



## Technical Assistance

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Project Number: 40017  
November 2006

# People's Republic of China: Preparing the Qingdao Water Resources Management Project

Asian Development Bank

## CURRENCY EQUIVALENTS

(as of 13 October 2006)

Currency Unit	–	yuan (CNY)
CNY1.00	=	\$0.126
\$1.00	=	CNY7.915

## ABBREVIATIONS

ADB	–	Asian Development Bank
EARD	–	East Asia Department
EA	–	executing agency
EIA	–	environmental impact assessment
EMP	–	Environmental management plan
FSR	–	feasibility study report
IA	–	implementing agency
IWRM	–	integrated water resources management
PFSR	–	prefeasibility study report
PRC	–	People's Republic of China
QMG	–	Qingdao municipal government
RP	–	resettlement plan
TA	–	technical assistance
TOR	–	terms of reference

## WEIGHTS AND MEASURES

ha	–	hectare
km	–	kilometer
m	–	meter
m <sup>2</sup>	–	square meter

## TECHNICAL ASSISTANCE CLASSIFICATION

<b>Targeting Classification</b>	–	General intervention
<b>Sector</b>	–	Agriculture and natural resources
<b>Subsector</b>	–	Water resources management, environment, biodiversity, and forestry
<b>Themes</b>	–	Environmental sustainability, sustainable economic growth
<b>Subthemes</b>	–	Natural resource management, urban environmental improvement, and promoting economic efficiency

## NOTE

In this report, "\$" refers to US dollars.

<b>Vice President</b>	C. Lawrence Greenwood Jr., Operations Group 2
<b>Director General</b>	H.S. Rao, East Asia Department (EARD)
<b>Director</b>	K. Kannan, Director, Agriculture, Environment, and Natural Resources Division, EARD
<b>Team leader</b>	A. Siddiq, Principal Project Economist, EARD
<b>Team member</b>	Q. Zhang, Environment Specialist, EARD

## I. INTRODUCTION

1. During the Country Program Midterm Review in November 2005, the Government of the People's Republic of China (PRC) requested technical assistance (TA) from the Asian Development Bank (ADB) to prepare the Qingdao Water Resources Management Project.<sup>1</sup> The concept clearance was approved by the Vice President in February 2006. During the 2006 Country Programming Review Mission, the Government confirmed its request. In July 2006, the Fact-Finding Mission was fielded to assess the results of available studies and determine the scope of the TA. The Mission held discussions with representatives of the Government and those of Qingdao Municipality in Shandong province. Understanding was reached on the TA impact, outcome, output, cost estimates, financing plan, implementation arrangements, and the consultant's terms of reference. The TA design and monitoring framework is in Appendix 1.

## II. ISSUES

2. The PRC economy has grown rapidly since 1978, starting its gradual transition from a centrally planned to a market economy. Over the past three decades, PRC has maintained gross domestic product growth of about 9% per annum, and lifted 450 million people out of absolute poverty. Despite this rapid economic growth, about 135 million people still live on \$1/day and about 500 million live on less than \$2/day. Therefore, poverty reduction remains the major focus of the Government. The PRC also faces daunting challenges in maintaining rapid economic growth and employment generation; managing resource demands and environmental consequences of rapid industrialization; and addressing the resulting income inequalities.

3. Qingdao, the host city for the 29th Olympic Sailing Regatta in 2008, is a coastal city situated by the Yellow Sea on the east and south, adjoins the cities of Yantai, Rizhao, and Weifang to the northeast, southwest, and west, respectively, and faces People's Democratic Republic of Korea, Republic of Korea, and Japan across the sea. Qingdao is a major city for finance and foreign trade in Shandong Province. Some local companies, such as Haier, Hisense, Tsingtao Brewery and Aucma, are recognized worldwide. Qingdao has established extensive connections with foreign countries and organizations for economic cooperation, resulting in a stable economic growth, increase in foreign direct investment, and trade. The total area of Qingdao Municipality is 10,654 square kilometers (km<sup>2</sup>) with the urban area totaling 1,102 km<sup>2</sup>. Its population is 7.10 million, of whom 2.38 million are urban dwellers.

4. With rapid urban development and population growth, water shortages as well as regular flooding have become key constraints to sustainable development. To overcome these constraints, the Qingdao municipal government (QMG) intends to (i) expand and conserve the Jiaozhou Bay and Dagu River wetlands in Jiaozhou county—located northwest of Qingdao City; and (ii) improve water availability on a sustainable basis by developing Quanxinhe Dam in Laoshan district—located southeast of Qingdao city. Both are geographically and hydrologically separate and distinct subprojects.

5. There is an urgent need to protect the lower parts of Jiaozhou City from Dagu River floods, and the wetlands from the negative impact of rapid urban, industrial, and agricultural development from the surrounding areas. These are the only wetlands in Qingdao Municipality identified in the national wetland protection list. The wetlands, located within the Jiaozhou Bay economic zone, are home to 156 species of waterfowl, of which 21 fall under special State

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<sup>1</sup> The TA first appeared in ADB *Business Opportunities* on 22 August 2006.

protection. More than 10 species are globally endangered. Wetland pollution has caused severe damage to the local environment, resulting in degradation of wildlife habitat and a sharply declining number of wildlife species, and impairing ecosystem functions. Jiaozhou City, located in the southern part of the Dagu River Basin, is frequently exposed to floods. There is a proposal to construct an artificial lake of approximately 8 km<sup>2</sup> in surface area with an average depth of 2.7 meters (m). The lake will aid in flood retention as well as serve as a multipurpose reservoir to supply water to the surrounding wetlands for the upkeep of their ecological function. Surplus water will be diverted for industrial and agricultural uses. The total area is spread over 96 km<sup>2</sup>.

