by strengthening countermeasures against pollution. In particular, in 2004 the national government issued a notification to step up efforts for measures to prevent water contamination in the river basin of the Huai River, the river from which water was taken and treated water was discharged into, which also is the source of water to be improved by this project. The major goal of the notification was to raise the quality of the water in the main stream of the river and the source of urban drinking water to the level of Category III in the Environmental Quality Standards for Surface Water (GB3838-2002)[5] by the end of 2010 by further promoting the construction of sewage treatment facilities, pipes and drains. Following these plans and the notification, the people's government of Bengbu City set the *11th Five-Year Plan for Environmental Protection in Bengbu City (2006–2010)* and announced that it would prioritize developing sewerage facilities and improving the quality of water at the drinking water source.

In its *13th Five-Year Plan (2016–2020)*, China's national development plan at the time of the ex-post evaluation, the government announced seven major goals, including maintaining medium- to high-speed economic growth. The two goals related to this project were to improve the overall quality of the ecological environment and to raise the level and quality of national life universally. The former emphasized reductions in water consumption and the latter stressed measures such as restoration of public services. The sewerage-related goal was

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

[4] ③ High, ② Fair, ① Low

[5] The categories of Environmental Quality Standards for Surface Water (GB3838-2002) are as follows: Category I mainly covers water at the source of water supply and national nature reserves; Category II first-class reserves for intensive surface sources of household drinking water, habitats for rare aquatic life, spawning grounds for fish and crustaceans, feeding grounds for fry, etc.; Category III second-class reserves for intensive surface sources of household drinking water, wintering grounds for fish and crustaceans, migratory routes, fishing waters such as nurseries for marine products, and swimming areas; Category IV waters for general industrial water and entertainment waters where human bodies do not come into direct contact with the water; and Category V waters for agricultural water and for general landscaping.

to improve the quality of 70% of all surface water to Category III level of the Environmental Quality Standards for Surface Water by aiming to achieve a sewage treatment rate of 95% in urban areas by the end of 2020. In addition the government strives to raise the rate of water reuse through the system to collect pollutant discharge fees, to reform the sewerage rates, and to invest in the development of sewage treatment technology. The goal related to water service was to ensure the efficient and effective use of water resources and in particular the government steps up its comprehensive water-resource management efforts with a focus on water saving. In urban areas, in addition to improving the deteriorating water pipe networks in particular, it aims to promote development and introduce technology to save water and make further efforts to monitor the use of water by large users, to reform the water charge system, to install water meters, and to collect water charges. Following the national plan, the people's government of Bengbu City formulated the *13th Five-Year Plan for Environmental Protection in Bengbu City (2016–2020)*, whose aim is to promote urban development while also taking nature protection into account. The goals for water service and sewerage as well as the aquatic environment are to: (1) protect water resources and make all-out efforts to save water, (2) prevent water pollution, ensure strict compliance with drainage standards and thorough drainage management, and (3) step up the construction of water supply and sewerage facilities as well as water pipe networks and operate them in a stable manner. The *Five-Year Plan* stipulates that the municipal government shall aim to achieve a sewage treatment rate of 95% in urban areas by 2020 and attain Grade I-A as described in the Discharge Standard of Pollutants for Municipal Wastewater Treatment Plants (GB18918-2002)[6] for treated sewage.[7]

As described above, at the time of both planning and the ex-post evaluation, China's national development policy placed emphasis on stepping up its water supply and sewerage infrastructure development and protecting water resources, more specifically, reducing the amount of major pollutants discharged and economizing on water. In addition, based on the national development policy, the people's government of Bengbu City worked out an environmental protection policy at the time of both planning and the ex-post evaluation, and similarly it announced the goal of improving the living environment through water supply and sewerage infrastructure development and maintaining safe water resources. This project was highly consistent with the development policy of both governments because it conformed to these goals.

3.1.2 Consistency with the Development Needs

At the time of the appraisal, Bengbu City saw demand for water supply grow because of remarkable population growth along with the rapid progress of industrialization and urbanization, and in particular water pollution in the Huai River, both the source of water supply and the recipient of sewage, was becoming increasingly serious. At the time of the ex-post evaluation, also, further population growth as well as industrialization and

[6] Based on the environmental functions of surface waters that flow into urban sewage treatment plants, environmental protection goals, and sewage treatment plants' treatment technology, the national Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002) stipulate twelve basic management items and 22 optional management items for the average daily maximum permissible concentrations of discharged pollutants. The pollutant standards are divided into first-, second-, and third-grade standards with the first-grade standards subdivided into A and B standards. The grade I-A standards are applied if sewage treated at urban sewage treatment plants is discharged into any of the closed or half-closed waters designated by the national and provincial governments, including priority waters, lakes and dams, or reused. In the case of functional waters in Category III of the Environmental Quality Standards for Surface Water (GB3838-2002), the Grade I-B standards are applied.
(Source) Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002).

[7] According to the executing agency, at the time of the ex-post evaluation, there was no specific policy for countermeasures against water pollution in the Huai, and the Plan for Prevention of Water Pollution in the River Basin of the Huai River (2011-2015) was formulated to replace the notification applicable at the time of the appraisal. A total of 33 projects, including the development of water supply and sewerage infrastructure, were carried out in accordance with the plan, and in 2015, this allowed the local government to achieve Category II and III of the Environmental Quality Standards for Surface Water (GB3838-2002) for the quality of part of the water in the main stream of the Huai River and that in its tributaries, respectively.

urbanization were progressing, making it necessary to continue working on infrastructure development. The development needs of each sector were as follows:

A) Sewerage: At the time of the appraisal, the population of Bengbu City was about 2.2 million. In the river basin of the Huai River where the city is located, the sewerage penetration rate was low at about 30%, although the construction of sewage treatment plants had been under way in the previous years. Also, the amount of sewage generated was 350,000 m^3/day, already exceeding the combined treatment capacity of three sewage treatment plants in operation, which stood at 240,000 m^3/day. This indicated that the plants could not catch up with the growing amount of sewage generated as the economy developed rapidly. If future growth was taken into account, it was feared that water pollution in the Huai River would become even more serious and improving the aquatic environment in the river basin was becoming an urgent issue to address. At the time of the ex-post evaluation, the population in the project target area was about 2.6 million. In 2018 thanks to the operation of sewage treatment plants at eight locations (see Table 1), the sewerage penetration rate rose to as high as 98%. Treated sewage was discharged into the main stream or tributaries of the Huai River, but mainly because of the Environmental Protection Bureau introducing a real-time water quality monitoring system, including the application of stricter national sewage discharge standards, all treated sewage achieved Grade I-A as described in the Discharge Standard of Pollutants for Municipal Wastewater Treatment Plants (GB18918-2002). For this reason the quality of water in the Huai River, which stood at Category IV of the Environmental Quality Standards for Surface Water or lower at the time of the appraisal, improved to Category III at the time of the ex-post evaluation. However as urbanization and industrialization were still progressing even at the time of the ex-post evaluation, the amount of sewage generated is expected to grow in the future.

Table 1: Sewage Treatment Plants and Water Purification Plants in Bengbu City and Their Treatment Capacity at the Time of the Ex-Post Evaluation

Area	Name of sewage treatment plant	Treatment capacity (m^3/day)	Name of water purification plant	Treatment capacity (m^3/day)
Urban area	1. Bengbu Sewage Treatment Plant	200,000	1. Bengbu Central Environmental Water Purification Plant	500,000
	2. Bengbu Sewage Treatment Plant No. 2	**200,000**		
	3. Bengbu Sewage Treatment Plant No. 3*	25,000		
	4. Bengbu Sewage Treatment Plant No. 4	25,000		
Huaiyuan County	5. Huaiyuan County Guozhen Sewage Treatment Plant*	30,000	**2. Bengbu Central Environmental Water Service Co., Ltd. Water Purification Plant No. 1**	**37,000**
			3. Bengbu Central Environmental Water Service Co., Ltd. Water Purification Plant No. 2	20,000
Wuhe County	6. Wuhe County Huaqi Water Affairs Co., Ltd.	50,000	4. Wuhe County Jingyuan Water Affairs Co., Ltd. (Capital North)	50,000
			5. Wuhe County Jingyuan Water Affairs Co., Ltd. (Capital South)	40,000
Guzhen Country	**7. Guzhen County Economic Development District Sewage Treatment Plant**	**20,000**	**6. Guzhen County Economic Development District Water Purification Plant**	**20,000**
	8. Guzhen County Capital Sewage Treatment Plant	20,000	7. Guzhen Central Environmental Water Service Co., Ltd.	25,000
Total **(Percentage of the project)**		570,000 **(39%)**	Total **(Percentage of the project)**	692,000 **(8%)**

Source: Materials provided by the executing agency

Note: The underlined sewage treatment and water purification plants in bold letters were developed as part of this project.

* These plants are connected to part of the sewage pipe networks, developed in this project, and used for the treatment.

B) Water supply: At the time of the appraisal, three water purification plants were in operation in Bengbu City but the water service penetration rate was low at about 50% and underground water of poor quality was used in many areas of the city. As it was predicted that demand for water supply would grow as a result of economic development, it was indispensable to develop water supply facilities using rivers with water of good quality as

the source of water supply in order to improve the living environment of the city's residents. At the time of the ex-post evaluation, the number of water purification plants in operation increased to seven (see Table 1) improving the water service penetration rate to as high as 99%. The use of underground water was prohibited and the Huai River, in Category III of the Environmental Quality Standards for Surface Water, was used as a major source of water supply which enabled the local government to maintain safe water resources and supply water in a stable manner. As described above, however, Bengbu City is expected to continue seeing economic growth in the future and as a result, it is predicted that water demand will also rise in the years to come.

