IMPLEMENTATION COMPLETION AND RESULTS REPORT
(IBRD-76840)

ON A

LOAN

IN THE AMOUNT OF US$130.0 MILLION

TO THE

PEOPLE’S REPUBLIC OF CHINA

FOR A

JIANGSU WATER AND WASTEWATER PROJECT

June 7, 2016

Water Global Practice
China and Mongolia Country Management Unit
East Asia and Pacific Region
CURRENCY EQUIVALENTS

(Exchange Rate Effective May 31, 2016)

Currency Unit = Renminbi (RMB)
RMB1.00 = US$0.15
US$1.00 = RMB6.57

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

AAA     Analytical and Advisory Assistance
CEA     Consolidated Environmental Assessment
CNAO    China National Audit Office
COD     Chemical Oxygen Demand
CPMO    City Project Management Office
CPS     Country Partnership Strategy
DO      Development Objectives
EA      Environmental Assessment
EIA     Environmental Impact Assessment
EIRR    Economic Internal Rate of Return
EMP     Environmental Management Plan
EPB     Environmental Protection Bureau
FB      Finance Bureau
FIRR    Financial Internal Rate of Return
FM      Financial Management
FMS     Financial Management Specialist
GDP     Gross Domestic Product
GIS     Geographic Information System
ICB     International Competitive Bidding
ICR     Implementation Completion and Results
IBRD    International Bank for Reconstruction and Development
IP      Implementation Progress
JPFD    Jiangsu Provincial Finance Department
JWWP    Jiangsu Water and Wastewater Project
KPI     Key Performance Indicator
LA      Land Acquisition
M&E     Monitoring and Evaluation
MTR     Mid Term Review
NCB     National Competitive Bidding
NMWGC   Nanjing Municipal Water Group Company
NRW     Non-Revenue Water
PAD     Project Appraisal Document
PDO     Project Development Objective
PIU     Project Implementing Units
PPMO    Provincial Project Management Office
PMO     Project Management Office
RAP     Resettlement Action Plan
RF  Results Framework
RP  Resettlement Plans
RPF  Resettlement Policy Framework
SEPA  State Environmental Protection Bureau
TA  Technical Assistance
VO  Variation Order
WTP  Water Treatment Plant
WWTP  Wastewater Treatment Plant

Regional Vice President: Victoria Kwakwa
Country Director: Bert Hofman
Senior Global Practice Director: Jennifer Sara
  Practice Manager: Ousmane Dione
  Project Team Leader: Khairy Al-Jamal
  ICR Principal Author: Heinrich K. Unger
PEOPLE’S REPUBLIC OF CHINA
Jiangsu Water and Wastewater Project

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MAP IBRD No. 36486
A. Basic Information

<table>
<thead>
<tr>
<th>Country:</th>
<th>China</th>
<th>Project Name:</th>
<th>Jiangsu Water and Wastewater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project ID:</td>
<td>P096926</td>
<td>L/C/TF Number(s):</td>
<td>IBRD-76840</td>
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<tr>
<td>ICR Date:</td>
<td>11/13/2015</td>
<td>ICR Type:</td>
<td>Core ICR</td>
</tr>
<tr>
<td>Lending Instrument:</td>
<td>SIL</td>
<td>Borrower:</td>
<td>PEOPLE'S REPUBLIC OF CHINA</td>
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<tr>
<td>Original Total Commitment:</td>
<td>USD 130.00M</td>
<td>Disbursed Amount:</td>
<td>USD 129.20M</td>
</tr>
<tr>
<td>Revised Amount:</td>
<td>USD 130.00M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Category:</td>
<td>B</td>
<td></td>
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</table>

Implementing Agencies:
Jiangsu Provincial Project Management Office

Cofinanciers and Other External Partners:

B. Key Dates

<table>
<thead>
<tr>
<th>Process</th>
<th>Date</th>
<th>Process</th>
<th>Original Date</th>
<th>Revised / Actual Date(s)</th>
</tr>
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<tbody>
<tr>
<td>Appraisal:</td>
<td>09/09/2008</td>
<td>Restructuring(s):</td>
<td></td>
<td>11/21/2013 03/11/2015</td>
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<tr>
<td>Approval:</td>
<td>06/02/2009</td>
<td>Mid-term Review:</td>
<td>05/28/2012</td>
<td>11/05/2012</td>
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<tr>
<td>Closing:</td>
<td></td>
<td></td>
<td>12/31/2014</td>
<td>12/31/2015</td>
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C. Ratings Summary

C.1 Performance Rating by ICR

<table>
<thead>
<tr>
<th>Outcomes:</th>
<th>Highly Satisfactory</th>
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<tbody>
<tr>
<td>Risk to Development Outcome:</td>
<td>Low</td>
</tr>
<tr>
<td>Bank Performance:</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Borrower Performance:</td>
<td>Satisfactory</td>
</tr>
</tbody>
</table>

C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)

<table>
<thead>
<tr>
<th>Bank</th>
<th>Ratings</th>
<th>Bank</th>
<th>Ratings</th>
</tr>
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<tbody>
<tr>
<td>Quality at Entry:</td>
<td>Satisfactory</td>
<td>Government:</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Quality of Supervision:</td>
<td>Satisfactory</td>
<td>Implementing Agency/Agencies:</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Overall Bank Performance:</td>
<td>Satisfactory</td>
<td>Overall Borrower Performance:</td>
<td>Satisfactory</td>
</tr>
</tbody>
</table>
C.3 Quality at Entry and Implementation Performance Indicators

<table>
<thead>
<tr>
<th>ImplementationPerformance</th>
<th>Indicators</th>
<th>QAG Assessments(if any)</th>
<th>Rating</th>
</tr>
</thead>
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<tr>
<td>Potential Problem Project at any time (Yes/No):</td>
<td>No</td>
<td>Quality at Entry (QEA):</td>
<td>None</td>
</tr>
<tr>
<td>Problem Project at any time (Yes/No):</td>
<td>No</td>
<td>Quality of Supervision (QSA):</td>
<td>None</td>
</tr>
<tr>
<td>DO rating before Closing/inactive status:</td>
<td>Satisfactory</td>
<td></td>
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D. Sector and Theme Codes

<table>
<thead>
<tr>
<th>Sector Code (as % of total Bank financing)</th>
<th>Original</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public administration- Water, sanitation and flood protection</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Wastewater Collection and Transportation</td>
<td>26</td>
<td>20</td>
</tr>
<tr>
<td>Wastewater Treatment and Disposal</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Water supply</td>
<td>49</td>
<td>55</td>
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</table>

<table>
<thead>
<tr>
<th>Theme Code (as % of total Bank financing)</th>
<th>Original</th>
<th>Actual</th>
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</thead>
<tbody>
<tr>
<td>City-wide Infrastructure and Service Delivery</td>
<td>75</td>
<td>70</td>
</tr>
<tr>
<td>Pollution management and environmental health</td>
<td>25</td>
<td>30</td>
</tr>
</tbody>
</table>

E. Bank Staff

<table>
<thead>
<tr>
<th>Positions</th>
<th>At ICR</th>
<th>At Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vice President:</td>
<td>Victoria Kwakwa</td>
<td>James W. Adams</td>
</tr>
<tr>
<td>Country Director:</td>
<td>Bert Hofman</td>
<td>David R. Dollar</td>
</tr>
<tr>
<td>Practice Manager/Manager:</td>
<td>Ousmane Dione</td>
<td>Ede Jorge Ijjasz-Vasquez</td>
</tr>
<tr>
<td>Project Team Leader:</td>
<td>Khairy Al-Jamal</td>
<td>Mara Warwick / Mingyuan Fan</td>
</tr>
<tr>
<td>ICR Team Leader:</td>
<td>Khairy Al-Jamal</td>
<td></td>
</tr>
<tr>
<td>ICR Primary Author:</td>
<td>Heinrich K. Unger</td>
<td></td>
</tr>
</tbody>
</table>

F. Results Framework Analysis

Project Development Objectives (from Project Appraisal Document)
The project development objective was to improve the efficiency and effectiveness of water and wastewater services and reduce pollution discharges in local rivers in Jiangsu Province.
Revised Project Development Objectives (as approved by original approving authority)

The Project Development Objectives (PDO) were not revised.

(a) PDO Indicators

<table>
<thead>
<tr>
<th>Indicator 1</th>
<th>Baseline Value</th>
<th>Original Target Values (from approval documents)</th>
<th>Formally Revised Target Values</th>
<th>Actual Value Achieved at Completion or Target Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coverage of water supply in project cities/towns (percent)</td>
<td>96% for cities 78% for towns</td>
<td>98% for cities 92% for towns</td>
<td>98% for cities 93% for towns</td>
<td>99.8% for cities 100% for towns</td>
</tr>
<tr>
<td>Date achieved</td>
<td>04/16/2008</td>
<td>12/31/2014</td>
<td>11/21/2013</td>
<td>12/31/2015</td>
</tr>
<tr>
<td>Comments (incl. % achievement)</td>
<td>Target was exceeded: Zhenjiang achieved 99%, and other 4 cities 100%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Indicator 2 | Non-revenue water (NRW) average over supply area of 4 city water companies (percent) | 27% | 22% | 22% |
| Date achieved | 04/16/2008 | 12/31/2014 | 12/31/2015 |
| Comments (incl. % achievement) | Target was achieved. Weighted average NRW percentage from four cities was used to calculate indicator values |

| Indicator 3.1 | Total annual COD load reduction from municipal wastewater in project catchment area in Taixing - Huangqiao (in tons) | 0 | 1,825 | Indicator dropped | N/A |
| Date achieved | 04/16/2008 | 12/31/2014 | 11/21/2013 | 12/31/2015 |
| Comments (incl. % achievement) | The Taixing - Huangqiao sub-component was dropped from the project as part of the November 2013 restructuring. However, the proposed WWTP was built under BOT |

| Indicator 3.2 | Total annual COD load reduction from municipal wastewater in project catchment area in all other areas (in tons) | 18,302 | 39,436 | 43,000 | 60,729 |
| Date achieved | 04/16/2008 | 12/31/2014 | 11/21/2013 | 12/31/2015 |
| Comments (incl. % achievement) | The target was substantially exceeded by the two WWTPs in Nanjing, i.e., Qiaobei and Tiebei |
(b) Intermediate Outcome Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Baseline Value</th>
<th>Original Target Values (from approval documents)</th>
<th>Formally Revised Target Values</th>
<th>Actual Value Achieved at Completion or Target Years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicator 1.1</strong></td>
<td><strong>Number of project towns with 24-hour water supply</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value (quantitative or qualitative)</td>
<td>40</td>
<td>50</td>
<td>52</td>
<td>84</td>
</tr>
<tr>
<td>Date achieved</td>
<td>04/16/2008</td>
<td>12/31/2014</td>
<td>11/21/2013</td>
<td>12/31/2015</td>
</tr>
<tr>
<td>Comments (incl. % achievement)</td>
<td></td>
<td></td>
<td></td>
<td>The target was substantially exceeded.</td>
</tr>
<tr>
<td><strong>Indicator 1.2</strong></td>
<td><strong>Number of project towns receiving city water supply</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value (quantitative or qualitative)</td>
<td>14</td>
<td>68</td>
<td></td>
<td>70</td>
</tr>
<tr>
<td>Date achieved</td>
<td>04/16/2008</td>
<td>12/31/2014</td>
<td></td>
<td>12/31/2015</td>
</tr>
<tr>
<td>Comments (incl. % achievement)</td>
<td></td>
<td></td>
<td></td>
<td>The target was fully achieved.</td>
</tr>
<tr>
<td><strong>Indicator 1.3</strong></td>
<td><strong>Number of project towns with NRW at or below target determined in NRW reduction strategy(^1)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value (quantitative or qualitative)</td>
<td>18</td>
<td>51</td>
<td></td>
<td>58</td>
</tr>
<tr>
<td>Date achieved</td>
<td>04/16/2008</td>
<td>12/31/2014</td>
<td></td>
<td>12/31/2015</td>
</tr>
<tr>
<td>Comments (incl. % achievement)</td>
<td></td>
<td></td>
<td></td>
<td>Target was exceeded.</td>
</tr>
<tr>
<td><strong>Indicator 2.1</strong></td>
<td><strong>Coverage of wastewater service in project cities (percent)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value (quantitative or qualitative)</td>
<td>67%</td>
<td>80%</td>
<td>83%</td>
<td>95%</td>
</tr>
<tr>
<td>Date achieved</td>
<td>04/16/2008</td>
<td>12/31/2014</td>
<td>11/21/2013</td>
<td>12/31/2015</td>
</tr>
<tr>
<td>Comments (incl. % achievement)</td>
<td></td>
<td></td>
<td></td>
<td>Target was exceeded significantly by Nanjing. Dayang and Taixing were cancelled by the November 2013 restructuring.</td>
</tr>
<tr>
<td><strong>Indicator 2.2</strong></td>
<td><strong>Ratio of municipal wastewater generated to treated wastewater in project cities (percent)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>50%</td>
<td>81%</td>
<td>83%</td>
<td>100%</td>
</tr>
</tbody>
</table>

\(^1\) The NRW strategy consisted of: improved pressure management; reinforced leakage detection capabilities; improved customers’ meter management; improved asset management; and City water supply companies were to take over towns and reorganize and improve town systems management.
(quantitative or qualitative) | Date achieved | Comments (incl. % achievement)
---|---|---
| 04/16/2008 | Target was exceeded significantly by Nanjing. Dayang and Taixing were cancelled by the November 2013 restructuring.

**Indicator 3.1**: Proportion of total revenue to total expenditure for wastewater services in project cities (ratio)

| Value (quantitative or qualitative) | Date achieved | Comments (incl. % achievement)
---|---|---
| 0.63 | 04/16/2008 | Wastewater components were dropped N/A

**Indicator 3.2**: Ratio of cost recovery from imposed tariff of wastewater in project cities (ratio)

| Value (quantitative or qualitative) | Date achieved | Comments (incl. % achievement)
---|---|---
| 1.03 | 04/16/2008 | Wastewater components were dropped N/A

(c) Core Sector Indicators

This project was approved before core sector indicators (CSI) became mandatory but project restructuring in November 2013 added three CSI for which baseline were readily available but no specific targets were set.

| Core Sector Indicator | Baseline | Achievement |
---|---|---|
Direct project beneficiaries (number) | 0 | 4,769,000 |
- of which female (percentage) | N/A | 48.5 |
Water utilities that the project is supporting (number) | 0 | 5 |
Volume of BOD pollution loads removed by the treatment plants supported under the project (tons/year) | 0 | 1,792 |

**G. Ratings of Project Performance in ISRs**

| No. | Date ISR Archived | DO | IP | Actual Disbursements (USD millions) |
---|---|---|---|---|
1 | 05/12/2010 | Satisfactory | Satisfactory | 8.00 |
2 | 04/14/2011 | Satisfactory | Satisfactory | 46.97 |
3 | 04/04/2012 | Satisfactory | Satisfactory | 73.28 |
4 | 03/31/2013 | Satisfactory | Satisfactory | 86.58 |
5 | 12/16/2013 | Satisfactory | Satisfactory | 92.13 |
<table>
<thead>
<tr>
<th>Restructuring Date(s)</th>
<th>Board Approved PDO Change</th>
<th>ISR Ratings at Restructuring</th>
<th>Amount Disbursed at Restructuring in USD millions</th>
<th>Reason for Restructuring &amp; Key Changes Made</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/24/2014</td>
<td>Satisfactory</td>
<td>Satisfactory</td>
<td>92.13</td>
<td>1. The following sub-components were dropped from the project: (i) Danyang wastewater system, because of lack of progress with land acquisition; (ii) Taixing-Huangqiao WWTP because the facility was built under a BOT scheme; and (iii) part of institutional TA associated with Taixing sub-component.</td>
</tr>
<tr>
<td>11/29/2014</td>
<td>Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>96.19</td>
<td>2. The scope of the following sub-components was reduced: (i) Yancheng water supply system, due to use of non-Bank financing; and (ii) Nanjing-Tiebei wastewater collection system, due to delays in the linked construction of roads.</td>
</tr>
<tr>
<td>06/08/2015</td>
<td>Satisfactory</td>
<td>Satisfactory</td>
<td>119.20</td>
<td>3. To utilize loan savings from dropped items, the following were added: (i) Longtan WTP in Nanjing, and (ii) water supply system extension in Taixing. The loan was reallocated accordingly.</td>
</tr>
<tr>
<td>11/21/2013</td>
<td>N/A</td>
<td>S</td>
<td>92.13</td>
<td>4. Closing date was extended by one year to December 31, 2015 to allow completion of the additional sub-components.</td>
</tr>
<tr>
<td>03/11/2015</td>
<td>S</td>
<td>S</td>
<td>108.34</td>
<td>Disbursement percentage was increased from 50 to 80% for Longtan WTP to allow full utilization of the loan.</td>
</tr>
</tbody>
</table>