6. A prefeasibility study report (PFSR) for the Jiaozhou wetlands subproject has been prepared. The Jiaozhou county administration intends to develop part of the lakeshore as recreational park, and business and residential areas. The proposed interventions will include realignment of the Dagu River course, construction of a flood-retention lake, hydraulic infrastructures for wetland conservation, a sewage treatment plant, and afforestation. The total investment cost of the Jiaozhou wetlands subproject is estimated at \$104 million.

7. The objective of the second subproject—Quanxinhe Dam—is to increase the quantity, quality, and reliability of the water supply in Laoshan district. A new dam will be constructed to replace the existing 40-m-high stone-arch dam. The existing dam was constructed 35 years ago and is considered unsafe. Water leakages through the dam structure have been observed recently. The stored water will be primarily supplied to 50,000 inhabitants of the coastal villages and towns for domestic use. Currently, these communities get 60% of their water supplies from surface water and the remaining 40% from groundwater sources. Surplus water from the dam will be used for irrigation in the surrounding areas. The proposed new 76-m-high concrete-faced rockfill dam will be constructed 150 m downstream of the existing one and about 500 m from the coastline. The new reservoir will have a storage capacity of 6.83 million cubic meters with a surface area of 180,000 m<sup>2</sup>.

8. There are no human activities in the catchment area (12 km<sup>2</sup>) upstream of the dam site. Therefore, the water quality is good. The material for dam construction (granite rocks) will be largely taken from the catchment area and from the bottom of the existing reservoir. Geotechnical investigations have not revealed any seepage in the area of the new dam site. A PFSR for the dam design and construction was prepared in 2004. The environmental impact assessment (EIA) will be completed in 2006. The dam site lies within the Laoshan National Park. QMG will initiate the approval process for change in land use—expected to result from expansion in the reservoir area—from concerned agencies once the EIA has been completed. The total cost of the Quanxinhe Dam subproject is estimated at \$32 million.

9. Despite the growing capacity of different water sector agencies and departments in QMG, the integrated water resource management (IWRM) approach has not yet been adopted to address related issues. Therefore, the existing institutional arrangements—to develop and manage water resources—require an appropriate framework to operate coherently. Important aspects of water policy have continually been improved but the enforcement, particularly of wastewater disposal and water quality, remains weak. With rapid urban and industrial growth in Qingdao municipality sustainable and efficient management of water resources has become a major challenge. Adoption of the IWRM approach along with further improvement in institutional capacity of water sector agencies is imperative to sustain rapid economic growth and reduce poverty.

### III. THE TECHNICAL ASSISTANCE

#### A. Impact and Outcome

10. The TA will help QMG prepare an investment proposal to develop and better manage its water resources. The outcome of the TA will be an agreement with the Government on project design, feasibility study reports (FSR) for both subprojects, and project implementation arrangements. The TA design and monitoring framework is in Appendix 1.

#### B. Methodology and Key Activities

11. The output of the TA will include (i) a review of the design for an artificial lake and development plans for the Jiaozhou wetlands including wastewater treatment, afforestation, and biodiversity conservation; (ii) a review of the design for Quanxinhe Dam; (iii) additional technical studies/tests, if required; (iv) analysis of the economic and financial viability of both subprojects; (v) preparation of the project cost estimates; (vi) a review of current water management practices and institutional arrangements, and development of an IWRM plan; and (vii) preparation of safeguard documents, i.e., EIA, and resettlement plans (RPs) according to ADB policies and guidelines.

12. PFSRs of both subprojects have been prepared but require a detailed review to determine their respective objectives and institutional arrangements. The TA will be implemented in two phases. In phase 1, a detailed technical review of both PFSRs will be carried out and subsector analysis accomplished. Institutional review will also be undertaken to establish an IWRM framework. Phase 2 will assist QMG in preparing comprehensive FSRs as well as the requisite EIAs, environmental management plan (EMP), and RPs following the Government and ADB policies and guidelines.

13. The TA—in accordance with international best practices—will analyze (i) the hydrology of Jiaozhou Bay wetlands and Dagu River system in light of the proposed interventions; (ii) the hydrology of Quanxinhe Dam, considering probable maximum flood and maximum historic return-flow; (iii) soil and geotechnical conditions of the Quanxinhe reservoir site; (iv) engineering designs of both subprojects; (v) cost estimates; and (vi) economic and financial viability of the project. Studies and investigations/tests—in addition to the work carried out by the design institutes and the Water Conservancy Bureau—will be undertaken, if required.

14. To help QMG adopt the IWRM approach, and to ensure that a wide range of issues and stakeholder interests are considered, the TA will review available information on the Dagu River system and analyze the current institutional framework for water resource management and water tariff policy. Based on this analysis—and a review of the existing watershed conditions—the TA will develop a river basin management plan focusing on land use, water quality, wastewater treatment, discharge practices, as well as conservation of the wetlands ecosystem.

15. Laoshan district aims to sustainably increase water availability and agricultural productivity in the area by developing key hydraulic structures. Quanxinhe Dam, and the associated water supply to the coastal villages and towns, will be the largest infrastructure development to regulate flows in Laoshan district. However, there are other smaller reservoirs planned—outside the scope of this Project—or even constructed within the valleys of the Laoshan district. Given that the project area is supported by different river systems and hydraulic structures, water resources management cannot be optimized by Quanxinhe Dam alone without considering the runoff regime of adjacent river systems on a real-time basis as

well as the operation of other existing and planned water control structures on those rivers. Technological advancements in hydrologic data collection, stream-flow forecasting, modeling, and computer technology can provide opportunities for adjusting daily reservoir operation according to the actual water demands.

16. With effective use of real-time data and computer models, the operation of Quanxinhe Dam can be upgraded to provide operators with a decision support system by which reservoir water releases would be optimized to meet water requirements downstream. Adopting an IWRM approach and optimizing associated water storage and diversion structures operation can enhance operational efficiency in the following areas: (i) real-time reservoir operation at the basin-level including tributaries and dams; (ii) integrated management of all water sources including dams, rivers/traditional canals, groundwater, drainage water, and treated wastewater; and (iii) enhanced (irrigation) water demand management. The TA will propose an IWRM approach for the project area including a survey of current status of water use/consumption and a projection of future water demand for the subsectors. The TA will prepare monthly basin water allocation plans, using scenario analysis. These scenarios will consider domestic water supply, irrigation, and environmental water demands over the envisaged project life span.