As described above, if the expected future economic growth is taken into account, the water supply and sewerage infrastructure developed in this project is indispensable and the project is highly consistent with the development needs of both the country and the city.

3.1.3 Consistency with Japan's ODA Policy

At the time of the appraisal, Japan's assistance policy toward China consisted of the government's *Economic Cooperation Plan for China (2001)* as well as the *Medium-Term Strategy for Overseas Economic Cooperation Operations (2005-2007)* of the Japan International Cooperation Agency (JICA) (former Japan Bank for International Cooperation (JBIC)) and the *FY2006 Country Assistance Strategy*. In the *Economic Cooperation Plan for China (2001)*, the government aimed to emphasize the protection of the environment and ecosystems which had been seriously polluted and destroyed, as well as the improvement of people's lives and social development in inland areas, and cited six priority areas. In particular, with regard to cooperation in coping with environmental and other global issues, it clearly stated that it would support efforts to manage water resources which was highly consistent with this project. The *Medium-Term Strategy for Overseas Economic Cooperation Operations (2005-2007)* stated that JICA would actively contribute to effectively grappling with environmental issues in developing countries, providing support to improve people's lives and solving global and other problems, which was highly consistent with this project. The *FY2006 Country Assistance Strategy* stressed environmental protection and with respect to water supply and sewerage, it strove to improve overall water use efficiency, including infrastructure development and human resources training, which was highly consistent with this project.

3.1.4 Appropriateness of the Project Plan and Approach

At the time of the ex-post evaluation, with respect to project planning and supervision, the two defects specified below were found.

(1) Change of the project scope and deficient project supervision: In 2010 and 2013 the scope of the project was changed and one sewage treatment plant in Huaiyuan County and one water purification plant in Wuhe County, which were both included at the time of the appraisal, were developed as a separate project (for details see "3.2.1 Project Outputs"). The reason for the change was that, because of the faster economic growth, greater population increase and higher rise in the number of corporate and other large users than expected at the time of planning, the people's government of Bengbu City changed the objective of the project to striving for greater resource efficiency. Essentially, if the scope of the project was changed, the executing agency would first need to take measures such as reconsidering the relevance of the project and resetting the targets for project operation and effectiveness indicators, then consult with JICA and obtain its approval. In this project, because the need for intermediate supervision was emphasized as a point to note at the time of planning, it was important to strive for thorough project supervision. However, the executing agency failed to go through the process specified above, partly because there was room for better project supervision at JICA and partly because the executing agency was not familiar with JICA projects. The above-mentioned change of the project scope was judged as relevant, however, because the initial development needs identified at the time of the appraisal were covered by other projects and because it was

confirmed from the outcome of the project at the time of the ex-post evaluation that the impact of the change did not affect the logic related to path that leads to the project goals and impact.[8]

(2) Deficiency in the calculation method for the effectiveness indicator: Plans called for the effectiveness of this project to be evaluated by sub-project based on the degree of goal achievement for the operation/effectiveness indicators[9] included in the ex-ante evaluation. However, the materials available at the time of the appraisal did not show any basis for setting standards and calculation methods for these indicators. In these materials, however, operation/effectiveness indicators and targets were set for the sewage treatment and water purification plants to be developed in the sub-projects. Therefore, these indicators were used for this ex-post evaluation. For Huaiyuan County, where sewage treatment plants were excluded from the project scope and only sewage pipe networks were developed, only those indicators for initially planned sewage treatment plants which were usable were selected. For Wuhe County, where only water and sewage pipe networks were developed, indicators were evaluated using the targets that had been submitted by the people's government of the county based on its feasibility studies (for details see "3.3.1.1 Effectiveness").

What is indicated in Item (1) and (2) above is consistent with the logic of the project as it aimed to achieve the objectives of its plan and bring development effects; therefore it was determined that the relevance of the project was not undermined. It should be said, however, that the project supervision was inadequate. In particular it was clearly stated at the time of the appraisal that the project required intermediate supervision and in both cases, adequate intermediate supervision and monitoring would have led to appropriate project management. Therefore this should be learned as a lesson in the ex-post evaluation.

As described above, at the time of both the appraisal and the ex-post evaluation, the consistency of the project was high because it was in accord with China's national development plan and policy for countermeasures against water pollution in the river basin of the Huai River. It also aligned with goals such as stepping up the water supply and sewerage infrastructure development and protecting water resources which were in both Anhui Province's and Bengbu City's environmental protection plans. In addition as it was in accord with the development needs of Bengbu City at the time of the appraisal and ex-post evaluation as well as Japan's assistance policy toward China at the time of the appraisal, the project was highly relevant. The scope of the project was changed and problems arose with regard to project supervision but these did not undermine the appropriateness of the project plan, approach, etc.

Based on the foregoing, this project has been highly relevant to the country's development plan, environmental protection plans and development needs, as well as Japan's ODA policy. Therefore its relevance is high.

[8] The sub-projects excluded from the scope of this project and the outputs of the project after the change of its scope complemented each other. Therefore to ensure that the project brought satisfactory effects as expected at the time of the appraisal, it was indispensable that the portion of the project which was excluded from its scope should be carried out without fail. During this ex-post evaluation, it was confirmed through interviews with the executing agency's personnel and beneficiaries, on-site inspections, and records of operation and maintenance management that the portion of the project which was excluded from its scope had also been implemented simultaneously while complementing this project, and that at the time of the ex-post evaluation it was bringing such effects as had been expected at the time of the appraisal.

[9] The five indicators set for sewerage in the ex-ante evaluation are the population treated, amount of wastewater treated, percentage of wastewater treated, effluent quality (biochemical oxygen demand (BOD) concentration), and effluent quality (chemical oxygen demand (COD) concentration). The three indicators for water supply are the percentage of population served, population served, and amount of water supply. All indicators show values for the entire project or entire area covered by the project while the breakdown of values for each sub-project and its basis are unknown.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs[10]

This project, which involved civil engineering work, equipment procurement, and training for water supply and sewerage infrastructure development in Bengbu City (urban area, Huaiyuan County, Wuhe County, and Guzhen County), comprised a total of eight sub-projects.

The five sub-projects for civil engineering work and equipment procurement to develop the water supply and sewerage infrastructure in the urban area (sewerage): Huaiyuan County (water supply[11]), Wuhe County (water supply and sewerage) and Guzhen County (water supply and sewerage in industrial complexes) were carried out as planned or almost as planned (difference from the plan was ±10% or less), but the development of one sewage treatment plant in the sewerage sub-project for Huaiyuan County was cancelled while all water supply sub-projects for Guzhen County (county capital) were cancelled. Details of and the reasons for these changes are described below.

- Huaiyuan County Sewerage Development Sub-Project: In this sub-project sewerage networks were developed almost as planned. However, because of the change by the people's government of Bengbu City to its city plan, the construction of sewage treatment plants covered by this project at the time of the appraisal was cancelled. It was decided that sewage should be sent for treatment to the Huaiyuan County Guozhen Sewage Treatment Plant and the Bengbu Sewage Treatment Plant No. 3 which is located in the adjacent Huaishang district in the urban area of the city. The people's government, determining that the economy of funds and greater operational efficiency should be achieved and that the above-mentioned sewage treatment plants had sufficient capacity to treat sewage from the areas served by them decided to change the project plan. The development of new sewage treatment plants under this project was cancelled but sewage from the project's target area was collected through the pipe networks developed in this project for treatment which indicates that the needs of residents and businesses are satisfied.
- Guzhen County (County Capital) Waterworks Development Sub-Project: The development of water supply infrastructure (water purification plants and water pipe networks) planned in this sub-project was entirely cancelled. The three reasons for the cancellation were: (1) the quality of water taken by the planned water purification plants failed to satisfy national standards, (2) the urban population increased as the 15-square-kilometer land and its residents were newly reclassified into the urban area of Guzhen County, and (3) the expropriation of land required for the construction of planned water purification plants encountered difficulties causing the project to be delayed. In 2013 for these reasons, the people's government of Guzhen County determined that it was impossible to meet the rapidly growing demand through this project and decided to entirely change the scope and site of the project, the source of water supply, and so forth. Instead, it decided to construct new water purification plants using its own funds. As a result, it conducted new feasibility studies, assessed the environmental impacts, expropriated 79.5-square-kilometer land at a new site, and started to construct water purification plants with a combined treatment capacity of 69,000 m^3/day[12] as a separate project from the present one. The sub-project satisfies the needs of the project's target

[10] For details of the major plans and results see "Comparison of Major Plans and Results."

[11] In the sub-project to develop water supply facilities in Huaiyuan County, the initial water purification plant site was changed, and the entire cost was covered by Chinese currency, but the sub-project was carried out along with the range of feasibility studies and environmental impact assessments conducted for this project. As the result of consultations between the executing agency and JICA, the sub-project was considered as included in the scope of the project.

[12] In 2015, Phase I saw the treatment of 25,000 m^3 of sewage per day begin, and Phase II (25,000 m^3/day) is scheduled to be completed at the end of 2019. The rest of the sub-project (9,000 m^3/day) will be carried out as a long-term plan.

area.