H. Restructurings
I. Disbursement Profile

![Disbursement Profile Graph]

- Original
- Formally Revised
- Actual

US $ Millions

Year

2009 Q4
2010 Q2
2011 Q2
2011 Q4
2012 Q2
2012 Q4
2013 Q2
2013 Q4
2014 Q2
2014 Q4
2015 Q2
2015 Q4
2016 Q2
2016 Q4
1. Project Context, Development Objectives and Design

1. Jiangsu is an economically important province in central eastern China. It has a population of about 75 million and, in 2007, had an average GDP per capita of approximately RMB 27,200 (US$4,000) which was the second highest provincial GDP in the country (after Guangdong province). Jiangsu’s economic success is mainly concentrated in the prosperous southern areas around the Changjiang Delta region where the capital city of Nanjing (current population about 7 million) is located. The Changjiang Delta region is water-rich but increasing pollution of surface waters had created a scarcity of adequate quality water for residential and industrial needs, and this has been limiting development in the province, especially in southern Jiangsu. In July 2007, a severe algal bloom in Lake Tai, an important water source for several large cities in Jiangsu, caused the emergency shutdown of the Wuxi City water supply system. Similar problems in smaller rivers and canals were causing frequent disruptions to water supply systems in Jiangsu’s towns and peri-urban areas and, for this reason, many town and peri-urban water providers had reverted to groundwater sources. This resulted in over-extraction and quality deterioration of groundwater, as well as saltwater intrusion in coastal areas. At the time, scarcity of adequate quality water was considered to be one of the most crucial limiting factors for sustainability of water supply systems and future development in the province.

1.1 Context at Appraisal

2. The proposed project interventions were fully consistent with the Bank Group’s 2006 – 2010 China Country Partnership Strategy (CPS) with its focus on managing resource scarcity and environmental challenges. The sub-components also were in line with the objectives of China’s 11th Five-year Plan (2006-10) that aimed to create a “harmonious society” that balances economic growth with distributional and environmental concerns. To address issues of water quality and water supply security, Jiangsu Provincial Government had adopted a forward-looking water resources management strategy to concurrently reorganize and develop the water supply and wastewater service sectors. This strategy, which was under implementation prior to appraisal, included the following key sectoral reforms and developments: (a) reorganization of the water supply sector to provide sustainable and better quality water to all residents and industrial users of the province, including those in towns, villages and peri-urban areas; and (b) rapid expansion of the provision of wastewater services in the province and raising of wastewater discharge standards, especially in highly sensitive environments.

3. Jiangsu Province had also chosen a strategy of municipal water supply expansion and aggregation as a way to address the poor sustainability of the water supply sector. Prior to 2000, all city, town and village water supply systems in the province were institutionally and physically separate. This high degree of fragmentation of the sector resulted in low efficiency and poor quality of water supply, especially in rural and urbanizing areas. While the provincial government is responsible for policy matters and oversight, the water supply and wastewater companies report to their respective municipal governments. Through a series of planning pilots in the most highly developed southern region, Jiangsu Province developed a model for replacing the smaller systems by expanding services from the urban
cores into the surrounding peri-urban and rural areas. Where possible, the program promoted the use of the higher-quality, more reliable Changjiang River as the raw water source. Furthermore, it was thought that through the expansion of city systems to peri-urban and rural areas, water service standards, including pressure, quality and leakage, could be improved. In some cases, that program also included the institutional aggregation of town and village water supply companies with larger city providers. In others, a system of bulk sales from the city system to the town and village providers was the preferred solution.

4. Jiangsu Province was relatively successful in developing wastewater systems for newly urbanizing areas in its cities, but less successful in effectively retrofitting services into older urban areas, especially those undergoing redevelopment. Many of the large cities and towns in Jiangsu, including the capital Nanjing, did not have wastewater services in the oldest, most heavily urbanized areas. Wastewater service provision to smaller communities in towns and villages was also lagging. In this context, in 2007, Jiangsu Provincial Government had issued a new provincial regulation that required wastewater treatment to Class 1A discharge standards. This implied tertiary treatment, irrespective of influent quality, pollution load, town size, affordability and capacity to operate sophisticated systems. The higher discharge standard was predicated by the importance attached by the Province and central government to water quality in the Lake Tai and Changjiang River areas, where considerable efforts were being made to improve or maintain water quality.

5. Jiangsu Province’s plans for water supply aggregation and wastewater service expansion brought with it significant challenges for ensuring financial sustainability. The water and wastewater tariff structure in Jiangsu, designed prior to the implementation of the water supply expansion program, was not appropriate for long-term financial sustainability of the program. As a result, short-term tariff adjustment measures had to be taken by the Province in the years leading up to the Project.

6. Lastly, in 2001, Jiangsu province had adopted the *Jiangsu City and Town System Strategic Plan*, which provided strategic direction for urbanization within the province. In line with this plan, the city and town system was reorganized to reflect updated development trends and to improve efficiency. Under the plan, some towns were merged and others absorbed into larger cities nearby. Through this process, the total number of towns in Jiangsu was expected to decrease from 2,000 to about 650 by 2020. The plan encouraged cross-boundary cooperation through regional coordination in environmental management, public infrastructure planning and construction, water resource development and tourism. The restructuring of the province’s water supply system was therefore being conducted consistent with the plan’s overall strategy for developing a more efficient urban structure within the province.
1.2 Original Project Development Objectives (PDO) and Key Indicators

7. The project development objective was to improve the efficiency and effectiveness of water and wastewater services and reduce pollution discharges to local rivers in Jiangsu.

8. Key indicators were: (i) coverage of water supply in project cities / towns; (ii) non-revenue water (NRW) (accounting for both commercial and physical losses) percentage averaged over the supply areas of city water companies; and (iii) total annual COD load reduction from municipal wastewater in project catchment area in (a) Taixing – Huangqiao, and (b) all others.

1.3 Revised PDO (as approved by original approving authority) and Key Indicators, and reasons/justification

9. The PDO were not revised. However, further to the cancelation of sub-component 2(iii) Taixing: Expanding wastewater collection and treatment in Huangqiao Town (see sub-section 1.6 below), the key indicator “total annual COD load reduction from municipal wastewater in project catchment area in Taixing – Huangqiao” was dropped. In addition, the target for key indicator (i) was slightly increased as part of the November 2013 restructuring, and key indicator (iii) (b) was made applicable to Nanjing only and also had its target value increased.

1.4 Main Beneficiaries

10. The water supply investments were to directly benefit 4,769,000 people in 78 towns and villages in Jiangsu province where service expansion was proposed by enhancing the capacity of city water supply systems. Populations in eight separate districts / towns² in the four project cities were expected to benefit from the expansion of the collection and treatment systems for municipal wastewater. Additionally, the project benefited staff of the municipal utilities in project cities through the capacity building and institutional strengthening component of the Project. The focus on project management, financial reform, non-revenue water (NRW) reduction strategies, training and foreign study tours was expected to greatly benefit municipal and utility company staff.

1.5 Original Components

(i) Danyang: Enhancing capacity of Danyang city water supply and expanding supply of treated water to 24 towns.
(ii) Taixing: Enhancing capacity of Taixing city water supply system and expanding supply of treated water to 22 towns, including reduction of NRW in five towns.

² The structural hierarchy of administrative divisions in the People's Republic of China consists of five levels: Provincial level (1st); Prefectural level, e.g., cities (2nd); County level, e.g., districts (3rd); Township level, e.g., towns and sub-districts (4th); and Village level (5th).
(iii) **Yancheng**: Enhancing capacity of Yancheng city water supply system and expanding supply of treated water to 21 towns, including rehabilitation and expansion of water distribution networks and reduction of NRW in two towns, and implementation of a participatory planning pilot in one town.

(iv) **Zhenjiang**: Enhancing the capacity of the Zhenjiang city water supply and expanding supply of treated water to 11 towns, including reduction of NRW in two towns.

12. **Component 2. Wastewater Management (Total cost: US$233.7 million)**
   (i) **Danyang**: Expanding wastewater collection in Shicheng urban district of Danyang city.
   (ii) **Nanjing**: Expanding wastewater collection and treatment in Qiaobei, Tiebei and Chengbei areas of Nanjing city.
   (iii) **Taixing**: Expanding wastewater collection and treatment in Huangqiao Town.

   (i) **Provincial Implementation Support and Capacity Building**: Strengthening and building institutional capacity at the provincial level, including (a) provision of technical assistance for project and contract management, and review of project design; (b) carrying out a study on the existing wastewater and water supply tariff system; (c) developing and piloting strategies to reduce NRW at the township level; and (d) carrying out training and study tours on various aspects of water supply and wastewater management.
   (ii) **Company Capacity Building**: Taixing Huangqiao Wastewater Treatment Company: Strengthening the company’s institutional capacity to manage and implement project activities through provision of technical assistance and training.

14. Project costs – including contingencies, interest during construction and front-end fees – were estimated at appraisal to be US$431.8 million. See Annex 1 for details of appraisal and completion costs.

1.6 **Revised Components**

15. Following the mid-term review (MTR) in November 2012, the project was restructured in November 2013. The following changes were made to project sub-components:
   - 1 (iii) Yangcheng water supply network was reduced substantially in scope;
   - 2 (i) Danyang (Shicheng urban district) wastewater collection system was dropped;
   - 2 (ii) Tiebei wastewater collection system in Nanjing city was reduced in scope;
   - 2 (iii) WWTP in Taixing (Huangqiao Town) was dropped, as the facility was built by a BOT scheme;
   - 3 (ii) institutional capacity building for the Taixing Huangqiao Wastewater Treatment Company was canceled;
   - 1 (v) Taixing Town Water Supply Networks Rehabilitation was added; and
   - 1 (vi) Nanjing Longtan Water Treatment Plant (WTP) was added.
16. As a result, total project costs decreased by about five percent to US$409.8 million. Loan funds were reallocated accordingly and the loan amount did not change.

1.7 Other significant changes

17. The following other significant changes were made:
- As part of the November 2013 restructuring, the closing date of the project was extended by one year to December 31, 2015.
- The March 2015 project restructuring increased the disbursement percentage for the sub-category of Nanjing Longtan WTP (added in November 2013) from 50 to 80 percent to allow full use of the loan funds allocated to that sub-category.
- In March 2013, the original Nanjing Municipal Water Co. Ltd. merged with Nanjing Municipal Drainage Administration into Nanjing Municipal Water Group Co. Ltd.
- Several interim outcome indicators had their target values increased marginally as part of the 2013 restructuring, based on the very good progress made towards achieving the original targets.

2. Key Factors Affecting Implementation and Outcomes

2.1 Project Preparation, Design and Quality at Entry

Rationale for Bank involvement

18. Water supply and wastewater management were – and still are – critical sectors for China. These are also areas of significant Bank expertise. In China, water shortages and water pollution have been constraining growth and affecting public health. Since the early 1990s, the Government of China has consistently requested Bank assistance in this important sector. In 2005 the Bank launched several Analytical and Advisory Assistance (AAA) thematic studies, including one on improving urban water and wastewater utilities. This study identified efficiency, governance, and financial sustainability as key issues affecting the long-term performance of water and wastewater utilities in China. As designed, the Jiangsu Water and Wastewater Project (JWWP) exemplified the Bank’s unique role in China’s water sector. As a limited lender, the Bank always supported innovation where spillover benefits are far greater than the direct benefits of the project itself. Bank involvement was particularly compelling in the case of Jiangsu where innovation in aggregation was homegrown and client-driven; however, it was in need of empirical analysis, a global perspective, and a strategy of diffusion to other provinces; these were all tasks that the Bank was well suited to support.

Project design

19. Pilot projects to implement (i) aggregation of town and village systems into larger city suppliers, and (ii) bulk sales from large city systems to town and village suppliers had been relatively successful in southern Jiangsu. However, the province did not succeed in replicating these pilots in less developed areas due to high investment costs, relatively lower existing connection rates, higher leakage rates in existing town systems, and weak institutional and financial capacities. The project was therefore designed to support the expansion of the Changjiang-based systems in the Nanjing Urban Cluster area. An extensive customer survey conducted in all potential service areas of the project had shown that there was high demand for these services amongst new industrial and residential customers. In addition, the reduction of non-revenue water (NRW), which was a problem in the existing systems in smaller towns, would be addressed concurrently, albeit on a pilot basis.

20. As described further above, large cities in Jiangsu lacked wastewater services in the oldest, densest parts; similarly, many smaller communities in towns and villages were without sewer systems. The project therefore focused its attention on the provision of wastewater services in these areas. One design priority was the reduction of resettlement impacts of the wastewater system retrofits through optimization of design; this principle demonstrated a more sustainable approach to the provision of services in urban areas. To ensure long-term financial sustainability of the municipal sector, project design included a comprehensive review and revision of water supply and wastewater tariff structures for the entire province. By addressing both water supply and wastewater service expansion concurrently, the project was in the unique position to assist Jiangsu to evaluate the true cost of these programs, and to design an equitable and sustainable tariff system that could support both programs concurrently.

21. Project design considered several alternatives for the reorganization of water supply, and eventually adopted the sale of bulk raw or treated water by large cities to smaller towns, complemented by a pilot NRW reduction program to address the serious leakage problems in the outdated town water distribution networks. Two alternatives were considered for the treatment of wastewater: either Class 1A effluent standard (tertiary treatment), which had just been mandated in Jiangsu; or Class 1B (secondary treatment), which was more commonly applied in other parts of China at the time. Although analysis had shown that tertiary treatment would achieve little incremental environmental benefit to the Changjiang River, Class 1A treatment was incorporated into the design of the project WWTPs in order to comply with provincial requirements.

Incorporation of lessons learned

22. The project considered and incorporated recent lessons from: (i) similar Bank projects in China, (ii) assessments by the Independent Evaluation Group, and (iii) relevant
Bank reports covering the urban, water supply and sanitation sectors in China and internationally. For example, recommendations for improving the operational performance of urban water utilities from the water sector study *Stepping Up* were used in the formulation of the project, with respect to: reducing NRW in towns; examining tariff requirements for water and wastewater services; ensuring adequate fiscal support; and recognizing the capabilities of town water supply agencies. Another lesson applied was the use of realistic demand projections based on extensive demand surveys undertaken during project preparation to ensure appropriate sizing of the facilities; some investments were phased to ensure appropriate short and medium term capacity. A lesson from the high cost estimates used in many recent projects led to the consideration of: (i) inflation in construction costs; (ii) relatively faster appreciation of the RMB; and (iii) prevailing market rates and prices during the preparation of cost estimates. Lastly, it was clear from past projects that significant efficiencies and economies of scale were possible through the construction of regional infrastructure, such as jointly financed and shared water supply and wastewater facilities.

*Risks and their mitigation*

23. Project design identified one substantial risk, i.e., that expected demand for water supply may not materialize due to the availability of alternative sources and the higher cost of central supply. This risk was mitigated by the use of: (i) phased expansion of city water supply capacity based on demand; (ii) least-cost approach to reduce investment costs; and (iii) appropriate incentives from the Government for towns to upgrade and connect, i.e., high quality and reliable bulk water supply from city utilities, government grants for network upgrading and rehabilitation, and NRW reduction pilot programs. All other risks were assessed to be modest or low and standard design approaches were used for mitigation. The overall risk rating for the project was Modest.