17. In accordance with ADB's *Environment Policy* (2002) and *Environmental Assessment Guidelines* (2003), the TA will conduct EIAs and prepare a report as well as a summary EIA report. The summary EIA report will be disclosed to the public 120 days before the Board considers the loan project. Necessary mitigation measures and environmental monitoring requirements will be incorporated into the EMP. The EMP will also recommend appropriate institutional- and capacity-building components for monitoring mechanisms.

18. In the wetlands subproject, the key objective is to protect the lower parts of Jiaozhou City from Dagu River floods. The Water Resources Bureau of Qingdao Municipality will take the lead in subproject formulation and implementation. However, closer consultations with the Forest and Environmental Protection Bureau are needed. While preparing the EIAs, the TA will identify potential impacts of subproject activities on wetlands and design mitigation measures by assessing (i) the operation of the artificial lake as a sustainable ecosystem; (ii) potential saltwater intrusion, sedimentation, and nutrient loading on the lake operation and water quality; (iii) changes in flood patterns due to the operation of the lake; (iv) wetlands ecosystem, i.e., aquatic habitats, fish diversity, and terrestrial biodiversity; and (v) the related social impacts. The TA will further examine to what extent the currently designed subproject activities will affect (both positively and negatively) wetlands conservation, and determine the overall objective of the subproject intervention. To this end, an analysis of how the wetlands conservation master plan and flood control actions could complement each other will also be analyzed.

19. As the height of the Quanxinhe Dam crest is designed at 76 m above the ground (or 106 m above sea level), the Project will be classified as Category A in accordance with ADB's environmental policy. As the dam site lies within the Laoshan National Park and the provincial nature reserve, competent national agencies will be consulted. A draft EIA is being prepared by Qingdao Environmental Institute. Public opinion has also been sought through a questionnaire survey. Under the TA, a more detailed stakeholder consultation with government agencies, local nongovernment organizations, research institutes, and affected people will be undertaken.

20. Since the Quanxinhe Dam will be built just 150 m downstream of the existing one, resettlement is not an issue. However, about 41 hectares (ha) of land will have to be acquired. In the Jiaozhou wetlands subproject, an estimated 1,500 people (in 5 villages) will have to be moved, and about 1,000 ha of land acquired. The TA will prepare detailed land acquisition and

RPs complying with Government and ADB safeguard policies. There are no ethnic minorities in either of the subproject areas. The initial poverty and social analysis framework is in Appendix 2.

### **C. Cost and Financing**

21. The total cost of the TA is estimated at \$850,000 equivalent. The Government has requested ADB to finance \$600,000 to cover most of the TA costs. The TA will be financed on a grant basis by ADB's TA funding program. The Government will finance the remaining \$250,000 equivalent through in-kind contributions by preparing FSR, and providing counterpart staff and office accommodation to TA consultants. Detailed cost estimates are in Appendix 3. The Government has been informed that approval of the TA does not commit ADB to finance any ensuing project.

### **D. Implementation Arrangements**

22. The TA will be carried out by a team of consultants, engaged through a firm, with experience in (i) water resources, institutional, economic, and financial analyses; (ii) water resources planning; (iii) hydrology; (iv) structural engineering; (v) wetland ecology; (vi) environmental management; (vii) dam safety; (viii) fisheries and forestry; (ix) resettlement and land acquisition planning; and (x) social development. The TA will require 16 person-months international and 36 person-months national consulting services. The consultants will be engaged by ADB in accordance with the *Guidelines on the Use of Consultants by Asian Development Bank and Its Borrowers* and other arrangements satisfactory to ADB for engaging national consultants. The consulting firm will be selected by (i) inviting simplified technical proposals; and (ii) using the quality- and cost-based selection method. The TA will be implemented in two phases over 7 months. There will be a break of 1 month between the phases for a detailed review of phase 1 outputs by the Government and ADB to determine whether to proceed to phase 2. Tripartite meetings will be held after the consultants submit the inception, midterm (at end of phase 1), and draft final reports. Outline terms of reference for the consultants are in Appendix 4. The vehicle and equipment provided for the consultants' work under the TA will be procured in accordance with ADB's *Guidelines for Procurement* and will be handed over to the Executing Agency upon completion of the TA. The TA is expected to start in February 2007 and be completed in October 2007.

23. The Qingdao Development and Reform Commission will be the Executing Agency. One project implementation unit each in Jiaozhou county and Laoshan district will be set up—headed by a respective project manager. A project steering committee will be set up—headed by Qingdao Development and Reform Commission and with representatives from Jiaozhou county and Laoshan district—to support the consultants and ensure timely preparation of the Project. ADB will provide close supervision by fielding review missions at major TA milestones—inception, midterm review at the end of phase 1, and draft final report review before the end of phase 2—and extending regular backstopping from both the headquarters and the resident mission.

## **IV. THE PRESIDENT'S DECISION**

24. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance not exceeding the equivalent of \$600,000 on a grant basis to the Government of the People's Republic of China for preparing the Qingdao Water Resources Management Project, and hereby reports this action to the Board.

## DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<p><b>Impact</b></p> <p>Improved and integrated water resources management (IWRM) in Qingdao Municipality of Shandong Province</p>	<ul style="list-style-type: none"> <li>• Decrease in flooding by 2012<sup>a</sup></li> <li>• Increase in water supply by 2012<sup>a</sup></li> <li>• Improved water quality in wetlands by 2015<sup>a</sup></li> <li>• Decreased threat to endangered species by 2015<sup>a</sup></li> </ul>	<ul style="list-style-type: none"> <li>• National, provincial, and municipal statistics monitoring environmental and economic performance of the sector</li> </ul>	<p><b>Assumptions</b></p> <ul style="list-style-type: none"> <li>• Project design and IWRM plan are implemented effectively.</li> <li>• The Government and the Asian Development Bank (ADB) sign the loan agreement.</li> </ul>
<p><b>Outcome</b></p> <p>Project design and detailed feasibility study agreed upon by the Government and ADB</p>	<p>Memorandum of understanding signed by the Government and ADB during the loan appraisal mission</p>	<ul style="list-style-type: none"> <li>• Final technical assistance report</li> <li>• Signed Memorandum of understanding</li> <li>• Back-to-office report of the loan appraisal mission</li> </ul>	<p><b>Assumptions</b></p> <ul style="list-style-type: none"> <li>• IWRM approach is fully supported by all government agencies.</li> <li>• Stakeholders effectively participate in the project design and demonstrate a sense of ownership.</li> </ul> <p><b>Risks</b></p> <ul style="list-style-type: none"> <li>• The Government priorities change.</li> <li>• The Government seeks other sources of funding.</li> </ul>
<p><b>Outputs</b></p> <p>Feasibility study, suitable for ADB loan processing, completed, including</p> <ol style="list-style-type: none"> <li>1. Initial assessment of subproject prefeasibility study reports and overall project objectives completed</li> <li>2. Detailed assessment of subproject technical design and initial financial and economic evaluation completed</li> <li>3. Project design finalized by undertaking technical, financial, and economic analyses; and preparing the environmental and social safeguard documents</li> </ol>	<p>Inception report (week 4)</p> <p>Interim report, end of phase 1 (week 12)</p> <p>Draft final report (week 26)</p>	<ul style="list-style-type: none"> <li>• TA progress reports</li> <li>• Back-to-office report of ADB review missions</li> </ul>	<p><b>Assumptions</b></p> <ul style="list-style-type: none"> <li>• Necessary technical and data reports are made available on time.</li> <li>• All geographical sites are accessible without any Government restrictions.</li> <li>• Stakeholders are willing to share information.</li> </ul> <p><b>Risk</b></p> <ul style="list-style-type: none"> <li>• Phase 1 assessment may not find one or both subprojects viable.</li> </ul>

<sup>a</sup> Detailed and specific targets will be set during technical assistance implementation.

<b>Activities with Milestones</b>	<b>Inputs</b>
<p>1.1 Review prefeasibility study reports undertaken by government agencies (completed by week 4).</p> <p>1.2 Prepare the sector review report (completed by week 4).</p> <p>1.3 Review environmental assessment study undertaken by Laoshan Water Conservancy Bureau (completed by week 4).</p> <p>2.1 Conduct additional studies on upper catchment degradation, water balances, hydrology, wetlands ecology, and water quality of Dagu River basin, if necessary (completed by week 12).</p> <p>2.2 Review dam design and safety, geology, water balance (completed by week 16).</p> <p>2.3 Review water tariff structure and policies for various subsectors and prepare recommendation for improvement (completed by week 18).</p> <p>3.1 Prepare environmental impact assessment of the project according to ADB policy and guidelines (completed by week 20).</p> <p>3.2 Prepare resettlement plans (RPs) according to ADB policy and guidelines (completed by week 20).</p> <p>4.1 Review estimated project costs, update to current prices, and present in COSTAB (completed by week 24).</p> <p>4.2 Carry out technical, economic, and financial analyses of the subprojects (completed by week 24).</p> <p>5.1 Undertake institutional assessment and formulate an IWRM plan (completed by week 24).</p>	<p>ADB—\$600,000</p> <ul style="list-style-type: none"> <li>• Consulting services, 52 person-months—\$410,000</li> <li>• International and local travel—\$30,000</li> <li>• Reports—\$10,000</li> <li>• Equipment—\$25,000</li> <li>• Training and surveys—\$25,000</li> <li>• Administration support—\$10,000</li> <li>• Representative for contract negotiations—\$5,000</li> <li>• Contingencies—\$85,000</li> </ul> <p>Government—\$250,000</p> <ul style="list-style-type: none"> <li>• Office accommodation—\$30,000</li> <li>• Feasibility study report preparation—\$150,000</li> <li>• Counterpart staff—\$70,000</li> </ul>

## INITIAL POVERTY AND SOCIAL ANALYSIS

### A. Linkages to the Country Poverty Analysis

<b>Is the sector identified as a national priority in country poverty analysis?</b>	<input checked="" type="checkbox"/> Yes  <input type="checkbox"/> No	<b>Is the sector identified as a national priority in country poverty partnership agreement?</b>	<input checked="" type="checkbox"/> Yes  <input type="checkbox"/> No
<b>Contribution of the sector or subsector to reduce poverty in the People's Republic of China:</b> The Project will promote integrated water resources management leading to higher water use efficiencies. By conserving wetlands resources, providing flood protection, and increasing water availability, the Project will assist the Government in meeting its responsibility to provide for the needs of the poor and reduce environmental pollution, which has a disparate impact on the poor.			

### B. Poverty Analysis

**Targeting Classification:** General Intervention

#### What type of poverty analysis is needed?

Basic poverty and social analysis is proposed (Appendix 4). The technical assistance (TA) will assess the incidence of poverty using existing data sources, supplemented by a social survey of potential beneficiaries. Both income and non-income poverty indexes will be determined. The analysis will be carried out following the *Handbook on Poverty and Social Analysis*<sup>a</sup> and *Handbook for Integrating Poverty Impact on Economic Analysis of Projects*.<sup>b</sup> Particular attention will be given to (i) profiling the beneficiaries, including gender-disaggregated demographic, economic, and social data, where possible; (ii) determining the incidence of poverty; and (iii) identifying vulnerable groups and any adverse impacts anticipated from the Project.