Here is a description on training. At the time of the appraisal, a total of two training sessions in Japan, one for ten people in managerial positions at the executing agency and the other for ten engineers, were planned. However, records show that two training sessions were held for a total of 14 people in managerial positions.[13]

3.2.2 Project Inputs

3.2.2.1 Project Cost

At the time of the appraisal, the total project cost was 17,036 million yen (9,271 million yen in foreign currency and 7,765 million yen in domestic currency). It was planned that the Japanese ODA loan would cover part of the foreign currency (84 million yen) with the rest (8,636 million yen) covered by financial funds of the people's government of Bengbu City and borrowings from domestic banks. The actual total project cost was 13,292 million yen (7,725 million yen in foreign currency and 5,567 million yen in domestic currency), 78% of the initially planned cost. It remained within the initially planned range.[14]

Information was obtained on the project cost not by sub-project but by target area (urban area, Huaiyuan County, Wuhe County, and Guzhen County). The project cost for the urban area and Wuhe County, where outputs were as planned, was 181% and 119% of the initially planned cost respectively, because of sharp rises in the price of materials and equipment, including steel materials, at the time of bidding as well as increases in personnel expenses. However, the project cost for Huaiyuan County where the construction of sewage treatment plants was excluded from the scope of the project and Guzhen County, where all waterworks sub-projects were excluded from the scope of the project, remained within the initially planned range, at 44% and 71% of the planned level respectively.

The actual project cost for two of the four project target areas exceeded the initially planned cost but that for the other two was lower than initially planned. However, these did not necessarily correspond with increases and decreases in project outputs.

3.2.2.2 Project Period

The project period planned at the time of the appraisal was three years and ten months (46 months) from March 2007 to December 2010. The actual period was substantially prolonged spanning nine years and three months (111 months) from March 2007 to May 2016, or 241% of the initially planned period. The reasons for the delays, which were common to all sub-projects, were as follows: (1) more procedures needed to be followed owing to the change of the international bidding system to a domestic one; (2) the executing agency was unfamiliar with Japanese ODA loan projects and so lacked smooth liaison and communication with the procurement consultants; and (3) mainly because of population increase, development needs grew larger than at the time of the appraisal, requiring the municipal government to adjust the content of the project in order to meet such growing needs, and that these procedural changes took time. Delays were caused mainly in the urban

[13] Training participants were received by the Pacific Resource Exchange Center. The first session was held for 14 days from December 12 to 25, 2009. It was attended by four people from the urban area, one from Huaiyuan County, two from Wuhe County, and one from Guzhen County. The training program covered: (1) frameworks for sewage treatment and water supply management, (2) regional environmental policy and city planning, (3) water supply management policy, including construction planning, operation and maintenance management, the setting of water rates, and public relations, (4) sewage treatment policy, including construction planning, (5) water quality testing for waterworks and sewerage facilities, (6) inspection of waterworks and sewerage facilities, and (7) environmental protection projects of enterprises in Osaka. The second session was held for 12 days from November 7 to 18, 2010. It was attended by three people from the urban area, one from Huaiyuan County, one from Wuhe County, and one from Guzhen County. The training program covered (1) city planning and waterworks, and sewerage projects in Japan, (2) urban planning and environmental policy, and (3) inspection of waterworks and sewerage facilities in Tokyo and Osaka.

[14] The percentage of the cost for each district to the actual total project cost was 68% for the urban area, 13% for Huaiyuan County, 7% for Wuhe County, and 11% for Guzhen County.

area's sewerage development sub-project. The Notice of the People's Government of Anhui Province to Step up Pollution Reduction Work (No. 84), which came into force in 2008, stipulated that newly constructed sewage treatment plants in urban areas needed to achieve an operating rate of 60% in their first year of operation; in order to attain this goal, at the time of the appraisal, this project planned to develop sewage treatment plants in two phases. However, the development of sewer pipe networks, which was moving ahead simultaneously, failed to catch up with that of the sewage treatment plants, making it impossible to achieve the goal. For this reason, the project divided the construction into three phases (100,000 tons/day for Phase I, 50,000 tons/day for Phase II, and 50,000 tons/day for Phase III), which is what caused the delays. Eventually, the plants started operation in 2015. Furthermore, the development of sewer and rainwater pipe networks in the urban area began in March 2008 but the road development project, which the people's government of Bengbu City had planned to implement simultaneously, was delayed causing the above-mentioned development project to be completed in May 2015. The development of waterworks, scheduled for completion in 2008, was completed in 2012 mainly because the construction of water purification plants in Huaiyuan County was delayed due to site changes.

As described above, the actual project period far exceeded the initially planned period because of adjustments associated with changes in the project scope, delays in the development of roads which was simultaneously under way, site changes, the longer times required for bidding-related procedures, etc. This did not correspond with decreases in project outputs.

3.2.3 Internal Rates of Return (Reference Only)

Financial Internal Rate of Return (FIRR)

In this project, the financial internal rate of return (FIRR) was calculated for all sub-projects at the time of the appraisal. At the time of the ex-post evaluation, based on the information that could be collected, FIRR was calculated again for the subprojects with the exception of the two sub-projects that were excluded from the project, and the three sub-projects whose operation and maintenance management expenses were all covered by subsidies instead of rate revenue, as a major emphasis is put on the public interest rather the profitability of the business or for the purpose of attracting companies. FIRR for the sewerage sub-project in the urban area, waterworks sub-project in Huaiyuan County, and sewerage sub-project in Wuhe County were calculated (see Table 2).[15]

Table 2: FIRR at the Time of Appraisal and Ex-Post Evaluation

Sub-projects	At the time of the appraisal		At the time of the ex-post evaluation	
	Sewerage	Waterworks	Sewerage	Waterworks
Urban area	4.77%		2.94%	
Huaiyuan County	4.04%	6.08%	Excluded from the project	-1.8%
Wuhe County	4.37%	6.15%	Incalculable	Not recalculated
Guzhen County (country capital)		6.10%		Excluded from the project
Guzhen County (industrial complex)	4.10%	6.46%	Not recalculated	Not recalculated

Source: At the time of the appraisal, materials provided by JICA were used. At the time of the ex-post evaluation, the evaluator recalculated the FIRR based on materials provided by the executing agency.

At the time of the ex-post evaluation, the FIRR for the sewerage sub-project in the urban area was low at 2.94% compared to the 4.77% achieved at the time of the appraisal because, in

[15] The prerequisites for calculating FIRR at the time of the appraisal were the project cost and operation/maintenance management expenses for expenses, rate revenue for benefits, and 30 years for the project life.

addition to the growth in the project cost, the rate revenue did not increase as expected for reasons such as the relocation of businesses in the target area. The FIRR for the waterworks sub-project in Huaiyuan County was minus 1.8% at the time of the ex-post evaluation compared to the 6.08% achieved at the time of the appraisal because the rate revenue earned at the time of the ex-post evaluation was expected to cover operation/maintenance management expenses but the planned future renewal costs needed to be added to the current project cost (for details see "3.4.3 Financial Aspects of Operation and Maintenance"). At the time of the ex-post evaluation, the FIRR for the sewerage sub-project in Wuhe County proved to be incalculable compared to the 4.37% given at the time of the appraisal because, in addition to the increase in the project cost, the rate revenue estimated at the time of the ex-post evaluation was not expected to cover the project cost as well as operation/maintenance management expenses throughout the 30-year project cycle. As described above, in all sub-projects for which FIRR could be calculated again at the time of the ex-post evaluation, the FIRR was lower than at the time of the appraisal, indicating that normally, these sub-projects should be considered as high-risk investments. However, interviews with personnel from the executing agency suggested that industrialization and urbanization were expected to continue progressing in the future as enterprises were attracted to the city. In addition water and sewerage rates were highly likely to be revised several years later; thus FIRR will improve compared to the figure given at the time of the ex-post evaluation. Moreover, as mentioned in "3.4.3 Financial Aspects of Operation and Maintenance," the basic policy of Bengbu City was to emphasize the public benefits of water supply and sewerage operations when managing them, and partly because the municipal government did not place much emphasis on profitability as it assumed that any deficits would be covered by its subsidies, the results cited above should be treated only as reference data.

In this project, to achieve greater project efficiency while responding to changes such as the greater population growth than was expected at the time of the appraisal, the municipal government revised the waterworks and sewerage development plans several times. This led to the construction of one sewage treatment plant and the waterworks development sub-project both being excluded from the project resulting in decreased project outputs. Because of this, the total project cost remained within the range of the initial plan. However, owing to the various procedures associated with scope changes, site changes and other external factors, the project period did not correspond with the decreases in project outputs because it far exceeded the initial plan.

As described above, although the project cost was within the plan, the project period exceeded the plan. Therefore, efficiency of the project is fair.

Sewer pipe in Wuhe County, which was installed in this project

Water quality test room and control center at the Guzhen County Sewage Treatment Plant, both developed in this project

3.3 Effectiveness and Impacts[16] (Rating: ③)

The outcome of this project is "to reduce the amount of water pollutants discharged into the Huai River and ensure the stable supply of safe water." The impacts are to "contribute to improvement of the living environment for Bengbu residents."

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

Regarding this project's outcome, that is "to reduce the amount of water pollutants discharged into the Huai River and ensure the stable supply of safe water," the indicators and calculation bases for the targets written on the ex-ante evaluation were unclear. Thus, the external evaluator basically used operation and effect indicators and targets with clear calculation bases at the time of the appraisal (for details see "3.1.4 Appropriateness of the Project Plan and Approach").

A) To reduce the amount of water pollutants discharged into the Huai River

For sewerage improvement, a sewage treatment plant was constructed at the Bengbu Sewage Treatment Plant No. 2 in the urban area and at the Guzhen County Economic Development District Sewage Treatment Plant. The external evaluator assessed these using the following indicators specified in Table 3: (1) population treated, (2) amount of wastewater treated, (3) facility utilization rate, (4) wastewater treatment rate, (5) BOD (biochemical oxygen demand, hereafter called "BOD") concentration (at entry and exit), (6) COD (chemical oxygen demand, hereafter called "COD") concentration (at entry and exit), (7) T-N (total nitrogen, hereafter called "T-N") concentration (at entry and exit), (8) T-P (total phosphorus, hereafter called "T-P") concentration (at entry and exit), (9) SS (suspended solids, hereafter called "SS") concentration (at entry and exit), (10) sludge treatment rate, (11) charge collection rate, (12) sewer penetration rate, and (13) sewer connection rate. As a result of consultations with JICA and the executing agencies, the external evaluator also evaluated sub-projects in Huaiyuan County, in which pumping stations and a sewer pipe network were constructed through this project, and in Wuhe County, in which just a sewer pipe network was constructed in this project, by using (1) population treated, (2) amount of wastewater treated, (4) percentage of wastewater treatment rate, and (13) percentage of sewer connection rate of the indicators listed above, as well as by adding (14) the national standard for sewage treatment plants at which wastewater collected through the pipe networks constructed in this project is treated, as a basis for judgement of "the reduction of the amount of water pollutants discharged."[17]

[16] Sub-rating for Effectiveness is to be listed with consideration of Impacts.