2.2 Implementation

*Implementation arrangements*

24. The project area included three municipalities (Nanjing, Yancheng and Zhenjiang), two county-level cities (Danyang and Taixing), and seven project implementation units (PIUs) in the above municipalities/cities. Project Management Offices in the province (PPMO) and the project municipalities/cities (CPMO) and also in the PIUs were established for the preparation and implementation of the project, in line with the standard arrangements for such projects in China. Nanjing Urban Construction Investment Group Company was the co-implementation agency for the Nanjing wastewater project.

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Consultants were engaged to provide support to the PPMO, CPMOs and PIUs in project management, procurement, contract management, detailed design review, bid document review, project monitoring and reporting, and to assist in the preparation of the Borrower’s Implementation Completion Report (ICR). The PPMO was responsible for procuring consultant services for project and contract management and design review services, safeguard monitoring and training. PIUs were responsible for carrying out procurement of works, goods and services for their respective activities with the assistance of the procurement agents and design institutes, and the guidance of the PPMO.

Progress and scope changes

25. Project implementation proceeded well, and project performance ratings for DO and IP were Satisfactory throughout the implementation period; there was an IP rating of Moderately Satisfactory in 2014 due to the slower than scheduled construction progress of the new sub-components. The project was never rated “at risk”. However, by early 2012, the PPMO had identified a number of contracts that did not proceed because of the reasons listed in Table 1 below. The PPMO was considering the cancellation of the affected sub-components and was proposing two major new water supply sub-components that would still benefit the same project cities, but would shift the sector balance slightly towards water supply. The achievement of the PDO would not be affected by the proposed changes, and the outcome indicators would not need revision.

26. The mid-term review (MTR) in November 2012 found generally very good progress with the construction of water and wastewater networks, as well as water and wastewater treatment facilities. The majority of the large contracts had been completed and over 60% of the loan had been disbursed – but there was still no formal application for restructuring the project to drop the stalled contracts and re-allocate the resultant loan savings. The MTR resulted in agreement on the scope and details of project restructuring, and the necessary actions, such as additional EAs, EMPs and RAPs. However, it took until November 2013 for the formal restructuring to be concluded and approved. The main changes and their reasons are shown in Table 1 below.

<table>
<thead>
<tr>
<th>CHANGE</th>
<th>REASON</th>
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<tbody>
<tr>
<td>Yangcheng water supply was reduced substantially in scope.</td>
<td>Towns involved used their own financing to construct part of the water supply lines.</td>
</tr>
<tr>
<td>Danyang (Shicheng urban district) wastewater collection system was dropped.</td>
<td>Lack of progress with land acquisition and resettlement of a linked river rehabilitation project.</td>
</tr>
<tr>
<td>Tiebei wastewater collection in Nanjing city was reduced in scope.</td>
<td>Contracts for linked urban roads were delayed and not all sewers could be installed.</td>
</tr>
</tbody>
</table>
Construction of WWTP in Taixing (Huangqiao Town) was dropped. | Local government decided to have the WWTP constructed under a BOT scheme.
---|---
Institutional capacity building TA for the Taixing Huangqiao Wastewater Treatment Company was canceled. | Because of the cancelation of the Huangqiao WWTP, there was no need for the associated institutional capacity building technical assistance.
Taixing Town Water Supply Networks Rehabilitation was added. | Use of loan savings to expand supply system and increase water sales from the new WTP.
Nanjing Longtan WTP was added. | Use of loan savings for new medium/long term WTP for the fast growing Nanjing City.

27. A total of US$21 million was saved by the dropped sub-components and all loan savings were re-allocated to the two new sub-components. To allow the completion of the large additional contracts, the closing date was extended by one year to December 31, 2015. Implementation continued to progress well and the project was completed before the extended completion date.

2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization

28. A comprehensive results framework, including realistic targets, was designed at appraisal to facilitate the measurement and monitoring of project progress towards achieving the PDO. In addition, the format of the semi-annual progress report required monitoring data on all aspects of project implementation, such as financial management (FM), loan disbursements, project scope and changes, implementation progress, land acquisition and resettlement, environmental aspects, and most importantly, project indicators. The system was well designed to generate all necessary M&E data and information.

29. Implementation of the M&E system was slow, and in early 2012 the PPMO and PIUs still did not satisfactorily collect and analyze all the necessary data and information for proper monitoring: project KPIs were not always updated in a timely and appropriate manner. The MTR recommended that the PMOs take full charge of the M&E systems. Starting in 2013, M&E implementation improved considerably, and complete semi-annual progress reports were delivered on time until project closing. The PMOs also showed disaggregated data for the aggregated indicators to better understand and improve the performance of individual project entities.

30. Once timely and complete reports were available, project entities and the Bank utilized the data and information to track progress and achievements. They also monitored the environmental and social aspects of project implementation and dealt with issues and problems as they arose. The timely and satisfactory completion of the project can, at least in part, be attributed to the effective utilization of the M&E system in the later stages of the project. Two intermediate outcome indicators on financial improvement of wastewater
services were dropped because the associated sub-components were dropped as part of the restructuring.

2.4 Safeguard and Fiduciary Compliance

Environment

31. The project was classified as Category B under OP4.01, for three reasons: none of the proposed facilities was located in areas with sensitive receptors which could be adversely influenced by the construction or operation of the facilities; proposed facilities discharge into water bodies with extremely high receiving capacities (i.e., Changjiang River); environmental issues associated with construction activities were limited in extent, were temporary and reversible, and could be readily managed by standard practices of good site management and engineering. During project implementation the original classification was found to have been correct as no serious environmental issues arose.

32. Jiangsu PPMO was responsible for the review of Environment Management Plan (EMP) implementation with the assistance of consultants; it also supervised and reviewed all environmental management activities, such as training, coordination and reporting, based on details included in the respective Project EMPs. Each PIU set up a separate environmental management division, and provided to contractors the detailed requirements for environmental management in construction contracts. To facilitate the smooth implementation of EMPs, targeted on-the-job environmental training was provided to the PIUs. No significant environmental management issues arose, and no complaints related to environmental impacts were received.

33. Both internal and external environmental monitoring was conducted during implementation, and monitoring results for operational plants met national environmental standards. By covering the treatment tanks of Tiebei WWTP, the wastewater utility minimized odor nuisance and avoided resettlement burden – a good solution to solve an environmental and social problem. In the later years of implementation, key water and wastewater quality data were reported regularly in the semi-annual progress reports. Based on the EMPs, the following key environmental mitigation measures were employed: (i) control of air and noise pollution; (ii) control of wastewater pollution; (iii) control of the spreading of solid waste; and (iv) reducing the incidence of traffic conflicts. For the project restructuring in November 2013, two additional EAs and EMPs were prepared for the two new sub-components. Compliance with environmental safeguards is rated satisfactory.

Land Acquisition and Resettlement

34. Land acquisition (LA) and resettlement of affected residents was undertaken in accordance with the resettlement action plans (RAPs) approved by the Bank. During project preparation, the reduction of potential resettlement was a key criterion for the analysis of alternatives, and through this process, land acquisition and resettlement needs were substantially reduced from the initial estimates. During implementation, PMOs and PIUs complied strictly with the requirements of the resettlement policies and relevant RAPs. The resettlement agencies had local offices and a well-trained full-time workforce.
35. Project-affected persons (PAPs) were fully engaged through public participation activities, i.e., mobilization meetings to collect comments and opinions from PAPs. The grievance redress and appeals mechanisms were also well publicized. PIUs attached great importance to the prompt restoration of public facilities to high standards after temporary land occupation. 494 PAPs were properly resettled and/or compensated; many of the PAPs initiated their own livelihood restoration measures, such as job training. A total of 59 ha of land was acquired, and 1,043 ha of land was temporarily occupied during construction. There was regular monitoring and review of all LA and resettlement activities by an independent external agency, and detailed reports were prepared periodically, with key findings summarized in the semi-annual progress reports. LA and resettlement generally proceeded smoothly and compliance with social safeguards is rated satisfactory.

Financial management

36. The project had a good financial management (FM) system that performed generally very well. Consolidated project accounts were prepared in a timely manner and audited, as covenanted, within six months of the end of the calendar year. All audit opinions were clean and no significant FM-related issues were identified by the audit reports. The FY2013 project audit report disclosed minor non-compliance under the Nanjing component concerning national bidding and tendering procedures and some project management weaknesses, such as poor maintenance and filing of engineering documents. The PPMO worked with the Nanjing PIU to address the noncompliance and improve the project management. Overall, FM performance was satisfactory.

Procurement

37. Procurement followed a detailed procurement plan that was updated regularly. All project procurement followed Bank rules as set out in the loan agreement. A total of 39 large contracts (prior and post-review), valued at more than US$200 million, involved Bank financing; three of these were ICB contracts for major plant equipment supply, valued at US$21 million. Procurement issues and delays, if any, were flagged for action and resolution in the semi-annual progress reports. The progress of bidding, contracting and construction was well monitored, and all contract changes, such as variation orders (VO), were well documented and followed the necessary Bank approval procedures. No serious issues arose during implementation; a bidder’s complaint that was investigated in detail (which caused a significantly delayed contract award) led to work on improved bidding documents. Compliance with Bank procurement guidelines is rated satisfactory.

2.5 Post-completion Operation/Next Phase

38. By December 2015, at the end of the extended project implementation period, all facilities built with Loan financing had not only been completed but they were in full operation. Specifically, the new and expanded WTPs are performing well and produce treated water at design capacity. Most PIU staff were assigned from the water supply / wastewater companies to work with the PIUs. These staff members have now joined the operating companies that are responsible for operation and maintenance (O&M). Therefore,
O&M of the constructed facilities is expected to be effective and the treated water will meet national standards for drinking water. Three of four WTPs meet O&M costs through revenues from water tariffs; Zhenjiang Water Supply Company’s tariff revenue is high enough to cover full costs, including overheads and debt service. The local governments provide subsidies to the other companies to make up shortfalls in tariff revenue; this is the accepted practice in China for urban water and wastewater utility companies, as water and wastewater companies are bound by the tariffs approved by local governments.

39. The new GIS-based network plans allow staff to operate and maintain pumping, transmission, and distribution facilities in an efficient manner, and the NRW reduction pilots have improved system performance. The water supply companies are committed to continue the NRW reduction initiative.

40. The two new WWTPs in Nanjing are in operation and produce effluent that meets the national standards for tertiary wastewater treatment. Capable staff are in place to operate the WWTPs and have been trained in all aspects of operations and management. Specialized training in sludge management and odor control was provided by the TA consultants to ensure that the new treatment technologies are utilized in an optimal manner. This training was complemented by international study tours to familiarize managers and operators with high standards of water and wastewater management. The newly established institutional arrangements in Nanjing are expected to provide a solid foundation for the further development of sustainable wastewater services in Nanjing. Wastewater tariffs were increased during the years of project implementation. Although the current net income of Nanjing Municipal Water Group Company (NMWGC) is still negative, financial performance of NMWGC is expected to improve and become positive based on increased wastewater volumes and the resulting lower unit treatment costs.

41. The raw water intake for the Nanjing-Longtan WTP, the newly added sub-component financed by counterpart funds, is located only 1.2 km downstream from a small, river-type oil wharf. This is not in full compliance with Class II raw water regulations which require that intakes should be at least 2 km away from any potential upstream source of pollution. However, the siting of the water intake for Longtan WTP is within the protection zone established by the Provincial Department of Water Resources since 2004 (covering the Nanjing Section of Yangtze River from Jiuxiang River Estuary to Qixiang River Estuary) and is compliant with the relevant regulations. This zone and the protective regulations were further confirmed in 2008 and 2009 when the “Decision of Strengthening the protection of drinking water source by the Standing Committee of Jiangsu Provincial People’s Representative Congress” (No. 146) and the “Approval of Provincial Government on the zoning of centralized drinking water source protection zones above county-level in Jiangsu Province” (SuZhengFu [2009] No.2) were issued.

42. Nanjing Municipal Government has further strengthened environmental protection for the surrounding areas to ensure safe water use and abstraction at the intake. Currently, staff from Longtan WTP patrols the water source protection zone twice a day in the Grade 1 protection zone and once a week in the Grade 2 protection zone. Online monitoring instruments have been installed to monitor key parameters, such as turbidity, pH,
temperature, electronic conductivity, ammonia, COD and DO levels of raw water. In addition, other important indicators of raw water quality are regularly monitored, including chromaticity, odor, visible substances, alkalinity, nitrite and nitrate, chlorine gas and free chlorine, total bacteria, total coliform and heat-resistant coliform. To cope with any accidental pollution of the water source, emergency plans to deal with oil pollution and organic trace pollution have been developed. An automated activated carbon dosing system has been installed and oil-absorbing cotton and pillows have been prepared for emergencies. Working in parallel, relevant governmental departments have started to facilitate the relocation of the upstream wharf.

43. With regard to financial sustainability, all project cities witnessed an 11% average annual increase in GDP between 2009 and 2014. The rate and trend of increases indicates the potential economic capacity to afford the service and that the local governments have sufficient capacity to provide supplemental financial support. This is consistent with China’s policy to provide financial support to water utilities to keep water and wastewater tariffs affordable. An action plan, prepared by the project-financed tariff and institutional reform study, has laid out a road map of short, medium and long term actions on all important areas of water and wastewater service provision (see Annex 2).

3. Assessment of Outcomes

3.1 Relevance of Objectives, Design and Implementation

Relevancy of Objectives
Rating: High

44. The PDO was fully consistent with the Bank Group’s 2006 – 2010 China CPS, which sought, among other objectives, to: (i) improve the competitiveness of the various regions of China and the overall investment climate, and (ii) address the needs of disadvantaged groups and underdeveloped areas through financing infrastructure. Specifically, the project supported the CPS objectives of: (i) reducing poverty, inequality, and social exclusion; (ii) financing sustained and efficient growth; and (iii) improving public and market institutions. The PDO continued to be relevant to the current CPS for the period of 2013 – 2016, which highlights the high level of pollution in China’s water bodies that necessitate better management of environmental pollutants from wastewater. The current CPS also recognizes the need for high-quality public services; promoting an integrated approach to water and environmental management; expanding safe water supplies to smaller cities; enhancing urban environmental services through improved water supply and wastewater collection, treatment and disposal; and enhancing opportunities in rural areas and towns through improved services.
45. The project was also relevant to China's 12th Five Year Plan[^5], which covered the years from 2011 to 2015; it promoted sustainable growth, and it particularly aimed to address environmental and social imbalances through the development of services and measures to set targets for reduction of pollution and increased energy efficiency. The project was – and continues to be – relevant to the current phase of the Jiangsu Rural Drinking Water Initiative, which started in 2009 and will be effective until 2018. The objective of the initiative is to provide better water services for rural areas, including townships, and to connect households. Network expansion and improvements were part of this initiative, and the project responds to this provincial program.

*Relevance of Design and implementation*
Rating: High

46. Project design built on the lessons of earlier projects in Jiangsu. Possible design alternatives were carefully considered before selecting an option that would deliver high water and wastewater quality standards; meeting the standards Jiangsu Province considered a necessity and a priority. The few modest risks discussed in section 2.1 were mitigated through project design and government actions. The PDO addressed the key sector needs and the environmental concerns clearly. The three projects components, namely water supply expansion, wastewater management, and implementation and capacity building support, were fully aligned with each element of the PDO.

47. Project design was flexible and accommodated some changes in the project scope. The project was adjusted to cope with linked road construction schedules, resettlement challenges, and opportunities for leveraging extra funds through BOT financing; these led to a surplus of loan funds that was used to finance other priority sub-projects.