### C. Participation Process

#### Is there a stakeholder analysis?

Yes       No

A stakeholder analysis will be prepared as part of the TA. Participatory on-site consultations and workshops will be held to strengthen the participatory approach. A workshop will be held for stakeholders to discuss and agree on the proposed scope and designs of subprojects. More intensive focus group meetings, interviews, and surveys will be held with local government agencies, development partners, and nongovernment organizations, the private sector, and identified project beneficiaries to ensure a sense of ownership and agreement with the detailed design and implementation arrangements. Funds are being made available under the TA to ensure that an effective stakeholder analysis is undertaken.

#### Is there a participation strategy?

Yes       No

A participation strategy will be prepared as part of the TA. The strategy will aim to ensure the involvement of local government and communities, particularly the poor, women, and vulnerable groups throughout project design and implementation. The strategy will ensure engagement with people who might be adversely affected by the Project.

### D. Gender Development

#### Strategy to maximize impacts on women:

A gender analysis will be conducted—as part of the poverty/social assessment—by the social development specialist. Information will be gathered on issues such as gender roles and responsibilities in the water sector, with emphasis on women's role in water resources management; their access to, and control over water resources for agriculture and domestic uses; gender aspects of wetland agriculture; participation in decision making and community-based organizations for water resources management; income levels; and their willingness and ability to pay for water services. The analysis will (i) identify implications in terms of risks, benefits, opportunities, and adverse impacts of the Project according to gender; and (ii) recommend project design features and mitigation measures to strengthen the gender impact of the proposed interventions.

#### Has an output been prepared?

Yes    No

A strategy to maximize impacts on women will be prepared as part of the TA.

<sup>a</sup> ADB. 2001. *Handbook on Poverty and Social Analysis*. Manila.

<sup>b</sup> ADB. 2001. *Handbook for Integrating Poverty Impact on Economic Analysis on Projects*. Manila.

**E. Social Safeguards and Other Social Risks**

Item	Significant/ Not Significant/ None	Strategy to Address Issues	Plan Required
<b>Resettlement</b>	<input checked="" type="checkbox"/> Significant <input type="checkbox"/> Not significant <input type="checkbox"/> None	There may be significant land acquisition and resettlement impacts especially in the wetlands subproject. An RP will be prepared during the TA and is reflected in the terms of reference for consultants (Appendix 4)	<input checked="" type="checkbox"/> Full <input type="checkbox"/> Short <input type="checkbox"/> None
<b>Affordability</b>	<input type="checkbox"/> Significant <input checked="" type="checkbox"/> Not significant <input type="checkbox"/> None	The issue of affordability will be considered during the social survey and the initial environmental examination and appropriate mitigation measures will be prepared as necessary.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<b>Labor</b>	<input type="checkbox"/> Significant <input checked="" type="checkbox"/> Not significant <input type="checkbox"/> None	A reemployment plan may need to be prepared for workers affected by the Project. Additional funds are included in the TA budget to assess the need for a plan.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>Indigenous Peoples</b>	<input type="checkbox"/> Significant <input type="checkbox"/> Not significant <input checked="" type="checkbox"/> None	The Project is located in the coastal areas of Shandong Province which has no ethnic minorities.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<b>Other Risks and/or Vulnerabilities</b>	<input type="checkbox"/> Significant <input checked="" type="checkbox"/> Not significant <input type="checkbox"/> None	The issue will be considered during the social survey and the initial environmental examination, and appropriate mitigation measures defined as needed. Most updated data and information on the health-related indicators in the project area, with emphasis on waterborne diseases and sexually transmitted infections, should be provided.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

**COST ESTIMATES AND FINANCING PLAN**  
(\$)

Item	Total Cost
<b>A. Asian Development Bank Financing (ADB)<sup>a</sup></b>	
1. Consultants	
a. Remuneration and Per Diem	
i. International Consultants	302,000
ii. National Consultants	108,000
b. International and Local Travel	30,000
c. Reports, Translation, and Communications	10,000
2. Equipment <sup>b</sup>	25,000
3. Training, Workshops, and Conferences	
a. Resource Persons	5,000
b. Workshop and Surveys	20,000
4. Miscellaneous Administration and Support Costs	10,000
5. Representative for Contract Negotiations	5,000
6. Contingencies	85,000
<b>Subtotal (A)</b>	<b>600,000</b>
<b>B. Government Financing</b>	
1. Office Accommodation	30,000
2. Feasibility Study Report Preparation	150,000
3. Remuneration and Per Diem of Counterpart Staff	60,000
4. Counterpart Travel	10,000
<b>Subtotal (B)</b>	<b>250,000</b>
<b>Total</b>	<b>850,000</b>

<sup>a</sup> Financed by ADB's technical assistance funding program.

<sup>b</sup> Includes a vehicle and office equipment, i.e., facsimile/copy machines, computer, printer, software, and accessories.  
Source: ADB estimates.

## OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

1. For technical assistance (TA) implementation, an international firm will be engaged to provide the services of a multidisciplinary team comprising international and national experts. The consultants will apply international best practices and lessons learned from similar interventions elsewhere in the world while preparing this Project. The baseline data on technical, social, environmental, financial, and economic aspects will be collated (and collected where necessary) for baseline reference in the future. The consultants are expected to work closely with the counterpart staff of the Executing Agency (EA)—Qingdao Development and Reform Commission—and both the implementing agencies (IAs)—Jiaozhou county and Laoshan district governments. They will have full access to all relevant data and information pertaining to the subproject prefeasibility study reports (PFSR) and other planning documents.

2. The PFSRs of the subprojects have been prepared, but they require a detailed review to determine their respective objectives and institutional arrangements. The TA will be implemented in two phases. In phase 1, a detailed technical review of both PFSRs will be carried out and subsector analysis accomplished. Institutional review will also be undertaken to establish an integrated water resources management (IWRM) framework. If found viable, the TA in phase 2 will assist the EA to prepare a comprehensive feasibility study reports for both subprojects along with the requisite environmental impact assessments (EIA), environmental management plan (EMP), and the resettlement plans (RPs) following the Government and ADB policies and guidelines.