[17] In recent years, the Chinese government has promoted a split type to separate wastewater from rainwater for development of new sewerage in urban areas, and a split type of sewerage facilities were also constructed in this project. Especially in the urban area, not only a sewage treatment plant but also a storm sewer network were developed as a priority, and thus the external evaluator discussed which indicators could serve as supplementary information especially for evaluating the effectiveness of the storm sewer network construction in this ex-post evaluation. As a result, the external evaluator obtained information on improvement of the flood/inundation control capacity. The catchment of the storm sewer network constructed in the urban area is about 31.2 km^2. The infrastructure before the project could only respond to flood/inundation on such a small scale as once every two years, whereas after this project it has the capacity to respond to flood/inundation on a larger scale than once every ten years. This way the split type made it possible to prevent flood/inundation damage to the urban area. In addition, the operating load and overflow risk on the sewage plants were reduced, which has resulted in reducing the Huai River's pollution by eliminating the discharge of untreated water.

Table 3: Effectiveness of the Sewerage Improvement Project

Name of indicator		Target Value 2 years after project completion	Actual Values				
			2016 Project completion year	2017 1 year after project completion	2018 2 years after project completion		
【Urban area/Bengbu City No. 2 Sewage Treatment Plant】						Target achievement rate	
(1) Population treated (10,000 persons)		43.62	51	55	58	133%	Target achieved
(2) Amount of wastewater treated ($10,000m^3$/day)		20	15.7	15.7	*14.9*	*75%*	*Target not achieved*
(3) Facility utilization rate (%)		100	100	100	100	100%	Target achieved
(4) Wastewater treatment rate (%)		70 or more	95	98	98	—	Target achieved
(5) BOD concentration (mg/L)[Note1]	Entry	210	92	80	85	—	Target achieved
	Exit	≤10	8	6.5	2.7	—	Target achieved
(6) COD concentration (mg/L)[Note1]	Entry	420	235	188	171	—	Target achieved
	Exit	≤50	23.7	19.9	16.2	—	Target achieved
(7) T-N concentration (mg/L)[Note1]	Entry	45	31.1	29.9	28.1	—	Target achieved
	Exit	≤15	13.1	11.6	12.4	—	Target achieved
(8) T-P concentration (mg/L)[Note1]	Entry	4	2.4	2.4	2.3	—	Target achieved
	Exit	≤0.5	0.39	0.4	0.39	—	Target achieved
(9) SS concentration (mg/L)[Note1]	Entry	180	108	107	107	—	Target achieved
	Exit	≤10	8	8	8	—	Target achieved
(10) Sludge treatment rate (%)		100	100	100	100	100%	Target achieved
(11) Charge collection rate (year, %)		90	95	95	90	100%	Target achieved
(12) Sewer penetration rate (%)		100	100	100	100	100%	Target achieved
(13) Sewer connection rate (%)		100	100	100	100	100%	Target achieved
【Guzhen County/Guzhen Economic Development District Sewage Treatment Plant】							
(1) Population treated (10,000 persons)		2.2	3	3.5	3.5	159%	Target achieved
(2) Amount of wastewater treated ($10,000m^3$/day)		2	2	3	3	150%	Target achieved
(3) Facility utilization rate (%)		100	100	100	100	100%	Target achieved
(4) Wastewater treatment rate (%)		70 or more	95	98	98	—	Target achieved
(5) BOD concentration (mg/L)[Note1]	Entry	180	122.8	114.8	101.1	—	Target achieved
	Exit	≤10	9	8	9	—	Target achieved
(6) COD concentration (mg/L)[Note1]	Entry	380	235	188	171	—	Target achieved
	Exit	≤50	21.6	33	30.9	—	Target achieved
(7) T-N concentration (mg/L)[Note1]	Entry	40	31.3	32.7	36.2	—	Target achieved
	Exit	≤15	13.3	12.9	15.0	—	Target achieved
(8) T-P concentration (mg/L)[Note1]	Entry	4	2.9	3.3	3.7	—	Target achieved
	Exit	≤0.5	0.39	0.45	0.36	—	Target achieved
(9) SS concentration (mg/L)[Note1]	Entry	250	207	191	191	—	Target achieved
	Exit	≤10	7	8	7	—	Target achieved
(10) Sludge treatment rate (%)		100	100	100	100	100%	Target achieved
(11) Charge collection rate (year, %)		90	Note 2	Note 2	Note 2	—	—
(12) Sewer penetration rate (%)		90	100	100	100	111%	Target achieved
(13) Sewer connection rate (%)		90	95	98	98	109%	Target achieved
【Huaiyuan County: Sewerage Development】							
(1) Population treated (10,000 persons)		12	14	14	18	150%	Target achieved
(2) Amount of wastewater treated ($10,000m^3$/day)		4	4	4	5	125%	Target achieved
(4) Wastewater treatment rate (%)		70 or more	100	100	100	—	Target achieved
(13) Sewer connection rate (%)		90	95	98	98	109%	Target achieved
(14) National standards for sewage treatment plants where sewage collected by the sewer network constructed by the project is treated*		Grade I-A	Grade I-A	Grade I-A	Grade I-A	—	Target achieved
【Wuhe County: Sewerage Development】							
(1) Population treated (10,000 persons)		12	13	13	13	108%	Target achieved
(2) Amount of wastewater treated ($10,000m^3$/day)		5	5	5	5	100%	Target achieved
(4) Wastewater treatment rate (%)		70 or more	95	98	98	—	Target achieved
(13) Sewer connection rate (%)		90	95	98	98	109%	Target achieved
(14) National standards for sewage treatment plants where sewage collected by the sewer network constructed by the project is treated*		Grade I-A	Grade I-A	Grade I-A	Grade I-A	—	Target achieved

Source: Target values are from documents provided by JICA, actual values are from documents provided by the executing agency.
Italics indicate that the targes were not achieved.
Note 1: As for indicators (5) to (9), entry values are from the design value, and exit values are those required by the "Discharge Standard of Pollutants for Municipal Wastewater Treatment Plants" in order to achieve Grade I-A.
Note 2: In Guzhen County Industrial Park, as a measure to attrackt investment, sewerage and water supply fees are not charged, thus fees are not collected.
*: Discharge Standard of Pollutants for Municipal Wastewater Treatment Plants (GB18918-2002).

As shown in Table 3, even though only the target of Indicator (2) “amount of wastewater treated” in the urban area has not been achieved (Level of target achievement: 75%), the targets of the other indicators for all the sub-projects have been achieved. The amount of wastewater treated in the urban area can be attributed to the relocation of many companies acting as wastewater sources from the urban area to the industrial park located at the junction with the rural area due to the municipal government’s urban policy change, which resulted in a decrease in the amount of wastewater from the time of the appraisal. However, according to interviews with the executing agency houses including apartments will continue to be built in the urban area meaning the target at the time of the appraisal is expected to be achieved from 2020 on. In addition among the indicators in Table 3, attention should be paid to Indicators (5) through (9) at the two sewage treatment plants in the urban area and Guzhen County, and Indicator (14) in Huaiyuan County and Wuhe County which are directly related to this project’s outcome: “to reduce polluted water discharged into the Huai River.” All of these indicators had already been achieved when the project was completed and have continued to show an improving tendency since then. Both of the two sewage treatment plants constructed in this project and the three sewage treatment plants (not included in this project) connected to the sewer pipe networks constructed in this project have achieved Grade I-A of the Discharge Standard of Pollutants for Municipal Wastewater Treatment Plants established by the Government of China. In comparison with the time when untreated water was discharged into the Huai River, the amount of polluted water discharged into the River after project completion has been significantly reduced, meaning a clear project effect can be seen.

B) To ensure a stable supply of safe drinking water

The following water purification plants were constructed in this project: “First purification plant of Bengbu Zhongyang Environment & Waterworks Co., Ltd.” in Huaiyuan County, and “Guzhen economic development zone’s purification plant” constructed in the industrial park in Guzhen County. In Wuhe County, just a water pipe network was constructed. The external evaluator evaluated sub-projects in which a purification plant was constructed by collecting the following as key indicators: (1) population served, (2) amount of water supply, (3) facility utilization rate, and (4) water supply coverage ratio, and by adding the following as auxiliary indicators: (5) water quality (chromaticity), (6) water quality (turbidity), and (7) water outage period. Regarding Wuhe County, the external evaluator confirmed (1) population served, (2) amount of water supply, (3) facility utilization rate.

Sedimentation basin of the 1st purification plant of Bengbu Zhongyang Environment & Waterworks Co., Ltd., Huaiyuan County, constructed in this project

All of the sub-projects have achieved the targets for population served and the amount of water supply. Therefore, all of the percentages of population served reached 95% or more exceeding the target significantly. In the sub-projects in Huaiyuan County and Guzhen County (industrial park) where a purification plant was constructed, the percentage of facility utilization reached 95% or more exceeding the targets, both the chromaticity and turbidity of water quality have achieved the “daily life drinking water sanitation standards” established by the State, and the annual water outage periods are 8 hours/year and 5 hours/year respectively exceeding the targets significantly. Moreover, with regard to “to ensure a stable supply of safe drinking water,” this project’s outcome, a clear project effect can be seen.