48. The technical assistance support was well designed and implemented; it focused on practical aspects of water supply and wastewater management operations, such as high quality treatment standards, taste and odor control, network management and optimization, NRW reduction and financial modeling to ensure financial viability. Tariff structure and institutional reforms were addressed in a short, medium and long-term action plan. Capacity building as part of project implementation also provided valuable experience – as described in the Borrower’s completion report (see Annex 7) – in procurement and project management. Considering the relatively small budget for consultants’ services, the TA was very efficient in view of the significant impacts it had on building technical and institutional capacity.

49. The results framework (RF) was well designed with focused and appropriate key and intermediate outcome indicators that captured the most important outcomes. The indicators focused on service coverage and some were aggregated to facilitate monitoring. The indicators and targets were reviewed during implementation and modified through

[^5]: The current CPS and the 12th Five Year Plan were informed by the joint study, “China 2030”, prepared by the Bank and the Development Research Center of the State Council of China.
restructuring, where appropriate. Apart from the initial minor delay, the well-established M&E system enabled regular and smooth data collection to update the RF.

3.2 Achievement of Project Development Objectives

PDO: Improve the efficiency and effectiveness of water and wastewater services and reduce pollution discharges to local rivers in Jiangsu.

Rating: High

(i) Improve efficiency of water supply services
Sub-rating: High

50. Project activities contributed significantly to important efficiency improvements to water supply services in Nanjing and in the other four cities. The NRW reduction strategy was developed by the TA consultants jointly with the four water supply PIUs. It comprised improved pressure management, reinforced leakage detection capabilities, improved customers’ meter management, improved asset management, and improved town system management through agglomeration and reorganization of services. Implementation of this strategy led to average NRW being reduced in the targeted four cities from 27% to 22%, and it increased the number of towns which meet the strategic targets for NRW to 58. NRW activities have increased water availability by more than 50,000 m³ (equivalent to around US$10 million in annual revenue increase at an average price of US$0.5 per m³).

51. Implementation of Jiangsu Province’s integrated urban and rural water supply plan under the project resulted in a staffing plan being developed based on the size of service area, annual water sale and number of water users. Out of the original team, most staff was recruited into the new team based on their experience and capability, while the remaining staff were either reassigned by the local government or took early retirement. For example, in Danyang 165 staff were finally recruited while in Zhenjiang, over 85% of the staff from the original town/township water treatment plants were taken on by the three new wholly-owned subsidiaries of Zhenjiang Municipal Water Supply Company.

52. The project also improved the efficiency of water supply services through: (i) increasing the efficiency of WTPs and reduction of water treatment costs; (ii) improving the operational performance of the water distribution networks, using project-financed GIS-based mapping and monitoring (implemented with the support of project-financed consultants); (iii) reduction of water losses and increased water sales and revenues, as a result of project-financed rehabilitation and repairs of pipeline networks, water meters and house connections; and (iv) expanding service areas to cover 84 rural towns, leading to increase in water sales and hence revenues. The efficiency increase in water supply interventions is demonstrated by Economic Internal rates of return (EIRR) in the 10% to 20% range for various water supply sub-components (see Section 3.3 and Annex 3 for details).

(ii) Improve effectiveness of water supply services
Sub-rating: High
53. The project successfully improved the availability of adequate, reliable and high quality water supply for a population of 4.65 million through investments, supported by the highly effective and focused TA that led to improved project management. Good project outcomes are demonstrated by water service coverage reaching 99.8% in cities (from a baseline of 96% while the target was 98%) and 100% for towns (from a baseline value of 78% and a target of 93%). Project towns with 24 hours coverage has increased to reach 84 from a baseline of 40 (well above the target of 52) and 70 towns have been agglomerated with the city services from a baseline of 14.

54. The main project outputs that contributed to improve the effectiveness of water supply services in Jiangsu Province and to achieve the above outcomes, include the construction of: (i) three new raw water intakes and pumping stations with a combined capacity of 705,000 m³/day; (ii) 26.1 km of large diameter raw water transmission pipelines; (iii) five new WTPs with a combined capacity of 650,000 m³/day; (iv) three new clear water pumping stations with a total capacity of 145,000 m³/day; (v) 594 km of treated water transmission and distribution pipes; and (vi) 1,815 km of new and rehabilitated water distribution lines in the rural towns.

(iii) Improve efficiency of wastewater services
Sub-rating: High

55. The project contributed to the improved efficiency of wastewater services in three cities in Nanjing Municipality (Chaobei, Chengbei and Tiebei), as a result of the following measures: (i) design and layout of WWTPs optimizing the use of space and reducing the need for costly and disruptive land acquisition; (ii) application of advanced tertiary wastewater treatment technology that achieved effluent quality at the lowest possible energy costs; (iii) reducing the fixed part of treatment cost through maximizing the utilization of WWTPs, construction of a new sewage pumping station in Meijiatang that enabled the existing Chengbei WWTP in Nanjing to be operated at full capacity of 300,000 m³/day; (iv) utilization of efficient variable speed pumps that improved energy efficiency at partial flows; (v) covering of WWTP treatment tanks to reduce odor nuisance to a tolerable level and avoid resettlement of residents in the vicinity; (vi) comprehensive training of plant operators in new treatment technology and sludge handling; and (vii) acquiring the services of a private sector operator for sludge incineration through service contracts as the least-cost option for sludge disposal.

56. The above achievements were supported by well targeted and competently executed TA support that focused on procurement and contract management, quality of technical design and construction, and the training of operating staff. The efficiency of the wastewater investments was demonstrated by the EIRR results of 13.4% for the Nanjing wastewater component (see Section 3.3 and Annex 3 for details).

(iv) Improve effectiveness of wastewater services
Sub-rating: High

57. The project contributed to improving the effectiveness of wastewater services in the project areas by expanding the collection systems and reducing pollution discharge to
local surface and groundwater. The technical assistance for design review, training and study tours made important contributions to the standards of quality of works and outputs. Achievements in terms of wastewater service effectiveness are evident through: (i) annual COD load reduction from municipal wastewater to 60,729 tons, exceeding the target of 43,000 tons a year; (ii) service coverage reaching 95%, exceeding the target of 83%; and (iii) 100% of the generated wastewater in Nanjing being treated, exceeding the target of 83%. The Taixing WWTP was dropped from the project, but was constructed by the private sector under a BOT arrangement. This, in turn, freed up funds to finance additional works relevant to the PDO, e.g., the strategic Longtan WTP in Nanjing.

58. The expansion of the sewerage collection system and increase in WWTP capacity benefitted 533,000 people (and is projected to serve 781,000 by 2020) within a coverage area of 146.9 km². The associated achievements in terms of reduced pollution discharges are shown in Section 3.2 (v) below.

59. The above improvements in wastewater service were achieved through the construction of: (i) 99 km of new wastewater collection lines in Tiebei and Chengbei; (ii) two sewage pump stations in Tiebei and Chengbei with a combined capacity of 77,000 m³/day; and (iii) two WWTPs in Qiaobei and Tiebei with a combined capacity of 200,000 m³/day.

(v) Reduce pollution discharges to local rivers in Jiangsu
Sub-rating: High

60. As mentioned earlier, the project achieved a very significant and measurable reduction in pollution discharges to local rivers: in 2015 it amounted to a reduction of 60,729 tons/year of COD pollution loads from municipal wastewater in the project catchment area – far exceeding the key indicator target set at appraisal (39,436 tons) as well as the revised target set at project restructuring (43,000 tons), in spite of two cities (Danyang and Taixing) dropping out during project implementation. Key parameters of the treated effluent were tested regularly by an external environmental monitoring agency and met the Class 1A Pollutant Discharge Standard. Expansion of, and improvements to, the wastewater collection systems, including the construction of 99 km of 300 – 1,500 mm diameter wastewater collection pipes and two large sewage pump stations with a combined capacity of 77,000 m³/day in Tiebei and Chengbei in Nanjing, greatly contributed to the pollution reduction. TA support for design review and quality construction supervision as well as project innovations also contributed to these achievements. Investments in wastewater infrastructure resulted in the treatment of 100% of the generated wastewater, thus protecting local rivers and water bodies in Jiangsu from domestic wastewater pollution.

3.3 Efficiency
Rating: High

61. Economic Internal Rates of Return (EIRR) had been calculated for all sub-components at appraisal. Re-calculation of the EIRR of the various sub-components after completion demonstrated good rates of return: in the 10 – 11% range for city water supply
sub-components; 20% for the Nanjing Longtan WTP; and 13.5% for the WWTPs in Nanjing. All EIRRs are particularly sensitive to increases in operating costs. EIRRs at appraisal had ranged from 10.6 to 13.1%, i.e. they were close to the rates at completion.

62. Project-financed TA updated the financial models for the participating utility companies; this enabled them to calculate Financial Internal Rates of Return (FIRR) at project completion. FIRRs for the four city water supply companies are in the 10 – 11% range, for Nanjing Longtan water supply the FIRR is 19%, and for the two Nanjing WWTPs the FIRR is 6.9%. The FIRRs are sensitive to lower revenues and higher operational costs, two aspects that received special attention under project TA. FIRRs at appraisal were between 8.8 and 10.5% for water supply, and 8.5% for the Nanjing wastewater sub-components. 99% of project costs were subject to EIRR and FIRR analysis. Annex 3 provides more details on the assumptions and results of the EIRR and FIRR calculations; further details are in Annexes 5 and 6 of the Borrower’s ICR.

63. To ensure least cost results, competitive bidding was used for all supply and construction contracts, including ICB contracts for large treatment plant equipment. Cost-efficient solutions were adopted whenever possible, i.e. avoiding costly and disruptive resettlement by covering the Tiebei WWTP to reduce odors, and by stacking the sedimentation tanks above the reservoir in the Zhenjiang WTP. TA inputs, which accounted for less than 0.5% of total project costs, contributed significantly to reducing costs and increasing efficiency.

64. Project implementation also demonstrated high administrative efficiency: (i) original project components were implemented at or below costs and within the project period; (ii) sub-components added at restructuring only required a one-year extension of the closing date and were completed as planned; and (iii) the Loan was almost fully utilized (99.6%).

3.4 Justification of Overall Outcome Rating
Rating: Highly Satisfactory

65. Based on the ratings of high for relevance of project objectives, relevance of design, achievement of the PDO, and efficiency, the overall outcome of the project is rated Highly Satisfactory.

3.5 Overarching Themes, Other Outcomes and Impacts
(a) Poverty Impacts, Gender Aspects, and Social Development

66. Lower income households which are more likely found in underserviced areas of cities would have benefited proportionally more from the significant expansion and improvements of water supply and wastewater services, especially in the surrounding rural areas; however, poverty impacts of the project were neither monitored nor measured. There were no specific gender themes or impacts of this project, but the environmental and resettlement monitoring likely had considerable positive social impacts on the affected households. Local communities were encouraged to participate in public consultations and had opportunities to contribute to addressing environmental and social problems through
the well-designed grievance process.

(b) Institutional Change/Strengthening

67. The capacities of staff of the provincial, local government and utilities were strengthened significantly, not only through the well-targeted capacity building TA, but also by acquiring practical on-the-job experience in project and financial management, application of competitive procurement procedures, and employing innovative technical solutions. Staff capacity for operation and management of the newly built facilities was increased through training and study tours. Staff of project utilities also benefited from the major project-financed study on tariffs and institutional reform; a financial model was built for all water companies to facilitate financial planning and projections. The study also provided a plan of actions to reform and strengthen the utilities over the medium term.

(c) Other Unintended Outcomes and Impacts (positive or negative)

68. Project investments in additional drinking water treatment capacity led some of the participating utilities to raise treated water quality to a higher level, i.e., they installed tertiary treatment, also called “polishing” (involving ozone and activated carbon), in Zhenjiang and in the Nanjing area out of concern over customer complaints regarding poor taste and odor. In the case of the two Nanjing WWTPs, wastewater effluent quality is high enough that there is now some water re-use by industry.

3.6 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

69. There was no beneficiary survey and no stakeholder workshop.

4. Assessment of Risk to Development Outcome
Rating: Low

70. The main risks to the PDOs are: (i) poor quality operations; (ii) failure to continue NRW reduction efforts; and (iii) inadequate tariffs to cover costs including debt service by the water supply and wastewater companies. These risks are rated low and were readily mitigated by: (i) training of staff using project-funded TA that focused on treatment technology and good O&M, as well as study tours; (ii) NRW reduction and network modeling and optimization techniques, plus training in asset management; and (iii) training and advice on financial aspects of utility management, e.g., financial modeling and tariff reform. Network expansion into growing peri-urban and rural areas is expected to increase the customer base, water sales and net revenues; this will enable the utilities to become financially more self-reliant. In addition, the municipal governments involved are able and willing to provide financial support to utilities whose revenues are falling short. The short term risk of the Nanjing intake being located close to an oil wharf is discussed in Section 2.5 above.
5. Assessment of Bank and Borrower Performance

5.1 Bank Performance
(a) Bank Performance in Ensuring Quality at Entry
Rating: Satisfactory

71. The quality of the Bank’s good performance during preparation and appraisal was demonstrated through: (i) designing a well-balanced water and wastewater project with a clear PDO that was highly relevant for the water and wastewater sector in China and in Jiangsu Province; (ii) appropriate technical solutions, based on the consideration of alternatives; (iii) conducting a well-documented economic and financial analysis of all infrastructure investments; (iv) carrying out a sound assessment of environmental and social impacts and guiding the project agencies in preparing acceptable EIAs and associated EMPs, as well as comprehensive RAPs, for each component; (v) ensuring that project implementation arrangements were appropriate and in line with provincial-level urban infrastructure projects in China; and (vi) assigning a competent task team to take the project to approval in a relatively short time. A minor shortcoming was the selection of some sub-components that had to be dropped during implementation as part of project restructuring in 2013.

72. Based on the above, the Bank’s performance in Ensuring Quality at Entry is rated as Satisfactory.

(b) Quality of Supervision
Rating: Satisfactory

73. The quality of the Bank’s performance during supervision has been demonstrated through: (i) focusing on technical aspects and project management to ensure good quality technical implementation that produced the outputs necessary to achieve the desired outcomes; (ii) fielding technical teams for follow-up outside of regular supervision missions; (iii) ensuring the submission of timely and comprehensive semi-annual progress reports to document status and progress towards achievement of outputs and outcomes; (iv) paying specific attention to procurement, FM and safeguards issues by assigning specialized staff to join supervision missions to review progress and resolve implementation issues; (v) actively assisting the PPMO to advance project restructuring and requiring new EMPs and RAPs to be prepared and reviewed before approving the restructuring; (vi) supporting institutional and financial aspects of implementation with sound advice; and (vii) supervising the project at regular intervals – albeit at longer intervals in the first few years – and providing thorough and candid assessments in the ISRs. The Bank’s Quality of Supervision is therefore rated Satisfactory.

(c) Justification of Rating for Overall Bank Performance
Rating: Satisfactory

74. Based on the Satisfactory ratings for Quality at Entry and for Quality of Supervision, Overall Bank Performance is rated Satisfactory.
5.2 Borrower Performance
(a) Government Performance
Rating: Satisfactory

75. Both the central government and the provincial government provided appropriate guidance and support during all stages of the project. The PPMO, which was responsible for the overall guidance and coordination of the project, had rich experience in implementing a Bank-financed project through the Tai Basin Urban Environment Project, and it had demonstrated a strong and efficient leadership in managing and implementing the project. In particular, the PPMO: (i) worked closely with the Bank during project preparation and generated timely feasibility reports, design documents and the required safeguards documents; (ii) installed proven implementation arrangements to provide effective project management and coordination with competent staff and adequate continuity; (iii) ensured timely preparation and delivery of all progress reports, audit reports, and interim financial reports (iv) when some sub-components had to be dropped during implementation, presented timely proposals for restructuring and successfully replaced dropped sub-components with equivalent investments; (v) prepared a comprehensive application for a project restructuring to still achieve the PDO and to fully utilize the Bank loan; (vi) updated the economic and financial analyses and re-calculated the EIRR and FIRR at project completion; and (vii) delivered a good quality and timely Borrower’s implementation completion report. The delayed formal application for, and late approval of, project restructuring were minor shortcomings.