3. The consultant team will comprise 14 international and national experts in a variety of disciplines (Table A4). The consultants will be engaged for a total of 52 person-months; 6 international consultants for 16 person-months and 8 national consultants for 36 person-months. An experienced international economist will lead the TA team. Detailed terms of reference (TOR) follow.

**Table A4: Consultant Inputs**

<b>International Consultants</b>	<b>Person-Months</b>
1. Project economist/team leader	6
2. Water resources planner/hydrologist	3
3. Structural design engineer	2
4. Wetlands ecologist	2
5. Environment specialist	2
6. Dam safety expert	1
<b>Subtotal</b>	<b>16</b>
<b>National Consultants</b>	
1. Structural design engineer/deputy team leader	6
2. Water resources specialist	6
3. Wetlands ecologist	4
4. Forestry specialist	2
5. Environment specialist	6
6. Financial analysis and financial management specialist	4
7. Resettlement specialist	4
8. Social development specialist	4
<b>Subtotal</b>	<b>36</b>
<b>Total</b>	<b>52</b>

### 1. Team Leader/Project Economist (6 person-months, international)

4. The expert will have a postgraduate degree in economics and over 10 years of experience in designing water resources projects following the IWRM approach in a variety of countries. The economist will take the lead in formulating and developing the project design by coordinating inputs of Government agencies and the TA team, and delivering quality TA outputs on time. The scope of work will include, but will not be limited to, the following tasks:

- (i) Prepare a detailed TA implementation plan and personnel schedule, and further elaborate specific tasks and outputs for both international and national consultants based on the outline TOR provided in this Report.
- (ii) Synthesize lessons learned from similar projects within the country and elsewhere, and summarize international best practices for similar interventions at the outset so that the project design benefits from such experience.
- (iii) Organize briefings, field visits, and workshops in consultation with key stakeholders, and help set up a mechanism for regular consultations including the project steering committee.
- (iv) Assess the institutional capacity of various project-related agencies and make recommendations for improvement.
- (v) Prepare a list of required expertise, inputs (in person-months), and TOR for consulting services to support implementation of the ensuing investment project.
- (vi) Establish the linkages between increasing water demand, economic growth, and poverty reduction. Identify policy and market failures preventing increased private sector investments in the sector. Analyze the role of public sector investments in the sector and identify their fiscal and macroeconomic impacts.
- (vii) Review the Government's national poverty reduction strategy and provincial poverty reduction interventions, and comment on the role of large-scale infrastructure projects in poverty reduction.
- (viii) Compute the *long-run marginal cost* of supplying water to different consumer categories and the full financial cost recovery tariff. Compare them with prevailing tariffs and identify any fiscal and cross-subsidies by analyzing affordability to different consumer groups. Comment on the Government's strategy for removing tariff distortions, if any.
- (ix) Prepare detailed project costs in COSTAB.
- (x) Undertake economic analysis of the Project following ADB's *Guidelines for Economic Analysis of Projects*. Compute the economic internal rate of return of the Project. The externalities, including the impact on natural environment, and price distortions should be internalized in the analysis as appropriate.
- (xi) Assess robustness of the Project's economic and financial viability by carrying out a sensitivity and risk analysis following ADB's *Handbook for Integrating Risk Analysis in the Economic Analysis of Projects*.
- (xii) Undertake distribution analysis of Project outputs and identify the proportion of benefits that will accrue to the poor. Compute the poverty impact ratio following ADB's *Handbook for Integrating Poverty Impact Assessment in the Economic Analysis of Projects*.
- (xiii) Based on inputs from the TA team, EA/IAs, and key stakeholders, (a) formulate the overall project design; defining its scope, implementation arrangements, estimating costs, and undertaking economic and financial analyses; and (b) prepare project reports suitable for appraisal by ADB and the Government.

## 2. **Water Resources Planner/Hydrologist** (3 person-months, international)

5. The specialist will have a university degree in civil engineering or hydrology and over 10 years of experience in designing similar projects in a variety of countries. The specialist will:

- (i) Review the hydrological studies undertaken for the PFSRs of both subprojects and make recommendations for improvement.
- (ii) Assess downstream impacts of the Jiaozhou wetlands subproject with respect to changes in water quality and flow in the Dagu River and estimate changes in the hydrological regime.
- (iii) Provide inputs for the EIA.
- (iv) Gather and review available reports and studies on water consumption patterns by different sectors in the Dagu River basin and the Laoshan district and assess whether the Project is likely to adversely affect other water users in these basins.
- (v) Establish a water balance, given the current supply and demand for the Dagu River basin and Laoshan district. Assume realistic development scenarios over the anticipated life span of the subprojects and forecast water demand for different uses, i.e., domestic, industrial, agricultural, and environmental.
- (vi) Provide inputs to the economist to estimate the economic viability of the subprojects.
- (vii) Work closely with the wetlands ecologist to assess the minimum water demand for optimal operation of Jiaozhou wetlands to maintain their ecological functions.
- (viii) Review the present and proposed institutional and legal framework for water resources management in the river basins, including the relationships among key water sector agencies at the central, provincial, and district levels.
- (ix) Propose a feasible approach to introduce IWRM on a basin level considering (a) optimization of the multireservoir system operation, (b) conjunctive use of water resources, and (c) managing water demand and water quality requirements.