Table 4: Effectiveness of the Water Supply Improvement Project

Name of Indicator		Target Value 2 years after project completion	Actual Value				
			2016 Project completion year	2017 1 year after project completion	2018 2 years after project completion		
【Huaiyuan County/Bengbu Central Environmental Water Service Co., Ltd. Water Purification Plant No. 1】						Target achievement rate	
(1) Population served (10,000 persons)		20	20	22	24	120%	Target achieved
(2) Amount of water supply (10,000 m^3/day)	Maximum	3	3.2	3.3	3.6	120%	Target achieved
	Average	2.8	3.2	3.4	3.7	132%	Target achieved
(3) Annual average facility utilization rate (%)		95	95	95	97	102%	Target achieved
(4) Water supply coverage ratio (%)		85	95	96	98	115%	Target achieved
(5) Water quality (chromaticity) Note 1		15 or less	14	13	12	—	Target achieved
(6) Water quality (turbidity) Note 1		3 or less	1.5	1	1.3	—	Target achieved
(7) Water outage period (hours/year) Note 2		100 or less	10	8	8	—	Target achieved
【Guzhen County Industrial Park/Guzhen County Economic Development District Water Purification Plant】							
(1) Population served (10,000 persons)		3	3	3.5	3.5	117%	Target achieved
(2) Amount of water supply (10,000 m^3/day)	Maximum	2	2	2	2	100%	Target achieved
	Average	2	2	2	2	100%	Target achieved
(3) Annual average facility utilization rate (%)		90	90	90	95	106%	Target achieved
(4) Water supply coverage ratio (%)		95	100	100	100	105%	Target achieved
(5) Water quality (chromaticity) Note 1		15 or less	13	14	13	—	Target achieved
(6) Water quality (turbidity) Note 1		3 or less	1.6	1.5	1.4	—	Target achieved
(7) Water outage period (hours/year) Note 2		100 or less	25	10	5	—	Target achieved
【Wuhe County Water Supply Development】							
(1) Population served (10,000 persons)		Unknown	16	18	18	—	Up-ward trend
(2) Amount of water supply (10,000 m^3/day)	Maximum	5	5	5	5	100%	Target achieved
	Average	2	2	2	2	100%	Target achieved
(4) Water supply coverage ratio (%)		90	90	92	95	106%	Target achieved

Source: Target values are from documents provided by JICA, actual values are from documents provided by the executing agency.
Note 1: Standard values from the "Environmental Quality Standards for Surface Water (GB5749-2006)" were set as target values.
Note 2: Total of planned and unplanned.

Based on the foregoing, in the four sub-projects for sewerage improvement, only the amount of wastewater treated at the sewage treatment plant in the urban area has not achieved its target but this is expected to improve. For the outcome of "to reduce polluted water discharged into the Huai River," all the sewage treatment plants have achieved the domestic standards. In addition, in the three sub-projects for water supply improvement, all the targets have been achieved and a stable supply of safe drinking water has been ensured. As a whole, looking at both water and sewerage services, effects have been produced, and the effectiveness of this project is high.

3.3.1.2 Qualitative Effects (Other Effects)

The qualitative effect of this project is "to improve the living environment for Bengbu residents." This can be understood as an effect of the impact level of this project. Thus, the external evaluator made this evaluation in "3.3.2.1 Intended Impacts."

3.3.2 Impacts

3.3.2.1 Intended Impacts

The impacts of this project are "to improve the living environment for Bengbu residents." Although the specific contribution of this project is not clear, the external evaluator picked out the percentage of people who can continuously use the improved source of drinking water and the percentage of those who can use the improved sanitation facilities as indicators to fully understand the impacts quantitatively. With the growth of the Chinese economy, the population in Bengbu City increased from 3.12 million in 2005 to 3.38 million in 2018 and the GDP increased significantly from 31.3 billion yuan in 2005 to 171.4 billion yuan in 2018. While the water supply and sewerage improvement were making progress in urban areas, the percentage of people who can continuously use the improved source of drinking water increased from 65% in 2005 to 98% in 2018 and the percentage of those who can use the improved sanitation facilities increased from 63% in 2005 to 98% in 2018. In any of these, significant improvement can be seen.

In this ex-post evaluation, the external evaluator analyzed the impacts qualitatively through group interviews with the beneficiaries because it was difficult to obtain statistics other than the indicators above.[18] In the group interviews, the external evaluator confirmed: (1) satisfaction with this project and the current water and sewerage services, and (2) changes in lifestyle or health conditions before and after the project, caused by the improved water and sewerage services (see Table 5).

Table 5: Project's Impacts: Main Results Obtained from the Group Interviews

	Results
Sewer age	**1) Satisfaction with this project and the current service** ・All participants answered "Very satisfied." The main reason is significant improvement of living conditions and the natural environment. The sewerage service is of good quality and regular maintenance has brought about a dramatic decrease in the clogging of sewer pipe networks. Regarding charges, all answered "Reasonable" partly because their incomes are also increasing. Multiple payment methods have improved convenience. Through the educational activities conducted by the government, living practices have generally been improving such as not dumping waste or oil in sewers. **2) Changes in lifestyle before and after the project, caused by the improved service** ・Before the project, residents living in areas without sewerage discharged domestic water into nearby rivers and used holes dug outside one-storied houses as simple toilets. Therefore, there were safety issues for children and the elderly. After the project, flush toilets were provided indoors, which improved the dwelling environment and the hygienic environment significantly. ・Before the project, apartment residents with sewerage developed often experienced clogging of the sewer pipes because the pipe diameter was small. Additionally, in most areas, sewerage was undeveloped and domestic water was discharged into roads or rivers, so bad odors were generated. After the project, towns became clean on the whole and townscapes were improved. The pollution and the bad smell of the Huai River were also improved. On the other hand, residents do not feel there has been any major change in water-borne diseases before and after the project.
Water works	**1) Satisfaction with this project and the current service** ・All participants in the four cities answered "Very satisfied." The water quality and pressure are stable irrespective of the number of floors of buildings. Water supply is suspended only at the time of planned power outages, when advance notice is given without fail. Regarding charges, all answered "Reasonable" because their household incomes are also increasing. The main reason is convenience improvement and the service improved as a whole. **2) Changes in lifestyle before and after the project, caused by the improved service** ・Before the project, well water or common tap water of poor quality was used and it was necessary to draw water with a hand pump and collect water in a jar every day (it took two hours on average every day to collect a day's water). Water resources were limited, so it was necessary to restrict the frequency of use. Sanitation was also insufficient. In areas with waterworks developed, because of deterioration of the water pipes, the water quality and supply were unstable such as rust mixed in the tap water. Drinking tap water frequently caused diarrhea, so it was necessary to boil and filtrate the tap water without fail for use as drinking water. ・After the project implementation, water of good quality can be used by "just turning on a faucet in the house," which means being freed from the labor of drawing water. Residents can keep themselves clean by more frequently washing their hands and taking a shower than before without having to worry about water-borne diseases such as diarrhea. As a whole, the living conditions have become more sanitary.

Source: Results of the group interviews at the time of the ex-post evaluation, summarized by the evaluator.
* The interview results were summarized according to sector instead of project target area, because they are common to the urban area and counties.

[18] The group interviews were held on April 10–12, 15 and 16, 2019, three times in the urban area and once in each county. There were 33 participants in the urban area, 8 in Huaiyuan County, 12 in Wuhe County, 20 in Guzhen County, and 77 in total (21 women and 56 men in their 20s to 60s). As for the characteristics of the beneficiaries interviewed, most of them lived at the junction between a rural area and the urban area before urban development. Regarding water supply and sewerage infrastructure development, sewerage was undeveloped while waterworks were partly developed. With the progress in urban development, the junctions were reclassified into urban areas, and the beneficiaries moved gradually into apartments built by the government in 2007–2015. At the time of the ex-post evaluation, beneficiaries other than the retired beneficiaries were engaging in new jobs instead of agriculture. To select the interviewees, we communicated the purpose of the group interviews and preferred sampling etc. to the executing agencies. Then, the people's governments and project implementing departments of the city and counties took the initiative to coordinate. Specifically, we contacted resident committees and estate management companies in the project target areas to communicate the schedule of the group interviews, and then looked for residents that could participate in the interviews.

As described above, the satisfaction with this project is very high for both waterworks sewerage. As a whole, a certain contribution made by this project to improve the living conditions of residents in the project target cities can be seen.

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

The Environmental Impact Assessment (hereafter called "EIA") for this project was approved on September 19, 2007 by the Environmental Protection Bureau of the People's Government of Anhui Province. As anti-pollution measures planned at the time of the appraisal, it was planned that all wastewater from the sewerage facilities would be treated and released into rivers in a state and manner that meets the wastewater standards in China, and that the sludge generated in sewage treatment plants would be processed according to the standards set by the Chinese government, and disposed of appropriately in reclaimed repository sites. Furthermore, it was assumed that these measures and the water quality monitoring would be implemented by the Bengbu Environmental Protection Bureau. Through the inspections, interview investigations and monitoring record checking at the time of the ex-post evaluation, the external evaluator confirmed that the anti-pollution measures were implemented as planned. As described in "3.3.1 Effectiveness," all the sewage treatment plants constructed in this project have achieved Grade I-A of the Discharge Standard of Pollutants for Municipal Wastewater Treatment Plants. Sludge generated in the sewage treatment plants is also appropriately disposed of in reclaimed repository sites specified by the people's governments of the city and counties.[19] Monitoring of water quality etc. by the Bengbu Environmental Protection Bureau has been strictly implemented and records have been appropriately kept. At the time of the ex-post evaluation, the water quality in the water supply and sewerage facilities as well as that of the Huai River for intake and discharge are monitored in real time. If the national standards are not observed, strict guidance and fines will be imposed on the project implementing departments and companies. Regarding the water quality of the Huai River for release from the sewage treatment plants constructed in this project, the external evaluator picked out the indicators shown in Table 6 at two monitoring points upstream and downstream (see Figure 1) from the Environmental Protection Bureau. As a result, the external evaluator confirmed that the water quality of the Huai River has been improved compared to before the project and has definitely achieved Category III of the national standards.