76. On balance, Borrower Performance is rated Satisfactory.

(b) Implementing Agency or Agencies Performance
Rating: Satisfactory

77. With the changes to project sub-components, the project had five PIUs: Taixing Water Supply Co.; Danyang Water Supply Co.; Zhenjiang Water Supply Co.; Yancheng Huijin Water Affairs Co. Ltd.; and Nanjing Municipal Water Group Co. Ltd. jointly with Nanjing Urban Construction Investment Holding (Group) Co. Ltd. (responsible for the implementation of the Nanjing wastewater sub-components and the Longtan WTP). Danyang Water Supply Co. implemented the project as per the original scope. The other four PIUs faced some changes which required amendments to the scope of the original contracts. The companies were successful in managing changes as a result of other infrastructure development plans, e.g., road construction in the case of Tiebei Water Supply Co., and availability of private sector financing in the case of Taixing Water Supply Co. and its BOT arrangement to build the WWTP. All PIUs completed the planned, as well as additional, works by proper sequencing of activities within the project period. The PIUs were supported by, and benefitted from, the TA and training. They achieved satisfactory implementation performance and maintained the focus on project management (including FM, procurement, technical quality, and safeguards monitoring).

78. All implementing agencies performed equally well in: (i) implementing EMPs and RAPs, and using external monitoring agencies to gather data on environmental and social aspects of implementation to ensure full compliance with Bank policies, especially on land
acquisition and resettlement; (ii) setting up separate units for implementing land acquisition, including public consultation and a grievance redress process; (iii) utilizing procurement training to ensure compliance with Bank procedures (including for some ICB packages) despite the initial lack of familiarity with Bank procurement of some PIUs; (iv) managing changes in contract scope and variations while keeping contract costs within set budget limits; (v) setting up project accounts and putting in place good FM systems that resulted in timely and issue-free audits; (vi) meeting all financial covenants; (vi) after some initial problems and delays, producing comprehensive and timely semi-annual progress reports with good monitoring data and information; (vii) keeping close track of project monitoring indicators and making sure that the targets were achieved; (viii) through the use of provincial authority and building on earlier pilot projects, successfully completing the agglomeration of a large number of peri-urban and rural systems into city water supply companies; (ix) designing and implementing an effective NRW reduction initiative for 58 agglomerated towns through the use of incentives to motivate staff; (x) by project closing, operating all project-financed facilities, especially treatment plants, and meeting water quality and effluent parameters; and (xi) adopting an action plan to guide utilities to continue tariff and institutional reform actions in the short, medium and long term until 2030.

79. Based on the above, the performance of implementing agencies is rated Satisfactory.

(c) Justification of Rating for Overall Borrower Performance
Rating: Satisfactory

80. Based on the Satisfactory ratings for Government and Implementing Agencies Performance, Overall Borrower Performance is rated Satisfactory.

6. Lessons Learned

(a) General

81. Strong provincial leadership can create a supportive enabling environment that contributes greatly to successful implementation. The Jiangsu Provincial Government’s strategy and pilot projects for water systems agglomeration, high effluent standards, and experienced and competent PPMO staff were key elements for achieving good outcomes. Salary incentives for staff, good support from the TA consultants, and helpful Bank supervision inputs also contributed to successful implementation.

82. Cost recovery can be achieved through subsidies by the municipal governments. In China it is common practice for municipal governments to set tariffs at levels that they consider affordable and provide annual subsidies to water and wastewater companies in order to cover any revenue shortfalls. Until agreement is reached with Government on the appropriateness of such subsidies, individual Bank projects should focus on strengthening the capacities of utilities to operate efficiently and ensure that municipal governments confirm that they would provide the required subsidies if the tariff levels are not raised to recover costs.
83. **Well designed, targeted and focused TA that is implemented in a timely manner can achieve good results, even on a low budget.** Project TA was less than 0.5% of project costs; nevertheless, it was credited by the Borrower and by staff for having built capacity for technical quality and innovation, project management and procurement, system mapping and NRW reduction, asset management, and O&M arrangements. The PPMO in particular was well supported by TA, which was key to successful project implementation.

(b) Operational

84. **Loan reallocations can be made in a timely and effective manner, without negative impacts on completion time and project outcomes.** Based on lessons from previous projects, the PPMO succeeded in adding two important new sub-components and fully utilized Loan proceeds: early preparations were made, discussions were held with the Bank, agreements were reached, and procedures were fast-tracked to allow the identification, preparation, and implementation of two beneficial additional investments, i.e., the Longtan WTP and the Taixing water supply network rehabilitation.

85. **Sub-standard water supply systems of peri-urban and adjacent rural areas can be successfully integrated and amalgamated into larger urban systems.** Based on a provincial strategy for the aggregation of water supply services, a large number of peri-urban and rural water systems were amalgamated without negatively affecting the viability and performance of the large urban water supply systems. This effective approach built on earlier pilot projects and employed well-planned and targeted network rehabilitations, GIS-based system mapping and management, NRW initiatives (see also below) and the installation of water meters. Centralized provincial level decision-making was a key factor for the quick aggregation of smaller systems.

86. **NRW reduction pilot projects can achieve their targets if they are well prepared and implemented using advanced technology and incentives for staff.** Targeted surveys, field visits and interviews helped the project to set realistic, yet challenging, NRW reduction targets specific to conditions in each project city. Leak detection devices, electronic metering and network mapping, together with ongoing monitoring, supported NRW implementation. Dedicated staff units and incentive systems for staff also helped to improve outcomes.

87. **Innovative solutions can help address environmental and social problems.** The new Tiebei WWTP caused odor problems that would have required the resettlement of several hundred close-by residents. Covering the treatment tanks at relatively low incremental cost solved the odor problem and thereby avoided the need for costly and socially disruptive resettlement of local people. In the case of the Zhenjiang WTP, the treated water reservoir was built directly below the sedimentation tanks, thereby saving valuable space and also avoiding more land acquisition and resettlement of people.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners
(a) Borrower/implementing agencies
88. The Borrower in the December 2015 draft implementation completion report (see Annex 7 for the Executive Summary) stated that “the JWWP has been very successful, with most of its original objectives achieved, particularly in terms of institutional intervention. The Bank was not only a funding source but also provided state-of-the-art management expertise regarding project implementation and business operations such as modern project management, international bidding and contracting, construction supervision, international routine practices, performance measurement, and project completion reporting. Significant capacity building in relevant aspects of procurement using Bank’s guidelines, contracting and project management, WTP and WWTP operations and maintenance, environmental monitoring, and financial management was achieved. In particular, the Bank’s construction management procedures, demonstrating fairness and accuracy, were considered to be a prerequisite of project success”.

89. The Bank concurs with these observations; they demonstrate the relevance and value of Bank support well beyond the financial resources. Jiangsu Province made very good use of the assistance and advice offered by Bank staff and the consultants, and as a result the project achieved its objectives in a highly satisfactory manner.

(b) Cofinanciers
N/A

(c) Other partners and stakeholders
N/A
Annex 1. Project Costs and Financing

(a) Project Cost by Component (in USD Million equivalent)

<table>
<thead>
<tr>
<th>Components</th>
<th>Appraisal Estimate (USD millions)</th>
<th>Actual/Latest Estimate (USD millions)</th>
<th>Percentage of Appraisal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Municipal &amp; City Water Supply</td>
<td>152.1</td>
<td>165.38</td>
<td>108.7</td>
</tr>
<tr>
<td>B. Wastewater management</td>
<td>199.3</td>
<td>207.40</td>
<td>104.1</td>
</tr>
<tr>
<td>C. TA &amp; Capacity building</td>
<td>2.5</td>
<td>1.69</td>
<td>67.6</td>
</tr>
<tr>
<td><strong>Total Baseline Cost</strong></td>
<td><strong>353.8</strong></td>
<td><strong>374.47</strong></td>
<td><strong>105.8</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Components</th>
<th>Appraisal Estimate (USD millions)</th>
<th>Actual/Latest Estimate (USD millions)</th>
<th>Percentage of Appraisal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Contingencies</td>
<td>17.6</td>
<td>0.00</td>
<td>0</td>
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<tr>
<td>Price Contingencies</td>
<td>43.4</td>
<td>0.00</td>
<td>0</td>
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<tr>
<td><strong>Total Project Costs</strong></td>
<td><strong>414.8</strong></td>
<td><strong>374.47</strong></td>
<td><strong>90.3</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Components</th>
<th>Appraisal Estimate (USD millions)</th>
<th>Actual/Latest Estimate (USD millions)</th>
<th>Percentage of Appraisal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest during implementation</td>
<td>16.7</td>
<td>0.33</td>
<td>0.5</td>
</tr>
<tr>
<td>Front-end fee IBRD</td>
<td>0.3</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Financing Required</strong></td>
<td><strong>431.8</strong></td>
<td><strong>374.80</strong></td>
<td><strong>86.8</strong></td>
</tr>
</tbody>
</table>

(b) Financing

<table>
<thead>
<tr>
<th>Source of Funds</th>
<th>Type of Cofinancing</th>
<th>Appraisal Estimate (USD millions)</th>
<th>Actual/Latest Estimate (USD millions)</th>
<th>Percentage of Appraisal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borrower</td>
<td></td>
<td>301.80</td>
<td>245.60</td>
<td>81.4</td>
</tr>
<tr>
<td>International Bank for Reconstruction and Development</td>
<td></td>
<td>130.00</td>
<td>129.20</td>
<td>99.4</td>
</tr>
<tr>
<td><strong>Total financing</strong></td>
<td></td>
<td><strong>431.80</strong></td>
<td><strong>374.80</strong></td>
<td><strong>86.8</strong></td>
</tr>
</tbody>
</table>
Annex 2. Outputs by Component

A. Components 1 and 2 of the project generated a large number and range of physical outputs with many general and some city-specific outcomes. The main outputs and outcomes are shown below in matrix format. The outcomes all contributed to the achievement of the PDO which were “to improve the efficiency and effectiveness of water and wastewater services and reduce pollution discharges to local rivers”.

<table>
<thead>
<tr>
<th>CITY</th>
<th>OUTPUTS</th>
<th>OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danyang</td>
<td>- capacity expansion of Changwan WTP from 100,000 to 200,000 m³/d including sludge treatment facilities</td>
<td>- improved supply capacity &amp; reliability for 310,000 customers</td>
</tr>
<tr>
<td></td>
<td>- construction of 15 km 1800 mm dia. raw water transmission pipeline</td>
<td>- treated water quality meets new national “Hygienic Standard for Drinking Water Quality”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- reduced water use &amp; increased working efficiency of WTP operations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- treatment of 11,000 tons of sludge in 2014 improved river environment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- reduced WTP operating costs</td>
</tr>
<tr>
<td>Taixing</td>
<td>- expansion of Baota WTP by 50,000 m³/d of capacity</td>
<td>- water supply capacity increased from 90,000 m³/d to 200,000 m³/d</td>
</tr>
<tr>
<td></td>
<td>- 27.3 km of clear water transmission lines (300 to 800 mm dia.)</td>
<td>- greater reliability of supply</td>
</tr>
<tr>
<td></td>
<td>- expansion of Heshi pumping station (PS) to 80,000 m³/d of capacity</td>
<td>- additional population of 700,000 is served by expanded system</td>
</tr>
<tr>
<td></td>
<td>- expansion of Huangqiao PS to 45,000 m³/d of capacity</td>
<td>- rural towns benefit from higher quality &amp; greater reliability of water supply</td>
</tr>
<tr>
<td></td>
<td>- construction of Zhangqiao PS with capacity of 20,000 m³/d</td>
<td>- treated water quality meets new national standard for drinking water</td>
</tr>
<tr>
<td></td>
<td>- construction of 144.8 km of clear water transmission lines (200 to 800 mm dia,) to townships</td>
<td>- water losses (=NRW) have been reduced</td>
</tr>
<tr>
<td></td>
<td>- construction of water supply systems in 8 townships involving 355.6 km of pipes up to 300 mm dia.</td>
<td>- water sales and company revenues have increased</td>
</tr>
<tr>
<td></td>
<td>- implemented “Township Water Supply Network Rehabilitation Project” incl. rehabilitation of 1,339.44 km of water distribution lines in 8 communities in 6 towns, incl. 41,000 house connections and water meters</td>
<td>- all 16 townships are covered by expanded system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- total population served is 1.2 million after township rehabilitation project</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Yancheng</td>
<td>- capacity expansion of Chengdong WTP from 100,000 to 200,000 m³/d capacity raw water intake PS</td>
<td>- significantly increased supply capacity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- greater reliability of supply</td>
</tr>
<tr>
<td>Component 1 – Water supply management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>----------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Zhenjiang</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| - construction of 10.75 km 1,400 mm dia. raw water pipeline  
- laying of 58.2 km 500 to 800 mm dia. clear water transmission lines  
- expansion & rehab of distribution networks (366 km, 50 - 200 mm dia.) in townships of Qinnan & Longgang | - high quality of treated water which meets new national standard for drinking water  
- total population served is 1.04 million in 2016, with capacity for 1.26 million by 2020 |
| **Longtan in Nanjing** |  |
| - capacity expansion of Jinshan WTP from 100,000 to 300,000 m$^3$/d  
- construction of 100,000 m$^3$/d capacity raw water intake PS  
- construction of 265m long 1200 mm dia. raw water intake pipe  
- rehabilitation & expansion of water distribution networks in Xinfeng & Dinggang towns involving 109.1 km of 50 to 200 mm dia., pipes  
- rehabilitation of 6,480 water meters | - expanded WTP serves a population of 1.1 million  
- guaranteed reliable supply for urban & suburban areas of Zhenjiang  
- high quality of treated water which meets new national standard for drinking water  
- significant reduction of NRW  
- increased water sales & revenue  
- accurate water metering increases revenue & reduced complaints |

**Component 2 – Wastewater management**

<table>
<thead>
<tr>
<th>Nanjing - Qiaobei</th>
<th></th>
</tr>
</thead>
</table>
| - construction of Qiaobei WWTP with capacity of 100,000 m$^3$/d using advanced A/A/O biological process | - total area served is 120.6 km$^2$ with current population of 408,000 growing to 750,000 in the medium term  
- 100% of WWTP effluent meets Class 1A of Pollutant Discharge Standard for towns |
| Nanjing - Tiebei |  |
| - construction of Tiebei WWTP with new capacity of 100,000 m$^3$/d  
- construction of PS with capacity of 50,000 m$^3$/d  
- construction of 56 km of 400 to 1,500 mm dia. wastewater collection system | - total area served is 26.3 km$^2$ with current population of 125,000 growing to 231,000 by 2020  
- 100% of WWTP effluent meets Class 1A of Pollutant Discharge Standard for towns |
| Nanjing - Chengbei |  |
| - construction of 43 km of 300 to 1,500 mm dia. wastewater collection system | - with completion of new PS, existing Chengbei WWTP can be operated at full capacity of 300,000 m$^3$/d  
- WWTP effluent meets Class 1A of Pollutant Discharge Standard for towns |
The project activities under Components 1 and 2 described above are the detailed activities as actually implemented. As part of November 2013 project restructuring, two activities were reduced in scope, three items of the original project scope at appraisal were dropped, and two new subcomponents were added. These changes are listed in detail in the table below; the table also provides the specific reasons for the various changes in the project scope.