## 3. **Structural Design Engineer** (2 person-months, international)

6. The specialist will have a university degree in civil engineering and over 10 years of experience in designing similar projects in a variety of countries. The specialist will:

- (i) Review detailed designs of water diversion and flood retention structures and wastewater scheme in the Jiaozhou wetlands subproject and verify, among others (a) the list of suggested investments; (b) hydraulic calculations; (c) the assessment of environmental impacts; (d) plant, equipment, materials, and construction standards; (e) detailed civil and mechanical designs; (f) prepared bills of quantities and detailed cost estimates; and (g) drawings required for construction and installation works.
- (ii) Review the overall subproject design of Quanxinhe Dam in the context of strategic priorities identified in the Report of the World Commission on Dams and the relevant ADB policies and guidelines.
- (iii) Review the optimization study, dam height, general layout, and the detailed design of the different components of the Quanxinhe Dam, paying special attention to (a) design of the chosen dam type, diversion and spillway mechanism; (b) adequacy of the adopted design floods for the various project structures. If the adopted design standards differ from internationally accepted standards, check whether the main project structures (dam, spillway, tailrace, etc.) will withstand the design floods based on international standards; (c) suitability of the spillway design criteria and assess the consequences of dam

- overtopping; (d) source and suitability of construction materials for the dam; (e) technical specifications of the bidding documents; and (f) cost estimates, including unit costs and estimates of quantities (costs should be split into foreign and local currencies) and provide input to the financial analysis and financial management specialist to estimate price and physical contingencies.
- (iv) Estimate operation and maintenance costs of both subprojects including the recurrent cost of implementing social and environmental safeguards.
  - (v) Prepare the schedule of contract packages indicating the procurement method for each contract and the source of financing. Prepare outline-bidding documents for contracts to be funded by ADB according to its Procurement Guidelines.
  - (vi) Prepare a detailed project implementation schedule on a Gantt chart indicating the tasks on the critical path. Prepare an indicative procurement schedule and provide input to the financial analysis and financial management specialist to prepare the financing schedule during construction.
  - (vii) Identify the Project's key technical risks and provide input to the economic model for sensitivity and risk analyses.
  - (viii) Review the technical capacity and experience of EA/IA agency staff to design, supervise, and manage the implementation of both subprojects. Identify the need for capacity building, external consultants, and training.

#### **4. Wetlands Ecologist (2 person-months, international)**

7. The specialist will have a university degree in the relevant discipline and over 10 years of experience in assessing the conservation of wetlands and preparing management plans in a variety of countries. The wetlands ecologist will:

- (i) Review planning and technical studies for the conservation of the Jiaozhou wetlands.
- (ii) Assess the current status of the ecological function and biological value of the wetlands.
- (iii) Conduct necessary analyses and field investigations to determine the impacts on aquatic ecology, including (a) impacts on fish and fish habitat, (b) loss of aquatic biological diversity, and (c) waterfowl of the wetlands.
- (iv) Assess water quality in the artificial lake and the potential mobilization of contaminants from surrounding soils into the food chain of fish and other aquatic organisms.
- (v) Assess the downstream impacts related to (a) reduced flooding of the Dagu River estuary; (b) changes in the hydrological regime and water quality downstream of the artificial lake; and (c) any morphological changes in the river channel (due to erosion and sedimentation) and their impact on aquatic habitats.
- (vi) Recommend mitigation measures and monitoring requirements, complete with cost estimates, for incorporation in the EIA.
- (vii) Review the current institutional framework at provincial, municipal, and district levels and propose modifications, if necessary.
- (viii) Review legislation, management categories, and zoning for protected wetlands.
- (ix) Assess the potential of Jiaozhou wetlands for ecotourism.
- (x) Provide input to the economist to estimate the economic viability of the subproject.
- (xi) Prepare proposals for (a) sustainable use of biological resources, conservation targets, integrated monitoring of habitats; and (b) strengthening the role of the local government and nongovernment organizations in wetland conservation.

## 5. Environment Specialist (2 person-months, international)

8. The specialist will hold a university degree in a related discipline and over 10 years of experience especially in preparing EIAs of Category A projects. The specialist—in accordance with ADB's *Environment Policy (2002)* and *Environmental Assessment Guidelines (2003)*—will conduct EIAs of both subprojects and prepare a report, and a summary EIA report. EIAs will be undertaken in cooperation with the international water resources planner and the wetlands ecologist, and national consultants with expertise in environment, water quality, fisheries, and forestry. The specialist will:

- (i) Review all relevant documents and studies, in particular, draft EIAs of both subprojects prepared by the government agencies.
- (ii) Assess the physical (i.e., hydrological impacts, water quality, salinity, soil erosion and sedimentation); biological (i.e., aquatic habitats, fish diversity, and terrestrial biodiversity); and the related impacts on the social environment.
- (iii) Identify mitigation measures and monitoring programs.
- (iv) Conduct public consultation at least twice: (a) once during the early stages of the EIA fieldwork; and (b) then during preparation of the draft EIA report.
- (v) Ensure that EIAs meet ADB's requirements for Category A projects and the Government's requirements for this Project.
- (vi) Assess and recommend the need for capacity building for the EA/IAs staff to ensure effective implementation of the EMP.
- (vii) Prepare the EMP.

## 6. Dam Safety Expert (1 person-month, international)

9. The expert will have a university degree in civil engineering and over 10 years of experience in dam designs in a variety of countries. The expert will:

- (i) Review the results of geological and geotechnical investigations, and suggest any modifications, paying special attention to the geological conditions of the foundation, spillway, and conveyance structures and abutments of the dam.
- (ii) Conduct additional technical studies and site surveys for the new Quanxinhe Dam, including flood hydrology and considering probable maximum flood and maximum historic return-flow, in accordance with best international practices.
- (iii) Review dam break/failure analysis and identify area of inundation. Use results of this study to develop an emergency evacuation and early warning plan.
- (iv) Review reservoir slope stability analysis using the saturated rock strength under condition of impounding and rapid drawdown, with emphasis on those which are close to the dam body and appurtenant structures.
- (v) Investigate the geological situation with respect to fault rupture hazard and re-analyze the existing seismic risk surveys to take into account near source effects.
- (vi) Review the Emergency Response Plan for operation staff and representatives of the cities and villages; and review and improve the Dam Safety Inspection Plan.
- (vii) Prepare an operation and maintenance manual for the Quanxinhe Dam.