Table 6: Project's impacts: Water quality Improvement Status of the Huai River*

(Units: mg/L)

Monitoring point	Year	Permanganate COD_{Mn}	Ammonium nitrogen NH_{4+}-N
Bengbumenshang	2005	4.34	0.927
	2016	3.50	0.387
	2017	3.60	0.270
	2018	3.50	0.410
Category III		≤6.0	≤1.0

Monitoring point	Year	Permanganate COD_{Mn}	Ammonium nitrogen NH_{4+}-N
Mohekou	2005	4.79	***1.388***
	2016	3.70	0.525
	2017	3.70	0.390
	2018	3.40	0.420
Category III		≤6.0	≤1.0

Source: Materials offered by the executing agencies

* These indicators were disclosed as key pollution indicators by the Environmental Protection Bureau at the time of the ex-post evaluation.

Note. Figures in bold italic type have not achieved the standard.

In addition, both at the time of the appraisal and at the time of the ex-post evaluation, the project target areas were not located in or around sensitive areas such as national parks. The external evaluator confirmed through on-site inspections etc. that adverse impacts on the

[19] At the time of the ex-post evaluation, reuse of sludge is prohibited by law in Bengbu City.

natural environment were minimal.

(2) Resettlement and Land Acquisition

Land acquisition of 30 ha had been planned at the time of the appraisal, while the actual number was 28 ha, slightly below the plan. The main reason is that part of the sewer pipe network site in the urban area was expropriated for another road improvement project in parallel with this project. The land acquired in this project was owned by the State. Thus, the domestic procedures of China, based on the "Urban Property Management Law," were carried out to undergo appraisal by the municipal government, defray the cost and acquire land-use rights without indemnification etc. Resident relocation was not planned at the time of the appraisal. It also did not occur during the actual implementation.

(3) Other Positive/Negative Impacts

At the time of the appraisal, there was a water charge subsidy system for the poor in Bengbu City, which was also to be applied to this project. At the time of the ex-post evaluation, there was no subsidy specifically covering water and sewerage charges. However, the external evaluator confirmed that a living allowance covering basic infrastructure in general including water and sewerage charges is given to households in need of life security[20] in the urban area, in accordance with the "Anhui Province Minimum Life Security Measures (No. 268, issued in 2016)" and the "Measures to be Implemented for Minimum Life Security of Urban Residents in Bengbu City (No. 9, issued in 2003)."

Based on the foregoing, this project has achieved its objectives. Therefore, the effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

The project implementing departments in charge of operation and maintenance of the infrastructural facilities constructed in this project are shown in Table 7. Through inspections and interviews with employees during the on-site investigation, the external evaluator confirmed that all the project implementing departments of the ten companies have a clear organization chart and decision-making process for operation and maintenance. They also have enough personnel to ensure normal operation and maintenance, while also ensuring a shift system for safe and efficient operation in terms of the working status of employees.[21]

[20] According to these measures, households under minimum life security shall meet the following two conditions: (1) the household's monthly income per person is below the minimum life security standard in the local area; and (2) the household's financial condition complies with the financial conditions of minimum life security households in the local area.

[21] At the time of the ex-post evaluation, Changyuan Waterworks Co., Ltd., Wuhe County, had a problem with management fraud. Thus, it was not possible to conduct any direct interviews. However, the People's Government of Wuhe County arranged the information collection and inspections necessary for the evaluation and accompanied the external evaluator's team. Although the fraud problem occurred, it has not hindered the operation and maintenance of the waterworks.

Table 7: System of the Project Implementing Departments

Sub-project	Sewerage (Engineers*/All employees)	Waterworks (Engineers*/All employees)
Urban area ● Sewage treatment plant ● Sewer pipe network south of the Huai River ● Storm sewer network north of the Huai River	Bengbu Zhongyang Environment & Sewage Treatment Co., Ltd. (17/28) Municipal Effluent Co., Ltd., Bengbu City (11/26) Second Municipal Administration Corporation, Bengbu City (20/60)	
Huaiyuan County	Guocheng Wastewater Treatment Corporation, Huaiyuan County (10/14) Public Work Management Division, Housing Bureau, Huaiyuan County (4/14)	Bengbu Zhongyang Environment & Waterworks Co., Ltd. (Purification plant: 10/43, Water pipe network: 9/40)
Wuhe County	Municipal Administration Corporation, Wuhe County (20/40)	Changyuan Waterworks Co., Ltd., Wuhe County (23/30)
Guzhen County (industrial park)	Anhui Riguang Waterworks Co., Ltd. (Sewage treatment plant: 12/26, Sewer pipe network: 4/4)	Bengbu Zhongyang Environment & Waterworks Co., Ltd. (Purification plant: 6/25, Water pipe network: 2/4)

Source: Materials offered by the executing agencies, based on interviews during the on-site inspection
* Engineers denote staff with professional qualifications at national or provincial level.

At the time of the ex-post evaluation, all the project implementing departments were state-run companies and had no plan to be privatized. Four out of the ten companies are subsidiaries of Zhongyang Environment Co., Ltd., a major company in the water and sewerage service sector in China. Especially for water and sewerage services in Huaiyuan County, based on a decision of the county government aimed at providing more sophisticated operation and maintenance, Bengbu Zhongyang Waterworks Co., Ltd. took over the operation and maintenance of waterworks in 2018. It is likely that examples of such strengthened systems will increase.

As described above, the project implementing departments have a clear organization chart and the necessary size for operation and maintenance. Systems for decision making, command, guidance, supervision etc. also function well enough to ensure the sustainability of this project.

3.4.2 Technical Aspect of Operation and Maintenance

The external evaluator assessed the technical aspects of operation and maintenance carried out by the project implementing departments in this project, based on: a) staff's technical level in operation and maintenance, b) preparation and utilization status of operation and maintenance manuals, c) investment in establishing training systems and technical improvement for staff in charge of operation and maintenance, and d) training implementation status.

Regarding a) staff's technical level in operation and maintenance, at the time of the appraisal, Bengbu City and the state-run companies had little experience in the operation and maintenance of sewerage, and there was special concern about their familiarity with the A2O process[22] adopted for the sewage treatment plants constructed in this project. At the time of the ex-post evaluation, however, through interviews at each sewage treatment plant, it was confirmed that they had the knowledge and experience for the safe operation and maintenance of waterworks and sewerage works, including the structure of and treatment in sewerage

[22] A2O process: the anaerobic-anoxic-oxic process, aimed at simultaneous removal of nitrogen and phosphorus, has been commonly introduced at sewage treatment plants in urban areas of China in recent years.

facilities (monitoring and management of the water quality of the influent and wastewater being treated, basic operating conditions including active sludge concentration, anaerobic degree, etc.) as well as ensuring and strictly observing national water quality standards. All of the treatment plants have achieved Grade I-A of the Discharge Standard of Pollutants for Municipal Wastewater Treatment Plants and have no special problems. This is backed by the wide adoption of the A2O process along with stricter water quality management in China. Furthermore, the project implementing departments are subsidiaries of Zhongyang Environment Co., Ltd. or Riguang Waterworks Co., Ltd., which are major companies specializing in water and sewerage services in China, which makes them highly familiar with operation and maintenance. In addition it was confirmed that improvements to respond to the stricter national standards for water quality in China (control of the type and input of chemicals at purification plants and sewage treatment plants, upgrading of equipment, machinery and materials, human resources development, etc.) have been made as needed. Regarding waterworks operation and maintenance are carried out by Bengbu City and the state-run companies under the jurisdiction of the city as in the past. Personnel needed at the purification plants newly constructed in this project were additionally employed and human resources development has also been strengthened. No special problems were found at the time of the ex-post evaluation just like at the time of the appraisal.

Regarding b) preparation and utilization status of operation and maintenance manuals, all the project implementing departments keep the originals of their own manuals, and the main work processes are enlarged and displayed as wall posters which allows the workers to see them at all times. Operation and maintenance records are also kept according to the main equipment and workflows. In addition, regarding inspections, there are daily inspections carried out every day and periodic inspections conducted once a month, once every half year or once a year according to the equipment. Individual inspection records are also kept. The necessary water quality testing and monitoring for both waterworks and sewerage are done and recorded at the frequency specified by the State Environmental Protection Administration. The environmental protection bureau's real-time online monitoring equipment has been installed at all the sewage treatment plants and purification plants. At the purification plants, unannounced water quality testing is done every month by the disease control center in order to strictly manage the water quality.