### Project Scope Changes and their reasons

<table>
<thead>
<tr>
<th>CHANGE</th>
<th>REASON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yangcheng water supply was reduced substantially in scope.</td>
<td>Towns involved used their own financing to construct part of the water supply lines.</td>
</tr>
<tr>
<td>Danyang (Shicheng urban district) wastewater collection system was dropped.</td>
<td>Lack of progress with land acquisition and resettlement of a linked river rehabilitation project.</td>
</tr>
<tr>
<td>Tiebei wastewater collection in Nanjing city was reduced in scope.</td>
<td>Contracts for linked urban roads were delayed and not all sewers could be installed.</td>
</tr>
<tr>
<td>Construction of WWTP in Taixing (Huangqiao Town) was dropped.</td>
<td>Local government decided to have the WWTP constructed under a BOT scheme.</td>
</tr>
<tr>
<td>Institutional capacity building TA for the Taixing Huangqiao Wastewater Treatment Company was canceled.</td>
<td>Because of the cancelation of the Huangqiao WWTP, there was no need for the associated institutional capacity building technical assistance.</td>
</tr>
<tr>
<td>Taixing Town Water Supply Networks Rehabilitation was added.</td>
<td>Use of loan savings to expand supply system and increase water sales from the new WTP.</td>
</tr>
<tr>
<td>Nanjing Longtan WTP was added.</td>
<td>Use of loan savings for new medium/long term WTP for the fast growing Nanjing City.</td>
</tr>
</tbody>
</table>

### B. Component 3

Component 3 comprised four consulting contract packages. The consultancy for project and contract management provided essential assistance to the PPMO and PMOs during implementation, and also produced the Borrower’s ICR report. Another package produced a comprehensive study of water tariffs and financial reform of water supply companies, and the fourth package piloted the implementation of GIS-based network management systems in two cities, including the supply of software and hardware. The last package was for several training and international study tours. One package – for institutional
The strengthening of Taixing WW Company – was canceled because the associated wastewater sub-component for Taixing – Huangqiao was dropped from the project. Together with some savings due to competitive bidding, this has resulted in major saving in the budget of component 3 (from $2.5 to $1.69 million), which though small but led to high percentage decrease in the overall component 3 budget to become 67% of the appraisal estimate. The consultancies provided a range of services; they are shown below in matric format, together with the key outcomes they generated.

<table>
<thead>
<tr>
<th>Contract</th>
<th>Outputs</th>
<th>Outcomes</th>
</tr>
</thead>
</table>
| **Project and Contract Management & Design Review Services** | - suggestions & on-the-job training on procurement, construction & contract management, fund utilization, env. mgt., land acquisition & resettlement  
  - specific training events were held:  
    *Financial management, withdrawal & disbursement procedures  
    *Operation & management of WWTPs, sewage sludge mgt. & odor control  
  - performed study on NRW reduction strategies targeting Danyang, Taixing & Zhenjiang | - project implementation proceeded smoothly  
  - no complaints received with regard to environmental & land acquisition aspects  
  - project stakeholders, such as PIUs, contractors, supervision consultants & others were fully supported with advice & training  
  - well trained operators in WW treatment & sludge handling  
  - 9 towns in Taixing & Zhenjiang were identified as pilots for NRW initiatives & significant NRW reductions were achieved by pilots |
  - preparation of “Water Tariff Institutional Reform Report” | - extensive consultations on tariff & financial reform were held with local authorities concerned  
  - discussion of action plan for utility companies to implement |
| **Action Plan** | Generated nine recommended actions for water and wastewater companies to implement over the  
  - short (3 – 5 years),  
  - medium (5 – 10 years), and  
  - longer term (10 – 15 years) | The nine action areas covered:  
  - Promotion of PS investments in water & wastewater services  
  - Tariff review mechanisms  
  - Tariff structures, incl. block and progressive tariffs  
  - Wastewater providers & tariff principles  
  - Performance benchmarking  
  - Government subsidy issues  
  - Provincial level water sector consultative committee  
  - Public participation promotion  
  - Incentive schemes for state-owned enterprises in water sector |
| **GIS-based Network Plans for** | - demand survey & analysis for each of 4 project cities | - Danyang integrated GIS network data with monitoring data in a |
| **Town Networks & Transmission Lines** | - outline design reports for 4 cities  
- procurement & supply of GIS platform software  
- start-up of data processing in Taixing & Yancheng  
- procurement of hardware for Taixing | new control center for early detection & quick repair of network problems  
- GIS data facilitates efficient & rational management of water supply system  
- targeted NRW reduction program |
| **Training & Study Tours** | - Nanjing PMO to Australia & NZ  
- Taixing PMO to France & NL  
- Zhenjiang PMO to Australia & NZ  
- Danyang PMO to Australia & NZ  
- Yancheng PMO to Australia & NZ  
- Jiangsu Prov. PMO to France & NL  
- Jiangsu Prov. PMO to Australia | - officials & technical staff from competent authorities had many opportunities to learn from the experience & expertise in developed countries about municipal water supply & wastewater management |
Annex 3. Economic and Financial Analysis

1. Economic benefits

Upon project completion, economic analysis was conducted to evaluate the economic performance of the project. The project’s primary benefits are:

- Reduction in poverty and inequality through balanced urbanization and access to basic infrastructure services;
- Better management of scarce water resources and environmental challenges; and
- Improvement of public health through safe and clean drinking water and a reduction of untreated wastewater discharge into local rivers and open channels.

In addition to these key benefits, project investments directly benefited an additional 1.99 million people with new and improved water supply, and an additional 1.04 million people with wastewater treatment facilities. The five water supply companies and the two WWTPs in Nanjing added about 900 permanent jobs to the local economies, with Taixing providing about half of these new positions.

1.1 Water Supply Component

Specific benefits associated with improved water supply treatment and distribution services include: (i) water tariff revenue; (ii) health benefits, such as reduction in incidence of stomach and intestinal diseases due to improved water quality; (iii) labor savings; and (iv) increased industrial production outputs (added value) in project cities. Due to the difficulty of quantifying the benefits of labor savings and increased industrial production, only tariff revenues and increased health benefits were used for calculating the EIRR, i.e., the same benefits that were used at appraisal for computing EIRR.

Municipal water operating revenues

Table 3.1 below presents the operating revenues for the five project cities in 2009 and 2014. Increases ranged from 30% for Nanjing to more than triple in Danyang and Yancheng over five years. With the exception of Danyang, operating revenue increase is substantially a direct result of the increase in the volume of water sold (as a result of increasing production capacity and reducing losses, as well as expanding the service area). In Danyang this is also attributed to the tariff increase (more details are provided in Section 2.1).

<table>
<thead>
<tr>
<th>City</th>
<th>2009</th>
<th>2014</th>
<th>Rate of increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhenjiang</td>
<td>110.1</td>
<td>157.7</td>
<td>46%</td>
</tr>
<tr>
<td>Danyang</td>
<td>40</td>
<td>137.1</td>
<td>243%</td>
</tr>
<tr>
<td>Yancheng</td>
<td>102.88</td>
<td>179.42</td>
<td>74%</td>
</tr>
<tr>
<td>Taixing</td>
<td>28</td>
<td>94</td>
<td>236%</td>
</tr>
<tr>
<td>Nanjing</td>
<td>529.04(2012)</td>
<td>688.19</td>
<td>30%</td>
</tr>
</tbody>
</table>
Water-borne disease incidence and reduced medical expenses

Important health benefits were derived from the specific project interventions. With the project, improved water quality would have reduced the incidence of diseases attributed to contaminated water. The EIRR was calculated for Danyang only, as an example of a city where good health data was available. The calculations used: disease incidence rates for 2009 and 2014 as reported by Danyang Water Supply Company, the respective population numbers, and reduced medical expenses for treating water-borne diseases.

Table 3.2: Water-borne Disease Incidence and Medical Expenses

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Incidence Rate % (2009)</th>
<th>Incidence Rate % (2014)</th>
<th>Reduced affected population</th>
<th>Medical Expense/time (RMB)</th>
<th>Expenses saved (million RMB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysentery</td>
<td>0.01835</td>
<td>0.00703</td>
<td>9,880</td>
<td>500</td>
<td>4.94</td>
</tr>
<tr>
<td>Typhoid</td>
<td>0.00195</td>
<td>0.0001</td>
<td>1,649</td>
<td>1800</td>
<td>2.97</td>
</tr>
<tr>
<td>Other Water-Borne Disease</td>
<td>0.00587</td>
<td>0.00531</td>
<td>325</td>
<td>500</td>
<td>0.16</td>
</tr>
<tr>
<td><strong>Total Savings</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>11,854</strong></td>
</tr>
</tbody>
</table>

1.2 Wastewater Component

Economic benefits of the investments in wastewater treatment are: (i) land value increases as a result of infrastructure improvements; (ii) ability of local governments to attract more investments and thus help to improve the local economy; and (iii) health benefits, such as reduction in incidence of stomach and intestinal diseases due to improvements as a result of upgrading wastewater treatment facilities. Only economic benefits due to land value increases have been calculated due to the difficulties of quantifying the other benefits.

Land Value Increase

The project improved the ecological water environment through the construction of the Nanjing, Tiebei and Qiaobei WWTPs. With more wastewater collected and treated, land values in these urban areas increased substantially. According to surveys of property prices in 2009 and 2015, there was an average annual increase of RMB533/m² of land values within one km of the Tiebei and Qiaobei WWTPs; this increase can be largely attributed to improved wastewater services.

1.3 Economic Internal Rates of Return
EIRRs, calculated by sub-component after project completion, are shown in Table 3.3 below. They range from 10.19% to 20.18%. Sensitivity analysis indicated that the EIRRs are highly sensitive to increase in operating costs and equally to delayed tariff increases; however, economic benefits remain positive assuming 10% fluctuations.

**Table 3.3: EIRR by Sub-Component**

<table>
<thead>
<tr>
<th>Component</th>
<th>Base Case EIRR</th>
<th>10% Decrease in Main Benefit</th>
<th>10% Increase of O&amp;M</th>
<th>Revenue Delayed by 1 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhenjiang Water Supply</td>
<td>11.95</td>
<td>9.82</td>
<td>11.48</td>
<td>11.75</td>
</tr>
<tr>
<td>Danyang Water Supply</td>
<td>10.44</td>
<td>5.28</td>
<td>6.92</td>
<td>9.66</td>
</tr>
<tr>
<td>Yancheng Water Supply</td>
<td>10.19</td>
<td>2.59</td>
<td>4.58</td>
<td>9.62</td>
</tr>
<tr>
<td>Taixing Water Supply</td>
<td>11.69</td>
<td>9.29</td>
<td>10.68</td>
<td>11.46</td>
</tr>
<tr>
<td>Nanjing WWTPs</td>
<td>13.43</td>
<td>10.40</td>
<td>9.85</td>
<td>9.80</td>
</tr>
<tr>
<td>Nanjing Longtan Water Supply</td>
<td>20.18</td>
<td>5.29</td>
<td>4.78</td>
<td>19.68</td>
</tr>
</tbody>
</table>

2. **Financial performance**

Financial projections were made for each utility, based on performance during 2009 – 2014 and the latest information available. An overview is presented below. The financial internal rates of return (FIRR) for each sub-project, along with the results of sensitivity analysis, are shown in Table 3.4; details of the analysis are in the Project Files.

**Water supply**

- Water supply tariffs in all project cities were raised in response to higher operating costs. However, total operating costs of water supply companies varied, as did total revenues, resulting in insignificant increases in net incomes.

- All water supply companies met the covenant requirement, i.e., for each fiscal year commencing in FY 2012, total revenues were higher than total operating expenditures.

- Except for Danyang, current water tariffs of the project cities cover O&M costs. However, only Zhenjiang Water Supply Company’s tariff is high enough to cover total costs, including overheads and debt service. The other water companies have to rely, to a lesser or greater degree, on local government financial support to supplement tariff revenues.

- When interest plus principal repayments commence in 2017, the water supply companies will face even higher financial pressure to (i) lower operating costs and overheads, (ii) decrease the percentage of NRW, and/or (iii) increase water tariffs.

- In terms of debt service coverage, apart from Danyang, none of the project water supply companies managed to meet the target of 1.1 or higher by 2014. However, municipal
governments in other project cities are providing adequate financial support to ensure full operation of the WTPs.

- There was a significant reduction in NRW in Zhenjiang (from 21.3% to 16.7%) and in Taixing (from 51% to 30.5%) as a result of the project, but NRW in Yancheng did not change during these years. NRW in Danyang in 2014 (30%) was higher than in 2009 (20.42%), but has shown a decreasing trend since 2015 (12%) as a result of significant improvements to the water distribution network.

- Financial projections show that by 2030, all project components will have sustainable financial performance, with FIRRs over 10% (see for summary of FIRR results further below in this annex in Table 3.4).

\textit{Wastewater}

- Jiangsu Province requires joint billing for water and wastewater; wastewater tariffs are computed based on the volume of water consumed.

- Wastewater tariffs increased by RMB0.12/m$^3$ to RMB1.42/m$^3$ from 2012 to 2014, i.e., an increase of 9%.

- The current unit O&M cost is lower than the wastewater tariff. The current net income of NMWC is negative; however, NMWC’s financial performance is expected to improve and become positive based on increasing water treatment volumes and low unit treatment costs.

- By 2030 the two WWTPs will have sustainable financial performance, with an FIRR of 6.9%.

\textbf{Table 3.4: Projected Financial Rates of Return at Completion (in percent)}

<table>
<thead>
<tr>
<th>Sub-Project</th>
<th>Base Case FIRR</th>
<th>Capital Cost plus 10%</th>
<th>Collection Rate less 10%</th>
<th>Operating Expenditure plus 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danyang Water Supply</td>
<td>10.44</td>
<td>9.44</td>
<td>5.28</td>
<td>6.92</td>
</tr>
<tr>
<td>Taixing Water Supply Project</td>
<td>10.48</td>
<td>10.11</td>
<td>8.09</td>
<td>9.56</td>
</tr>
<tr>
<td>Yancheng Water Supply</td>
<td>10.19</td>
<td>9.03</td>
<td>2.59</td>
<td>4.58</td>
</tr>
<tr>
<td>Nanjing Longtan Water Supply Component</td>
<td>19.01</td>
<td>17.34</td>
<td>6.57</td>
<td>5.6</td>
</tr>
<tr>
<td>NMPC WWTP</td>
<td>6.90</td>
<td>3.51</td>
<td>3.13</td>
<td>0.97</td>
</tr>
</tbody>
</table>
Financial benefits of project investments are highly sensitive to increases in operating costs and to lower revenues, i.e., failure of the utility companies and municipal governments to increase tariffs when needed.