## 7. National Consultants (36 person-months)

10. The national consultants, 8 in total (Table A4), will have university degrees in relevant disciplines and extensive work experience. They will work closely with the international consultants and assist them in (a) acquiring the relevant data, information, and maps by liaising with the Government agencies; (b) conducting field surveys relevant to their respective

disciplines; (c) processing data and carrying out the analyses; (d) drafting reports in the Chinese language; and (e) reviewing PFSRs/feasibility study reports and other relevant project reports. Summary TORs of national consultants, with international counterparts, are provided below.

11. The structural design engineer/deputy team leader will assist the team leader in guiding the national consultants. The engineer will review the engineering designs, quantities, and cost estimates of both subprojects and assist the international counterpart in accomplishing the tasks described in para. 6. The wetlands ecologist and forestry specialists will prepare all necessary maps<sup>1</sup> and conduct requisite field investigations to fill any gaps in baseline data for (a) fauna and flora; (b) fisheries; (c) wildlife, and terrestrial biodiversity; and (d) forest cover and other land use information, and assist the international wetlands ecologist. The forestry specialist will prepare the afforestation component in full technical and financial detail. The water resources specialist will conduct water quality surveys and, if necessary, undertake computer modeling studies to predict the water quality in the artificial lake, estuary, and the reservoir. The specialist will assist the international counterpart in accomplishing tasks as outlined in para. 5. The environment specialist will assist the international counterpart with assessment of environmental impacts and preparation of EIA, summary EIA reports, and the EMP as described in para 8.

12. Although the financial analysis and financial management, resettlement, and social development specialists are part of the 8-member national consultants team (Table A4), their specific and more detailed TORs are given below as they do not have international counterparts.

#### **a. Financial Analysis and Financial Management Specialist**

13. The specialist will have a university degree and relevant qualification in financial analysis and management and extensive work experience in analyzing and preparing project documents. In accordance with ADB's guidelines on *Financial Management and Analysis of Projects (2005)*, the consultant will undertake the financial analysis of the sector and the Project. The specific tasks follow:<sup>2</sup>

- (i) Prepare cost estimates including price and physical contingencies and a financing plan for the Project. Prepare the indicative disbursement schedule and compute the interest during construction based on the input provided by technical experts. Compute the financial internal rate of return and the weighted average cost of capital of the Project. Carry out sensitivity analysis consistent with that of economic analysis for key technical and commercial risks.
- (ii) Assess staffing and internal control procedures of IAs. Based on project needs and EA/IAs capacity to manage funds flow and disbursement, design the fund-flow mechanism and identify appropriate ADB disbursement procedures. Where applicable, review lending/onlending arrangements to ensure compliance with ADB policies and guidelines. The preliminary design should take account of the financial management responsibilities of each entity involved in the Project (EA and IAs and those in the province, municipality, districts, and counties).

#### **b. Resettlement Specialist**

14. The specialist will have a university degree and relevant qualification in social sector surveys and extensive work experience in designing RPs. The specialist will:

- (i) Review and prepare modifications to the draft RPs in compliance with ADB's *Involuntary Resettlement Policy and Operations Manual* (Section F2) on

<sup>1</sup> All maps will be prepared in a format compatible with the ArcView or ArcInfo Geographic Information Systems.

<sup>2</sup> A more detailed checklist of tasks will be provided during TA implementation.

- involuntary resettlement. The specialist may use the *Handbook on Resettlement* as a guide in preparing the RPs.
- (ii) Study recommendations on land use plans for both subprojects and ensure that affected persons are identified and socio-economic impacts addressed in the RPs.
  - (iii) Ensure that the RPs (a) are based on a socioeconomic survey of 10% affected persons and 20% of severely affected persons, (b) present gender-disaggregated socioeconomic data of affected persons, (c) mitigate gender-related resettlement impacts, and (d) include provisions to assist vulnerable populations.
  - (iv) Define categories for impact and compensation eligibility of affected people, prepare an entitlements matrix (consistent with the PRC Land Administration Law and other pertinent public regulations and ADB's *Involuntary Resettlement Policy*), and prepare village economic rehabilitation plans, where applicable.
  - (v) Assist EA/IAs and relevant government officials to (a) consult with the affected communities, local leaders, proponents, and stakeholders; and (b) prepare a resettlement implementation schedule consistent with the project schedule.
  - (vi) Review the capacity of concerned local government agencies to implement RPs and provide recommendations for improvement.
  - (vii) Based on individual subproject RPs, prepare a summary RP for the Project.
  - (viii) Assist EA/IAs in preparing and implementing a public consultation plan and ensuring that RPs are shared with affected persons, as per ADB's disclosure policy, in a form and language they can understand.

### **c. Social Development Specialist**

15. The specialist will have a university degree and relevant qualification in social sector surveys and extensive work experience in conducting stakeholder consultations. The specialist will conduct structured surveys using questionnaires, collect secondary data, and will:

- (i) Conduct surveys, consultations, and workshops with government agencies, local nongovernment organizations, research institutes, project beneficiaries, and affected people to discuss proposed subproject designs.
- (ii) Assess institutional and financial support required by the project beneficiaries, notably the vulnerable rural and urban poor, to access water, use and operate project facilities, and recommend arrangements to meet such needs.
- (iii) Collect data and information on health indicators in the subproject areas, with emphasis on waterborne diseases and sexually transmitted infections, through consultation with relevant centers for disease control and prevention.
- (iv) Prepare a plan to increase awareness of and develop the capacity of EA/IAs for international best practices in promoting socially-inclusive and gender-responsive practices for water resources management.
- (v) Analyze overall social, gender, and poverty-related issues in the subproject areas—with special emphasis on access to water resources and ability to pay the proposed water tariff—and prepare a report.
- (vi) Prepare a plan for participatory operation and maintenance of subproject infrastructure and water resources management schemes.