Regarding c) investment in establishing training systems and technical improvement for staff in charge of operation and maintenance as well as d) training implementation status, at the time of the ex-post evaluation, the project implementing departments manage the employees' acquisition of national qualifications. Each division in each individual operation executing department makes sure they understand the training needs and reports these needs every year to the human resources development department. The department makes an annual human resources development plan, and the necessary budgets are incorporated into the next fiscal year's budget, so that the training is provided as planned. The training is a combination of in-house training containing classroom lectures from invited domestic experts and OJT with training at outside training institutions. The outside training is provided to electricians, welders, water quality laboratory technicians, sewage plumbers, sewage treatment operators, and safety managers, especially those requiring national qualifications. At all the project implementing departments, training on "safety management," "basic sewerage knowledge," "basic waterworks knowledge," "labor discipline," etc. is provided at least once a month. In addition to these, training on the operating procedures of machinery and equipment in each facility, detection and repair of equipment failures, and relearning of national qualifications is provided at least once a year. In addition, in this project, training in Japan (see "3.2.1 Project Outputs" for details) was provided twice, in which a total of 16 people participated. At the time of the ex-post evaluation, however, only four people remained at the executing agencies or project implementing departments. The training in Japan was short-term training whose content was extensive, so the participants said that the training had served as an opportunity to broaden their horizons about Japan rather than to acquire knowledge that could be reflected in the

project.

As described above, all of the project implementing departments have an appropriate technical level of employees in charge of operation and maintenance, have developed training systems, and are always trying to maintain and improve their technical levels. The technical aspect to producing sustainable effects in this project has been ensured.

3.4.3 Financial Aspect of Operation and Maintenance

In this project, it was premised at the time of the appraisal that basically operation and maintenance costs would be covered by income from the charges, while it was premised at the time of the ex-post evaluation that a certain deficit would occur because the rates are set from the perspective of the public interest. However, in the case of a lack of funds, a system for additional spending of the treasury funds of the People's Government of Bengbu City has been established.

In Bengbu City, both at the time of the appraisal and at the time of the ex-post evaluation, the local government (the price bureau of the city, and the county development and reform commission) has the authority to decide the water and sewerage charges. There is no fixed frequency of revision, but revisions are made through the process of the business operators' applications to government based on price fluctuations and public hearing to reflect users' opinions. At the time of the appraisal, sewerage charges were collected by adding them to the water charges and were expected to be raised from 0.6 yuan/m^3 on average in FY2005 to 0.8 yuan/m^3 on average in 2010 to thereby cover operation and maintenance costs. As of 2018, the charges have been revised at 0.8–1.4 yuan/m^3 as planned or to a higher level. The operation and maintenance costs of the waterworks are covered by income from water charges, and it was planned that the water charges, although 0.9–1.2 yuan/m^3 on average in FY2005, would be raised to 1.48–1.6 yuan/m^3 in 2010 to cover operation and maintenance costs. As of 2018, only the charges in the urban area are 1.65–1.86 yuan/m^3, exceeding the rate at the time of the appraisal, while the charges in the counties are 1.0–1.45 yuan/m^3 and the planned increase in rates has not yet been implemented.

As a result of the above, as shown in the Attachment, Bengbu Zhongyang Environment & Waterworks Co., Ltd. alone has covered the operation and maintenance costs by using income from charges. Seven out of the nine companies receive a government subsidy[23] to cover operation and maintenance costs. There are also cases where all the costs are covered by the subsidy, such as the sewer pipe networks in the urban area and Wuhe County. Furthermore, in the case of Guzhen County, there were no water or sewerage charges as the government's corporate incentive for the industrial park, so all the costs were covered by the subsidy until 2018.

Waterworks and sewerage are directly related to public welfare. Thus, the policy is rate setting with management focused on the public interest, the deficits have been covered by government subsidy, and sustainability from the financial aspect is guaranteed.

3.4.4 Status of Operation and Maintenance

Regarding the use and maintenance status of facilities, machinery and materials, appropriate operations and maintenance are carried out as a whole across almost all of the sub-projects. The sewage treatment plants as well as purification plants are operated 24 hours a day in three shifts with a three- to four-person crew on average. Daily cleaning of storm sewer networks is carried out in two shifts with a one-person crew. Periodic inspections of drainpipes and water pipe networks are conducted once a month or once every two months. The following are the points requiring improvement, clarified through inspections and hearing:

[23] Contracts between the project implementing departments and the people's governments of the city and counties contain provisions for water and sewerage charges, charge adjustment, charging etc., presenting that operation and maintenance costs are to be complemented by allotting treasury funds of the People's Government of Bengbu City if these costs cannot be covered by income from the charges.

1) It is necessary to conduct thorough on-site safety management, tool decluttering and cleaning. Especially at the sewage treatment plant in Guzhen County, as the resident staff keep livestock, it is necessary to thoroughly separate the facilities and the equipment from the living space in order to ensure both safety management and appropriate operation and maintenance.
2) Bengbu Zhongyang Environment & Waterworks Co., Ltd., carrying out operation and maintenance of a purification plant in Huaiyuan County, had just taken over operations in January 2018, so they were still making ongoing repairs even at the time of the ex-post evaluation. The purification plant has been normally operated, but additional investment needs to be made to ensure the domestic major company's quality, and to secure the necessary budget and to be sure of implementing it because a plan to upgrade the facilities and equipment is being made.
3) Regarding the acquisition of spare parts, Anhui Riguang Waterworks Co., Ltd., undertaking operation and maintenance of the sewage treatment plant in Guzhen County, is examining replacement with domestic machinery and equipment, saying that the machinery and materials at the treatment plant include imported items (mostly pumps) and it takes time to acquire parts. The other project implementing departments use machinery, materials, equipment, chemicals etc. domestically produced or available in China. These have no problems.
4) Regarding the necessity and planning of future facility improvements and equipment renewals, the maintenance of submersible pumps was being carried out at sewage treatment plants and purification plants when the external evaluator's team conducted its inspections. Thus, it was confirmed that measures for pumping stations were taken such as introducing in-house power generation to respond to sudden power outages, but detailed information was not offered.

As described above, through inspections and interviews with the project implementing departments during the on-site investigation, it was found that all equipment is generally being well operated and maintained. All the project implementing departments have implemented more efficient facility operation, new equipment introduction etc., and are always trying to make improvements.

No major problems have been observed in the institutional/organizational, technical, financial aspects and current status of the operation and maintenance system. Therefore sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented in Bengbu City, Anhui Province, People's Republic of China (urban area, Huaiyuan County, Wuhe County, and Guzhen County), in order to reduce the amount of water pollutants discharged into the Huai River and ensure the stable supply of safe water by developing water supply and sewerage facilities, thereby contributing to improvement of the living environment for the residents in the said area. The project is sufficiently consistent with the development plans, environmental protection plans, and development needs of both China and Bengbu City at the time of the appraisal and the ex-post evaluation, as well as Japan's ODA policy toward China at the time of the appraisal; therefore, its relevance is high. Because the outputs were partly reduced, the project cost remained within the plan although the project was affected by soaring prices. The efficiency of the project is fair because the project period was much longer than initially planned mainly owing to the change of project sites and the various bidding procedures required. The outcome expected as the effect of the project was to reduce the amount of water pollutants discharged into the Huai River and to ensure the stable supply of safe water. The effectiveness of the project is high because both its sewage treatment and water purification plants have achieved or have largely achieved the operation and effect indicators set at the time of the appraisal. It also became clear through group interviews with

beneficiaries that the development of the water supply and sewerage facilities contributed to improving the living environment for the residents, which is the expected impact of the project. In addition, the project significantly helped improve two indicators: the percentage of people who can use the improved source of drinking water continuously and the percentage of those who can use the improved sanitation facilities. Furthermore, the water quality of the Huai River is continuing to improve. Land acquisition was carried out appropriately according to the relevant internal procedures in China, and no resettlement of residents occurred. During the construction work and at the time of the ex-post evaluation, impacts on the natural environment were monitored appropriately with environmental measures taken, and no negative impact was confirmed. Based on the foregoing, the effectiveness and impacts of the project is high, because its effect was confirmed as initially planned. No major problems have been observed in the institutional, organizational, technical, financial aspects and current status of the operation and maintenance system of the ten companies that were responsible for the operation of the project. Therefore, sustainability of the project effects is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

1) Auhui Riguang Waterworks Co., Ltd.: As described in "3.4.4 Status of Operation and Maintenance," to ensure safe and proper operation and maintenance, clearly and thoroughly separate the sewage treatment facility and equipment from the living space of staff including the livestock as soon as possible at the sewage treatment plant in the Guzhen economic development zone.
2) Bengbu Zhongyang Environment & Waterworks Co., Ltd.: Operation and maintenance of the first purification plant of Bengbu Zhongyang Environment & Waterworks Co., Ltd. was taken over in 2018, with the upgrading of facilities and equipment being implemented based on a plan. Some parts of the purification plant are getting older. Accordingly, secure the budget necessary to implement the plan, and continue the stable supply of safe water.

4.2.2 Recommendations to JICA

Confirm that the measures described in "4.2.1 Recommendations to the Executing Agency" have been implemented and inform the executing agency to continue with the efforts so that project's effects will continue to be realized.

4.3 Lessons Learned

- Appropriate change of project contents and secure production of project effects through thorough intermediate supervision

In this project, a major change was made to the project scope, but it was clarified at the time of the ex-post evaluation that this change had not gone through the process of consultation with and approval of JICA. Although this did not affect the relevance or production of project effects in this project, the need for intermediate supervision was identified for this project from the beginning of the appraisal, so it can be said that this project had the risk of a negative impact on the relevance or production of project effects. According to interviews with the executing agencies, this was attributed to a lack of smooth communication between the executing agency, the procurement management consultant for China, and JICA China Office. Even if many projects are implemented across a broad area like China, it is necessary to thoroughly take the necessary follow-up steps such as submission and scrutiny of progress reports from the executing agencies, and thoroughly implement procedures aimed at the secure production of project effects.