3. Financial capacity of project city governments

During 2009 to 2014 project cities experienced an average annual 11% increase in GDP. While GDP growth will likely moderate in the coming years, local governments are expected to have sufficient financial capacity to provide the necessary subsidies to the utility companies to enable them to operate and maintain project created assets in a satisfactory manner.
Annex 4. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

<table>
<thead>
<tr>
<th>Names</th>
<th>Title</th>
<th>Unit</th>
<th>Responsibility/ Specialty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lending</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mara K. Warwick</td>
<td>Sr. Water and Sanitation Specialist</td>
<td>EASCS</td>
<td>Task Team Leader</td>
</tr>
<tr>
<td>Aldo Baietti</td>
<td>Lead Infrastructure Specialist</td>
<td>WBISD</td>
<td>Financial Specialist</td>
</tr>
<tr>
<td>Mingyuan Fan</td>
<td>Sr. Water and Sanitation Specialist</td>
<td>EASCS</td>
<td>Co-TTL, Engineer</td>
</tr>
<tr>
<td>Haixia Li</td>
<td>Sr. Financial Management Specialist</td>
<td>EAPCO</td>
<td>Financial Mgt Specialist</td>
</tr>
<tr>
<td>Xujun Liu</td>
<td>Procurement Specialist</td>
<td>EAPCO</td>
<td>Procurement Specialist</td>
</tr>
<tr>
<td>Chongwu Sun</td>
<td>Senior Environmental Specialist</td>
<td>EASCS</td>
<td>Environment Specialist</td>
</tr>
<tr>
<td>Margaret Png</td>
<td>Senior Counsel</td>
<td>LEGES</td>
<td>Country Lawyer</td>
</tr>
<tr>
<td>Songling Yao</td>
<td>Sr. Social Development Specialist</td>
<td>EASCS</td>
<td>Social Development Spec</td>
</tr>
<tr>
<td>Chunxiang Zhang</td>
<td>Sr. Program Assistant</td>
<td>EACCF</td>
<td>Team Support</td>
</tr>
<tr>
<td>Vellet Fernandes</td>
<td>Program Assistant</td>
<td>EASUR</td>
<td>Team Support</td>
</tr>
<tr>
<td>Zhun Zhang</td>
<td>Consultant</td>
<td></td>
<td>Institutional Specialist</td>
</tr>
<tr>
<td>Yijing Ye</td>
<td>Consultant</td>
<td></td>
<td>Fin/Institutional Analyst</td>
</tr>
<tr>
<td>Chandra Godavitarne</td>
<td>Consultant</td>
<td></td>
<td>Municipal Engineer</td>
</tr>
<tr>
<td>Eleanor Dougoud</td>
<td>Consultant</td>
<td></td>
<td>Operations Officer</td>
</tr>
<tr>
<td><strong>Supervision/ICR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Khairy Al-Jamal</td>
<td>Sr. Infrastructure Specialist</td>
<td>GWA02</td>
<td>Task Team Leader</td>
</tr>
<tr>
<td>Suhail Jme’an</td>
<td>Program Leader</td>
<td>SACKB</td>
<td>Former TTL</td>
</tr>
<tr>
<td>Axel Baeumler</td>
<td>Sr. Infrastructure Economist</td>
<td>GSU11</td>
<td>Former TTL</td>
</tr>
<tr>
<td>Mingyuan Fan</td>
<td>Sr. Sanitary Engineer</td>
<td>GSU08</td>
<td>Former Co-TTL</td>
</tr>
<tr>
<td>Guangming Yan</td>
<td>Sr. Urban Development Specialist</td>
<td>GWA02</td>
<td>Co-TTL</td>
</tr>
<tr>
<td>Toyoko Kodama</td>
<td>Urban Specialist</td>
<td>GWA02</td>
<td>Operations Specialist</td>
</tr>
<tr>
<td>Feng Ji</td>
<td>Senior Environmental Specialist</td>
<td>GEN02</td>
<td>Environmental Specialist</td>
</tr>
<tr>
<td>Zheng Liu</td>
<td>Procurement Specialist</td>
<td>GGO08</td>
<td>Procurement Specialist</td>
</tr>
<tr>
<td>Meixiang Zhou</td>
<td>Social Development Specialist</td>
<td>GSO02</td>
<td>Social Development Spec.</td>
</tr>
<tr>
<td>Alejandro Alcala Gerez</td>
<td>Senior Counsel</td>
<td>LEGES</td>
<td>Lawyer</td>
</tr>
<tr>
<td>Huiying Guo</td>
<td>Program Assistant</td>
<td>EACCF</td>
<td>Team Assistant</td>
</tr>
<tr>
<td>Isabel Duarte A. Junior</td>
<td>Program Assistant</td>
<td>GWA02</td>
<td>Team Assistant</td>
</tr>
<tr>
<td>Dawei Yang</td>
<td>Consultant</td>
<td></td>
<td>Procurement Specialist</td>
</tr>
<tr>
<td>Urvakash Daraius Patel</td>
<td>Consultant</td>
<td>GTI02</td>
<td>Team Member</td>
</tr>
<tr>
<td>Tomoko Kato</td>
<td>Consultant</td>
<td></td>
<td>Team Member</td>
</tr>
<tr>
<td>Eddie Hum</td>
<td>Consultant</td>
<td>GSU08</td>
<td>Municipal Engineer</td>
</tr>
<tr>
<td>Yan Li</td>
<td>Consultant</td>
<td>GSU08</td>
<td>Economist</td>
</tr>
<tr>
<td>Wang Ling</td>
<td>Consultant</td>
<td></td>
<td>FM Specialist</td>
</tr>
<tr>
<td>Heinz K. Unger</td>
<td>Consultant</td>
<td>GWA02</td>
<td>ICR Author</td>
</tr>
</tbody>
</table>
### (b) Staff Time and Cost

<table>
<thead>
<tr>
<th>Stage of Project Cycle</th>
<th>Staff Time and Cost (Bank Budget Only)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of staff weeks</td>
<td>USD Thousands (including travel and consultant costs)</td>
</tr>
<tr>
<td><strong>Lending</strong></td>
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<td></td>
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<tr>
<td>FY07</td>
<td>7.61</td>
<td>40.99</td>
</tr>
<tr>
<td>FY08</td>
<td>29.55</td>
<td>175.49</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>37.16</strong></td>
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</tr>
<tr>
<td><strong>Supervision/ICR</strong></td>
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<td></td>
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<tr>
<td>FY09</td>
<td>26.44</td>
<td>144.23</td>
</tr>
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<td>FY10</td>
<td>21.83</td>
<td>67.51</td>
</tr>
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<td>FY11</td>
<td>15.61</td>
<td>64.94</td>
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<td>FY12</td>
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<td>FY13</td>
<td>11.16</td>
<td>87.56</td>
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<td>FY14</td>
<td>14.10</td>
<td>76.66</td>
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<tr>
<td>FY15</td>
<td>28.08</td>
<td>161.84</td>
</tr>
<tr>
<td>FY16</td>
<td>16.10</td>
<td>88.87</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>149.47</strong></td>
<td><strong>765.04</strong></td>
</tr>
</tbody>
</table>
Annex 5. Beneficiary Survey Results

There was no beneficiary survey.
Annex 6. Stakeholder Workshop Report and Results

No stakeholder workshop was held.
Annex 7. Summary of Borrower's ICR and/or Comments on Draft ICR

1. Project Background and Key Objectives

In view of existing development challenges, the Jiangsu Provincial Government (JPG) adopted a forward-looking water resources management strategy to concurrently reorganize and develop the water supply and wastewater service sectors, including the following key sectoral reforms and developments: (a) reorganization and aggregation of the water supply sector to provide sustainable and better quality water to all residents and industrial users of the province, including those in towns, villages and peri-urban areas; and (b) rapid expansion of wastewater services in the province and tightening of wastewater discharge standards, especially in highly sensitive environments.

Therefore, the Jiangsu Water and Wastewater Project (JWWP, hereinafter called the “Project”) was developed in 2009 to support the implementation of above-mentioned provincial water resources management strategy. The key project objectives have been designed to improve the efficiency and effectiveness of water and wastewater services and reduce pollution discharges to local rivers in Jiangsu Province. The objective would be achieved through municipal water supply expansion to towns and the expansion of wastewater collection and treatment in five project cities. Despite various component changes/adjustments, the key project objectives remain unchanged throughout project implementation.

1.1 Original Components

A US$130 million loan was approved for JWWP by the Bank in June 2009. The Loan was declared effective on Sep. 28th, 2009. The project aims to enhance the capacity of city water supply systems to expand service to 78 towns and villages, expand the collection and treatment of city and town wastewater, and improve the operational capacity of water supply and wastewater companies, which consists of the following components:

- Component 1. Water Supply Expansion (Total cost: US$ 178.5 million)
  (i) Danyang: Enhancing the capacity of Danyang water supply and expanding the supply to 24 towns.
  (ii) Taixing: Enhancing the capacity of Taixing water supply system and expanding the supply 22 towns, including NRW reduction in five towns.
  (iii) Yancheng: Enhancing the capacity of Yancheng water supply system and expanding the supply to 21 towns, including NRW reduction in two towns.
  (iv) Zhenjiang: Enhancing the capacity of the Zhenjiang water supply and expanding the supply to 11 towns including NRW reduction in two towns.

- Component 2. Wastewater Management (Total cost: US$ 233.7 million)
  (i) Danyang: Expanding wastewater collection in Shicheng district of Danyang city.
  (ii) Nanjing: Expanding wastewater collection and treatment in Qiaobei, Tiebei and Chengbei areas of Nanjing Municipality.
  (iii) Taixing: Expanding wastewater collection and treatment in Huangqiao Town.

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6 This is the unedited version of the Borrower’s draft ICR, dated December 2015.
- Component 3. Institutional Strengthening and Training (Total cost: US$ 2.50 million)
  (i) Provincial Implementation Support and Capacity Building, including (a) technical assistance for project and contract management, and review of project design; (b) study on the existing wastewater and water supply tariff system; (c) developing and piloting strategies to reduce NRW at the township level; and, (d) training and study tours on various aspects of water supply and wastewater management.
  (ii) Company Capacity Building: Taixing Huangqiao Wastewater Treatment Company.

1.2 Project Changes

The loan was restructured twice during project implementation, respectively in November 2013 and March 2015. With the MTR, a total of 5 original projects/contracts were removed from the World Bank-funded project list and were changed to NBF projects due to inconsistency of contractors’ progresses or delayed project implementation plan with World Bank’s schedule.

Component A – YCWS1.5 Water Distribution Network in Qinnan and Longgang of Yancheng Water Supply. Due to administrative adjustments of shared responsibilities between two towns, the pipelines have been constructed separately by local government using non-Bank funds.

Component B – NJTB1.3 Wastewater Collection System under Planned Road of Nanjing Tiebei Wastewater System, due to pending implementation plan of corresponding road which made it very likely impossible to complete the contract during the project period.

Component B – Danyang Shicheng Wastewater System (DYWW), since it was expected to be badly delayed due to delayed implementation of land acquisition and resettlement in the project area but under another government financed river rehabilitation project.

Component B – Taixing Huangqiao Wastewater System (TXHQ), upon the request of PPMO in July 2010 and on the premise of no resultant impact on the project’s overall targets.

Component C – JSTA3.4 Taixing - Huangqiao WW Company: Institutional strengthening, training and project management, which was cancelled together with withdrawal of Taixing Huangqiao Wastewater System (TXHQ) component.

Two new sub-components were thus added and carried out with savings from other Bank-financing projects with the Bank’s approval, namely Nanjing Longtan Water Treatment Plant (Phase I) and new Taixing Town/Township Water Supply Networks Rehabilitation Project.

1.3 Project Delays

The original closing date of the loan was Dec. 31st, 2014. With the addition of two new components after MTR, the loan closing date was accordingly extended to Dec. 31st, 2015.

1.4 Project Implementation

The procurement of all the project contracts was undertaken in accordance with the Bank guidelines. All bidding documents were reviewed by the Consultant and approved by the municipal PMOs. The contracts requiring Bank prior review were submitted for approval. By end 2015, all the 39 BF contracts under the Project have been awarded with a total value of RMB 1353.71 million. All these contracts have been physically completed and the total payment as reported by Dec. 25th, 2015 has summed up to RMB1299.95 million.
2. **Achievement of Objective and Outputs**

2.1 **Output by Components**

As per project design, the implemented project improved the efficiency of infrastructure service delivery, providing safe and quality water to cities and towns, reducing pollution discharge to water bodies, improving water resources management and utility performance. More specifically, the following positive benefits were provided: (i) improvement of a total water supply capacity by to meet future demand; (ii) improved mechanisms to safeguard the rural water supply and health of rural people; (iii) collection of wastewater to improve quality of urban life and industrial development; and (iv) treatment of wastewater to improve the water quality of rivers, as presented below.

(a) **Danyang City Water Supply - US$38.80 million in PAD, US$38.80 million completed**

The sub-component increased water treatment capacity of Danyang City by 100,000m$^3$/d and laid an additional raw water transmission pipe (DN1800, L=15km) which significantly improves local water supply reliability serving a total population of 310,000 people. The treated water quality meets the new national standard of “Hygienic Standard for Drinking Water Quality” (GB5749-2006).

(b) **Taixing City Water Supply - US$39.8 million in PAD, US$39.8 million completed**

This sub-component includes: extension of Baota WTP to the capacity of 50,000m$^3$/d; laying of Taihuang Phase 2 clean water transmission pipes (27.3km, DN300-DN800) with the extension of Heshi PS (to the capacity of 80,000m$^3$/d) and Huangqiao PS (to the capacity of 45,000m$^3$/d); construction of Zhangqiao PS (20,000m$^3$/d); laying of clean water transmission branches to townships (144.82km, DN200-DN800); construction of aggregated water supply systems in 8 townships (355.6km, De2-DN300). Together with the new Taixing Town/Township Water Supply Network Rehabilitation Project added after the Project MTR, the total water supply of Taixing Water Supply Company increased from 90,000m$^3$/d of 2009 to 200,000m$^3$/d of 2015 with an additional population of 700,000 persons served by Taixing water supply system covering all the 16 townships. The treated water quality meets the new national standard of “Hygienic Standard for Drinking Water Quality” (GB5749-2006).

(c) **Yancheng Municipality Water Supply –US$53.3 million in PAD, US$53.3 million completed**

This sub-component includes: expansion of Chengdong WTP from 100,000 to 200,000m$^3$/d, construction of a 200,000m$^3$/d raw water intake PS, laying of 10.75km long, DN1400 raw water pipe and 58.2km long DN500-800 clean water transmission pipe (partially financed by the WB loan), and expansion and rehabilitation of distribution networks (366km long, DN200-DN50) in 2 townships of Qinnan and Longgang. The sub-component served a total population of 1.04million people in 2014, and its served population will increase to 1.26million people by 2020. This project significantly increased the water supply capacity of Danyang and the treated water quality meets the new national standard of “Hygienic Standard for Drinking Water Quality” (GB5749-2006).

(d) **Zhenjiang Municipality Water Supply –US$46.6 million in PAD, US$46.6 million completed**

Before expansion, Jinshan WTP was installed with a treatment capacity of 100,000m$^3$/d, but in fact operated at the capacity of 70,000m$^3$/d to guarantee treated water quality. This
sub-component includes expansion of existing Jinshan WTP to 300,000m³/d, construction of a raw water intake PS (100,000m³/d), laying of a transmission pipe (265m long, DN1200) and rehabilitation and expansion of water distribution network in Xinfeng Town (69km, DN63-DN200) and Dinggang Town (40.1km, DN50-DN200) together with rehabilitation of water meters for over 6480 households. The completed Jinshan WTP is now serving a total population of 1.10million people, which makes the total water supply capacity of Zhejiang up to 500,000m³/d and effectively guarantee water supply of both its urban and suburban areas. The treated water quality meets the new national standard of “Hygienic Standard for Drinking Water Quality” (GB5749-2006).

(e) Nanjing Longtan WTP (newly added after MTR) – US$12.7 million completed
This component is to construct 200,000 m³/d Nanjing Longtan Water Treatment Plant (Phase I), including a Yangtze River water intake of 2*DN2200 raw water pipeline of 338m, an intake pumping station at full capacity of 800,000 m³/d equipped with 3x105,000 m³/d pumps for Phase I, and a 8.2km clear water main of DN1200. The constructed WTP has been put into commissioning serving a total population of 1million people. The treated water quality meets the new national standard of “Hygienic Standard for Drinking Water Quality” (GB5749-2006) with the turbidity no higher than 0.2NTU.

(f) Taixing City Water Supply (network rehabilitation, newly added after MTR) – US$9.00 million completed
Based on the outputs of original Taixing City Water Supply sub-component, this new sub-component implemented the rehabilitation of totally 1339.44km water distribution network in eight communities in six towns. Together with the original Taixing City Water Supply sub-component, it serves a total population of 1.20million people in 2015.

(g) Nanjing Wastewater System – US$213.4 million – PAD, US$ million completion
This component consists of three parts, namely:

Nanjing Qiaobei Wastewater Sub-component includes the construction of Qiaobei WWTP with a capacity of 100,000m³/d adopting A/A/O biological treatment process, all of whose wastewater discharge now meets Class 1A of the Pollutant Discharge Standard for Town WWTPs. The WWTP serves a total area of 120.6 km² and a total population of 408,000 in the short term and 750,000 in the long term. A total volume of 22.72 million m³ of sewage was treated in 2014 with annual COD load reduction of 3816t and annual BOD₅ load reduction of 1688t.

Nanjing Tiebei Wastewater Sub-component includes construction of a 56km long, DN400-DN1500 wastewater collection system, a 50,000m³/d capacity PS in Taixing Road and a new Tiebei WWTP with treatment capacity of 100,000m³/d. All of its wastewater discharge now meets Class 1A of the Pollutant Discharge Standard for Town WWTPs. The WWTP serves a total area of 26.3 km² and currently a total population of 124,300 (231,500 by 2020). A total volume of 4.60 million m³ of sewage was treated in the year of 2014 with annual COD load reduction of 323t and annual BOD₅ load reduction of 104t.

Nanjing Chengbei Wastewater Sub-component includes construction of a 43km long, DN300-DN1500 waste water collection system and a new Meijiatang PS with a capacity of 27,000 m³/d (in dry weather). The project operation enables existing Chengbei WWTP to be operated at its full capacity of 300,000m³/day for wastewater treatment to meet Class 1A of the Pollutant Discharge Standard for Town WWTPs.
Institutional Strengthening and Training - USD 2.5 million PAD, USD1.685 million completed

This part was implemented with four components:

JSTA3.1: Project and Contract Management and Design Review Services: The contract was extended once until project closing to provide support on procurement procedures, project and contract management, fund utilization, financial management, environmental management, implementation of land acquisition and resettlement and etc. In addition, as part of this contract, a study on NRW reduction strategies targeting at the project cities of Danyang, Taixing and Zhenjiang was completed in June 2011, which proposed strategies to achieve sustainable NRW reduction in project cities.

JSTA3.2: Tariff Study and Town Water Supply Institutional Financial Reform: The contract was awarded to develop the “Financial Projection Model and Analysis Report” tailored to each PIU, and through the study a “Water Tariff Institutional Reform Report” was finalized based on extensive consultation with local authorities and the World Bank in February 2014.

JSTA 3.3: GIS-based Network Plans for Town Networks and Dedicated Transmission Lines: Under this contract, based on demand survey and demand analysis conducted specific to each project city (Danyang, Taixing, Yancheng and Zhenjiang) and subsequently developed outline design, the procurement and supply of GIS platform software was completed for all the project cities. The internal development and data processing of GIS system was completed for Taixing and Yancheng. The procurement of hardware for Taixing has been completed and the goods were delivered in late August 2014. The Consultants has also completed the installation of delivered equipment, setting-up of database and provision of trainings under this contract.

JSTA 3.5: Training and Study Tours: The contract was implemented based on seven different delegations on various aspects of water supply and wastewater management during Nov. 2011 - Apr. 2014. These study tours provided the officials and engineers from competent authorities with good opportunities to learn advanced experience and expertise of developed countries on municipal water supply and wastewater management.

2.2 Economic Benefits

Major economic benefits from the project will arise from increased coverage and improved service of water supply, and wastewater collection and treatment. The project has undoubtedly contributed to the sustainability of continued strong economic growth in the region. The project has produced a number of benefits arising from: (i) Reduction in poverty and inequality through balanced urbanization and access to basic infrastructure services; (ii) Better management of scarce water resource and environmental challenges; and (iii) improvement of public health through safe and clean drinking water and a reduction of untreated wastewater discharge into local rivers and open channels.

2.3 Financial Performance

The financial design for the project aimed to ensure financial sustainability of involved water supply and wastewater companies. According to financial analysis conducted for each entity operating water supply/wastewater facilities constructed under the Project, it is found that:

- During project implementation, water supply tariff in all project cities were raised to balance high water supply cost. However, with the increase of overall operation cost,
there is only insignificant increase in terms of their net income. With the repayment of both principal and interest during 2016-2033, the project-involved water supply companies will face even higher financial pressure unless with the reduction of operating cost, overhead or service fee, NRW percentage or further increase of water tariff.

- All project-involved water supply companies managed to meet LA requirement by have a total revenue higher than total operating expenses in each fiscal year covered by the conducted financial analysis, commencing in FY2012.
- With project implementation (2009-2014), significant reduction of Non-Revenue Water (NRW) has been observed, in Zhenjiang (from 21.3% to 16.7%) and Taixing (from 51% to 30.5%). NRW remains at a stable level in Yancheng, and in Danyang, with significant expansion of centralized water supply services into suburban/rural areas, its NRW level in 2014 (30%) was even higher than that in 2009 (20.42%), but showing an obvious reduction trend since 2015 (12%) thanks to significant improvement of water distribution network.
- In terms of debt service coverage, apart from Danyang, none of the analysed water supply companies managed to meet the target of 1.1 or higher by 2014. However, the municipal governments in all the project cities are providing adequate financial resources to ensure full operation of the WTPs.
- As predicted, by 2030, all of these components have the ERR above the threshold acceptable to the GoC, i.e., the 10% discount rate recommended by NDRC in 2002.
- As predicted, by 2030, all of these components shows sustainable financial performance, with over 10% FIRR.
- During project implementation, wastewater tariff in Nanjing increased from 1.30RMB/m³ to 1.42RMB/m³, which is currently higher than unit treatment cost. Although the analysis showed negative net income of the WWTP operator, Nanjing Water Utilities Company, with low treatment cost and increased treatment volume, financial performance of the company is expected to be positive in the future.
- As prediction, by 2030, the two WWTPs can lead to sustainable financial performance, with over 6.9% FIRR.

2.4 Construction Management

The high involvement of international consultants under package JSTA3.1, enabled the construction management of the project to be carried out to a satisfactory standard.

2.5 Poverty Alleviation and Social Impacts

Throughout implementation, the Project has created several thousands of temporary job opportunities. Also, over 900 permanent job opportunities were created for project operation. The Project, seen as a promoter of the concept of economic sustainability, will be continuously conducive to a reduction of poverty and inequality through balanced urbanization and access to basic infrastructure services with the expansion of centralized water supply system into suburban and rural areas. With the implementation of Nanjing Wastewater component, more wastewater has been intercepted and discharged after centralized treatment. This has improved the local environment and living conditions and reduced the risk of health problems caused by water contamination. In addition, a priority
of the project design was the reduction of resettlement impacts through optimization of design, and this has already demonstrated a more sustainable approach to the provision of services in urban areas.

2.6 Environmental Impacts
No significant environmental management issues arose during project construction and the environmental management plans prepared to mitigate potential adverse environmental impacts resulting from the project activities were implemented in full. The Project is set to fully achieve the beneficial impacts identified in the PAD Environmental Assessment, and although it will only be possible to assess the full environmental impacts some years after project completion, specific benefits are already apparent.

2.7 Land Acquisition and Resettlement
All land acquisition and resettlement of affected persons was successfully dealt with in accordance with the resettlement plans approved by the Bank.

2.8 Achievements of Key Performance Indicators
During loan restructuring, some of the appraised KPI targets were found to be impractical and therefore revised. Most of the KPI targets were already met before December 2015; however, the targets of NRW reduction were only partially met in Danyang and Yancheng. This was due to the fact that some old water supply networks in township areas of other project cities remained to be replaced, and this would require more time and budget as the main constrains. Since NRW reduction should be considered as the key strategic issue for the long-term sustainable development of local water supply system, in particular, considering the ongoing trend of expanding centralized water supply system into suburban areas, continuous efforts would be made accordingly by local authorities, even after the Project completion.

3. Major Factors Affecting Implementation and Outcome

3.1 Factors Outside the Control of Local Government or the Implementing Agency
a) Fluctuation of exchange rate of US$ against Chinese RMB during project implementation;
b) The rule of awarding to the bidder offering the lowest bid price in some cases resulted in the contractors unable to provide quality services due to lack of funding, weak managerial capacity and low quality of project delivery. It has been identified that contract documents in general should be of a higher quality to prevent such situation.

3.2 Factors under the control of the local government
a) The Project was carried out in locations where economies were rapidly developing, in some cases regarded as key contributors to local socioeconomic development.
b) The project process under World Bank procedures can take some time compared to local procurement procedures. Consequently certain contracts were changed to use 100% local funding (non-Bank financed) during implementation.
c) Both State and Provincial governments have provided assistance throughout all stages of the Project. In particular, following good practice in earlier World Bank-funded project, a powerful and efficient project management group under the provincial government was assigned to be responsible for overall guidance and coordination of
project implementation. Relevant municipal/city governments, together with PIUs, have made great efforts in project management, financial and other resources arrangements.

d) The Project has been successfully implemented in full compliance with all applicable Bank policies, (procurement, contract management, construction supervision and safeguards). Major project deliverables have been achieved; however, it has to be noted that it has not yet proved possible to implement all the institutional and financial reforms set out during the project appraisal stage.

3.3 Factors under the control of the project implementing units (PIUs)

The project has enabled the PIUs to improve their capacity and efficiency in project management. Due to the comparatively long project implementation period there have been a number of changes in the project management personnel. This has occasionally caused difficulties during project implementation, but without adverse impacts on end results.

3.4 Costs and Financing

Total project costs identified during project appraisal were US$ 431.8 million, of which the total project costs without interest during construction and front-end fee was US$414.8 million. Other major funding resources include state bonds, provincial government provision, and local finance from municipal government and project units. The actual portion the Bank loan was 34.7% and other major funding resources were 65.3%. During project appraisal, this ratio was 30.1% to 69.9%.

4. Sustainability

4.1 Prospects for Sustainability

Generally speaking, the Project can be regarded as sustainable. The newly built WTPs are operating well and being maintained appropriately. The water tariffs form an integral part of financial sustainability. Current water tariffs in project cities are generally higher than current unit operating and maintenance costs, but lower than total unit costs when including overhead, service costs and other financial costs. The water supply companies should lower their operating costs, overhead and service costs, further reduce NRW, and/or further raise water tariffs for continuing financial sustainability.

For the wastewater component in Nanjing, it is believed that the combination of the newly established institutional arrangements with new tariff will provide a solid foundation for the sustainable development of wastewater services in Nanjing municipality. Current wastewater tariff is higher than total unit cost, which indicates improving financial performance and sustainability of the wastewater company, particularly considering low wastewater treatment cost and increase of treated wastewater.

4.2 Arrangement of daily operations

All five expanded/new WTPs are now fully operational complying with applicable national standard. Experienced or well-trained operational staff were recruited for the WTPs. The implemented TA component on GIS-based network plans also provided a good foundation for better operation of these WTPs in the near future.

Both new WWTPs are now fully operational. Experienced operational staff were recruited with proper training started with the WWTP commissioning. In addition, the TA
Consultants for JSTA3.1 have provided advice and training on wastewater operational procedures, treatment processes, asset management and awareness of pollution control. Following project completion, effluent from both WWTPs has complied with the requirements of the Class-1A National Discharge Standard. The wastewater treatment rate in Nanjing reached 95% in 2014, and all sewer and pipeline system performance was satisfactory.

5. Project Experience and Lessons Learned

The Project has been very successful with most of its original objectives achieved particularly in terms of institutional intervention. Significant capacity building in relevant aspects of procurement, contract and project management, WTP and WWTP operations and maintenance, environmental monitoring and financial management have been achieved. In particular the Bank’s construction management procedures, demonstrating fairness and accuracy, were considered to be a prerequisite of project success.

5.1 Project Experience

1) **Capacity building of project management organization** – Following good practice in earlier World Bank-funded project, a powerful and efficient project management group under the provincial government was assigned. Despite only staffed with four full-time officials, the PPMO was capable of efficient project coordination and management throughout project cycle with consultants’ support. In addition, the Project continued to provide training and valuable recommendations to project cities not familiar with the utilization of international funding.

2) **Institutional reform for wastewater management** – During project implementation, Nanjing municipality has completed institutional reform of its wastewater management. On March 1st, 2013, Nanjing Water Group Co., Ltd. was founded based on the original Nanjing Municipal Water Supply Company by integrating the whole Nanjing Utilities Water Co., Ltd. and part of Nanjing Municipal Drainage Management Department, which was planned to be built into a nationally first-class water and wastewater service provider and the investment and financing platform for the whole municipality in three to five years.

3) **Targeted efforts for NRW reduction** – Before project implementation, the NRW rate in some towns/townships within project areas was as high as 70% mainly due to physical loss caused by the aging of water supply network. During project preparation, different options were considered to support and facilitate the rehabilitation of existing network before being connected with urban water supply system. NRW reduction was also included as part of key performance indicators designed for the Project. During implementation, with loan financing, experienced international consultants were hired to conduct a study on NRW reduction strategy and guidelines, through which tailored NRW reduction strategies and guidelines were developed for project cities with 9 towns identified for piloting the strategies. With project MTR, some of the pilot towns were covered by the new component of water supply network rehabilitation in Taixing to further reduce local NRW. Upon project completion, the NRW percentage in project cities has been significantly reduced, even with large-scale integration of suburban and rural areas into their service scope. The project implementation has built up practical experience for urban-rural water supply services integration and further strengthened the management capacity of local PIUs on town/township water supply services.
4) Significant improvement of town water supply safety and reliability – The integration of township water supply system into urban water supply system under the Project has significantly increased the suburban and rural areas directly served by city water supply companies with water supply from Changjiang River and thus improved water supply safety and reliability of newly connected townships.

5) Benefited overall water quality in Nanjing Municipality – With project implementation, the coverage of wastewater services in Nanjing was increased from 67% in 2008 to current 95%. In old urban areas, more wastewater was able to be collected by the implemented separate drainage system for proper treatment at corresponding WWTPs before being used to replenish the local rivers for scenery purpose with compliant effluent quality.

6) Improved project cities’ images – The success of the Project have contributed to further development of project cities who were awarded with a number of honours during the Project implementation period.

7) Rational arrangement of remaining loan – With experience from earlier World Bank-financed project, the PPMO and local PIUs have started the preparation of loan reallocation based on expected loan saving from component cancellation and lower costs during bidding. Two new components were quickly identified for Bank funding with all project preparation, application procedures and approval completed in a short period of time. The construction of both new components was completed by the end of 2015.

5.2 Borrower’s Observations

1) Lowest price requirements in bid evaluation – The Bank’s Procurement Guidelines specify that contracts should be awarded to the lowest costs substantially responsive bid. However, there were still cases of irrational competition during project implementation despite efforts made, it was thus suggested that, in future, the preparation for design and bidding documents should be of a high quality to prevent irrational competitions.

2) Contributions from the Consultants – During project implementation, PMOs and PIUs became familiar with the use of the consultants, and the Project made better uses of the Consultants throughout its whole cycle. With their assistance, some technical issues were effectively solved and communications were strengthened, which was important for the successful completion of the Project.

5.3 Specific Lessons Learned

1) Improvement of network contract packaging – During the implementation of water supply/wastewater network under the Project, a lot of variations and serious delay was observed, in particular, in relation to wastewater collection pipelines under planned roads. This was mainly due to delayed implementation of corresponding planned roads. Instead of waiting for long pending road construction as part of changing urban development master plan during implementation, the possibilities of implementation shall be included as one of the considerations for network contract packaging in addition to catchment zoning and differentiation between mains and branches so as to prioritize the pipelines that can be easily implemented and thus to realize designed project benefits at an earlier date.
2) **Prevention of unreasonable variations** – PMOs and PIUs emphasized the importance of accurately preparing the bidding documents, including designs, specifications and BOQ, etc. This will benefit the PIUs by preventing unreasonable variations during construction.

3) **Familiarity with procurement and financial management procedures** – It was noted that PIUs would benefit from earlier training and timely guidance on the Bank’s procurement and financial management procedures, in particular, for those cities without prior Bank experience.

4) **Be less optimistic about project performance results for the indicators highly dependent on prevailing policy environment** - Do not set targets that are unlikely to be achieved in view of the prevailing policy environment and precedents. For example, both financial indicators were removed from the project result framework, since these indicators were not well selected since the utilities in the project cities do not have control of tariff adjustments – tariffs are usually imposed by the local governments.
Annex 8. Comments of Co-financiers and Other Partners/Stakeholders

N/A
Annex 9. List of Supporting Documents


Annex 10: Project pictures

Danyang WS - Construction of Changwan WTP
November 2009

Danyang WS - Completed Changwan WTP

Nanjing Tiebei - Construction of WWTP
November 2009

Nanjing Tiebei - WWTP in operation

Nanjing Qiaobei - Construction of WWTP
November 2009

Nanjing Qiaobei - Greening of WWTP site
<table>
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<th>Completed Nanjing Qiaobei WWTP</th>
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<td>Yancheng WS - Bridge for water transmission pipe</td>
<td>Zhenjiang WS – Old</td>
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<td>Zhenjiang WS – Pump station</td>
<td>Zhenjiang WS – Pump station</td>
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