- To set the indicators and targets of effectiveness, record the bases used for the process and always check the consistency of any recorded contents:

In this project, regarding the targets of the operation and effect indicators, there was no

consistency established between the contents of the ex-ante evaluation and the contents of the materials at the time of the appraisal, which hindered a smooth ex-post evaluation. Operation and effect indicators are critical elements for project management and indispensable information to fully understand the production status of project effects, project course corrections, etc. In the case of a project with numerous sub-projects like this one, breakdowns according to sub-projects are often unspecified on the ex-ante evaluation. However, it is normally necessary that the bases can at least be seen in the materials at the time of the appraisal. Moreover, in other projects, it is important to check the definition and setting of the operation and effect indicators, the calculation methods of the targets, etc. in order to prevent any mistakes, and to keep those with materials as their bases. It is also desirable to reset the targets promptly when any change of project scope is made like in this project.

End

Attachment to Financial Aspect of Operation and Maintenance: Profit and Loss Accounts of the Project Implementing Departments

Unit: 10000 yuan

【Urban Area】

Name of project executing department/ item	Detailed item	2015	2016	2017	2018
General Water of China (Bengbu) Sewage Co., Ltd. (Urban Area Waste Water Treatment Plant)					
Income	Income from charges	3,911.2	3,927.8	4,382.0	4,846.9
	Subsidy	191.8	380.6	384.2	386.5
	Other income	2.8	50.4	3.1	0.1
	Subtotal	4,105.8	4,358.8	4,769.3	5,233.5
Operation and Maintenance Expense	Personnel expenses*	343.5	344.3	399.1	406.2
	Other expenses**	4,163.4	3,987.8	4,087.7	3,960.5
	Subtotal	4,506.9	4,332.1	4,486.8	4,366.8
Balance		▲ 401	27	283	866.7

Name of project executing department/ item	Detailed item	2015	2016	2017	2018
Bengbu Municipal Sewerage Co., Ltd. (Urban area sewer pipe network)					
Income	Income from charges	0.0	0.0	0.0	0.0
	Subsidy	35.9	37.9	53.9	63.9
	Sutotal	35.9	37.9	53.9	63.9
Operation and Maintenance Expense	Personnel expenses*	7.9	7.9	7.9	7.9
	Other expenses**	28.0	30.0	46.0	56.0
	Subtotal	35.9	37.9	53.9	63.9
Balance		0.0	0.0	0.0	0.0

Name of project executing department/ item	Detailed item	2015	2016	2017	2018
Bengbu Second Municipal Company (Urban area rainwater pipe network)					
Income	Income from charges	0.0	0.0	0.0	0.0
	Subsidy	400.0	450.0	500.0	500.0
	Sutotal	400.0	450.0	500.0	500.0
Operation and Maintenance Expense	Personnel expenses*	200.0	250.0	300.0	300.0
	Other expenses**	200.0	200.0	200.0	200.0
	Subtotal	400.0	450.0	500.0	500.0
Balance		0.0	0.0	0.0	0.0

【Huaiyuan County】

Name of project executing department/ item	Detailed item	2015	2016	2017	2018
Guozhen Sewage Treatment Co., Ltd. of Huaiyuan County (Sewer pipe network)					
Income	Income from charges	630.0	655.0	720.0	618.0
	Subsidy	88.0	90.0	90.0	90.0
	Other income (if any)	0.0	0.0	0.0	0.0
	Subtotal	718.0	745.0	810.0	708.0
Operation and Maintenance Expense	Personnel expenses*	360.0	368.0	373.0	378.0
	Other expenses**	279.0	261.0	320.0	330.0
	Subtotal	639.0	629.0	693.0	708.0
Balance		79.0	116.0	117.0	0.0

Name of project executing department/ item	Detailed item	2015	2016	2017	2018
General Water of China (Bengbu) Co., Ltd. (Water supply project)					
Income	Income from charges	421.0	435.0	564.0	592.0
	Subsidy	0.0	0.0	0.0	0.8
	Sutotal	421.0	435.0	564.0	592.0
Operation and Maintenance Expense	Personnel expenses*	128.3	156.3	163.9	175.0
	Other expenses**	225.0	212.9	269.4	280.0
	Subtotal	353.3	369.2	433.3	455.0
Balance		67.7	65.8	130.7	137.0

【Wuhu District】

Name of project executing department/ item	Detailed item	2015	2016	2017	2018
Municipal Company of Wuhe County (Sewer pipe network)					
Income	Income from charges	23.7	26.1	28.7	31.6
	Subsidy	NA	NA	NA	NA
	Sutotal	23.7	26.1	28.7	31.6
Operation and Maintenance Expense	Personnel expenses*	16.8	18.9	19.9	20.9
	Other expenses**	23.4	27.8	25.4	28.4
	Subtotal	40.2	46.7	45.3	49.3
Balance		▲ 16.5	▲ 20.6	▲ 16.6	▲ 17.7

Name of project executing department/ item	Detailed item	2015	2016	2017	2018
Jingyuan Water Affairs Co., Ltd. of Wuhe County (Water supply pipe network)					
Income	Income from charges	0.0	0.0	0.0	0.0
	Subsidy	18.0	19.0	19.0	20.0
	Other income	260.0	270.0	270.0	290.0
	Subtotal	278.0	289.0	289.0	310.0
Operation and Maintenance Expense	Personnel expenses*	18.0	19.0	19.0	7.9
	Other expenses**	26.0	27.0	27.0	30.0
	Subtotal	44.0	46.0	46.0	37.9
Balance		234.0	243.0	243.0	272.1

【Guzhen County】

Name of project executing department/ item	Detailed item	2015	2016	2017	2018
Anhui Sunshine Water Affairs Co., Ltd. (Industrial park sewarage project)					
Income	Income from charges	0.0	0.0	0.0	0.0
	Subsidy	370.0	450.0	520.0	562.0
	Other income	0.0	0.0	0.0	0.0
	Subtotal	370.0	450.0	520.0	562.0
Operation and Maintenance Expense	Personnel expenses*	190.0	190.0	190.0	190.0
	Other expenses**	180.0	260.0	330.0	372.0
	Subtotal	370.0	450.0	520.0	562.0
Balance		0.0	0.0	0.0	0.0

Name of project executing department/ item	Detailed item	2015	2016	2017	2018
General Water of China (Bengbu) Co., Ltd. (Industrial park water supply project)					
Income	Income from charges	0.0	0.0	0.0	0.0
	Subsidy	217.0	272.0	282.0	265.0
	Other income	0.0	0.0	0.0	0.0
	Subtotal	217.0	272.0	282.0	265.0
Operation and Maintenance Expense	Personnel expenses*	197.0	197.0	197.0	197.0
	Other expenses**	20.0	75.0	85.0	68.0
	Subtotal	217.0	272.0	282.0	265.0
Balance		0.0	0.0	0.0	0.0

Source: Documents provided by the executing agency

*: Information provided by Wuhe County Pople's Government.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
(1) Project Outputs Facility construction and procured equipment [Urban area] <u>Sewerage improvement</u>		
1. Sewage pipes and drains	158 km (sewer pipe network: 9.9 km, storm sewer network: 148.4 km)	165 km (sewer pipe network: 9.9 km, storm sewer network: 148 km)
2. Sewage treatment plants	1 location: new construction (A2O process*, 200,000 m^3/day)	As planned
3. Pumping stations	1 location	As planned
[Huaiyuan County] <u>Sewerage improvement</u>		
1. Sewage pipes and drains	169 km (No detailed information)	167 km (sewer pipe network: 59 km, storm sewer network: 108 km)
2. Sewage treatment plants	1 location: new construction (A2O process, 20,000 m^3/day)	Cancelled
3. Pumping stations	2 locations	As planned
<u>Water supply improvement</u>		
4. Water supply pipes and drains	67 km	As planned
5. Purification plants	1 location: additional construction (30,000 m^3/day)	As planned (site change)
6. Pumping stations	1 location	As planned
[Wuhe County] <u>Sewerage improvement</u>		
1. Sewage pipes and drains	48 km (sewer pipe network: 219 km, storm sewer network: 21 km)	As planned
<u>Water supply</u>		
2. Water supply pipes and drains	43 km	As planned
[Guzhen County] <u>Sewerage improvement</u> Industrial park		
1. Sewage pipes and drains	15 km (sewer pipe network)	As planned
2. Sewage treatment plants	1 location: new construction (A2O process, 20,000 m^3/day)	As planned
<u>Water supply improvement</u> A. Industrial park		
1. Water supply pipes and drains	22 km (water pipe network: 15 km, intake pipes: 7 km)	As planned
2. Purification plants	1 location: new construction (20,000 m^3/day)	As planned
3. Pumping stations	1 location	As planned
B. County capital		
4. Water supply pipes and drains	39 km	Cancelled

5. Purification plants	1 location: new construction (10,000 m^3/day)	Cancelled
6. Pumping stations	1 location	Cancelled
[Training]		
1. Targets and number of people	Managers (10 people each time) and engineers (10 people each time) at the executing agencies or project implementing departments	Managers at the executing agencies or project implementing departments (a total of 16 people twice)
2. Content	Waterworks and sewerage works in Japan	Environmental policies, operation and maintenance of waterworks and sewerage, water charges etc. in Japan
3. Period and number of times	October and November 2007, twice in total	December 12–25, 2009 and November 7–18, 2010, twice in total
(2) Project Period	March 2007–December 2010 3 years 10 months (46 months)	March 2007–May 2016 9 years 3 months (111 months)
(3) Project Cost		
Amount Paid in Foreign Currency	9,271 million yen	7,725 million yen
Amount Paid in Local Currency	7,765 million yen (524 million yuan)	5,567 million yen (386 million yuan)
Total	17,036 million yen	13,292 million yen
ODA Loan Portion	8,400 million yen	7,725million yen
Exchange Rate	1 yuan＝14.8 yen (As of December 2006)	1 yuan＝14.43 yen (Average between March 2008 and May 2015)
(4) Final Disbursement	September 2015	

End