ADB

Technical Assistance Report

Project Number: 42453
Regional—Capacity Development Technical Assistance (R-CDTA)
June 2009

Achieving Urban Water Security for South Asia

(Financed by the Investment Climate Facilitation Fund under the Regional Cooperation and Integration Financing Partnership Facility)

Asian Development Bank

ABBREVIATIONS

ADB	–	Asian Development Bank
AWDO	–	Asian Water Development Outlook
O&M	–	operation and maintenance
NRW	–	nonrevenue water
TA	–	technical assistance

TECHNICAL ASSISTANCE CLASSIFICATION

Type	–	Regional—capacity development technical assistance (R-CDTA)
Targeting Classification	–	General intervention
Sector	–	Water supply and other municipal infrastructure and services
Subsector	–	Water supply and sanitation
Themes	–	Social development, governance, capacity development
Subthemes	–	Human development, public administration (national and decentralized)

NOTE

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

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I. INTRODUCTION

1. Most of the water service providers in many South Asian cities place greater focus on augmentation and creation of new assets than rehabilitation of existing systems. Routine operations do not include regular systemic analyses needed to evaluate performance in an urban area, such as assessments of operational efficiency, quality, service level, or consumer satisfaction. The supply of water is often intermittent, with no strategies to make water continuously available (24 hours per day, 7 days per week), which is one of the most important objectives in any urban water management system. Intermittent water supplies are the norm rather than the exception, and problems associated with the intermittent supply of water undermine urban water security (resulting in problems such as water contamination and wastage at all stages, unreliable metering, and possibly burst pipes due to the development of hydraulic water hammers). Many service providers in South Asian cities report high per capita levels of water consumption (over 200 liters per capita per day), despite restricted supply hours, indicating the fundamental problem is inefficient management of available water, rather than raw water shortages.

2. Proper assessment, planning, and management of water-related issues requires reliable data on critical factors related to urban water security. Adequate monitoring of the impact or development results of water-related interventions (including policies, programs, or projects) is made difficult, however, by inconsistent and biased results stemming from the use of differing (i) definitions and formats for gathering data; and (ii) processes for collection, aggregation, and analysis of data. To improve the performance of urban water management, water security in South Asian urban centers needs to be properly assessed, and reliable information shared.

3. The proposed technical assistance (TA)[1]on Achieving Urban Water Security for South Asia is included in the regional cooperation operations business plan 2009–2010.[2]. The TA is classified as category B. Critical issues and the necessary information have been identified based on (i) the experience of Asian Development Bank (ADB)-financed projects in the past several years, (ii) recommendations of the Asian Water Development Outlook 2007 (AWDO 2007),[3] and (iii) continuous consultations with various executing and/or implementing agencies involved in the implementation of ADB financed urban water supply projects in South Asia. Sufficient information was collected to allow TA processing to proceed without fielding a fact-finding mission.[4] The TA recipient countries (India, Nepal, and Sri Lanka) were consulted in writing and the recipient governments' no objection on the TA are obtained. The TA design and monitoring framework is in Appendix 1.

II. ISSUES

4. One of the fundamental constraints to economic development and better livelihoods for citizens of urban centers in South Asia is the inadequate and intermittent supply of safe drinking water. In recent years many developing countries in South Asia have come to understand this constraint and begun placing greater emphasis on urban water security, which is defined as the provision of safe, sustainable, equitable, and adequate drinking water to all urban citizens. Specifically, this involves:

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[1] The TA first appeared in the business opportunities section of ADB's website on 17 March 2009.
[2] ADB. 2008. *Regional Cooperation Operations Business Plan 2009–2010.* Manila.
[3] ADB. 2007. *Asian Water Development Outlook.* Manila.
[4] Memo (27 February 2009) endorsed by DG/SARD

(i) providing reliable, continuously available piped water supply through household connections;
(ii) ensuring drinking water conforms to acceptable quality standards;
(iii) maximizing operational efficiencies and have a proper operation and maintenance (O&M) system in place;
(iv) having an economically viable, rational, and affordable tariff structure;
(v) protecting and managing ground and/or surface water sources effectively;
(vi) managing demand for drinking water efficiently;
(vii) enforcing accountability, stakeholder participation, and transparency in operations;
(viii) ensuring waste water management as it affects downstream waterbodies and aquifers;
(ix) using alternate methods such as rainwater harvesting, groundwater recharge, used water recycling, and desalination wherever feasible; and
(x) coordinating with other water use requirements such as irrigation and industry, and energy, food, and environmental policies.

5. Massive capital investments are required to achieve urban water security, but the water sector in South Asian countries does not currently generate sufficient surpluses to allow for upgrading of ageing infrastructure or addition of new assets to meet increasing demand. For service providers, the negative or low surpluses are coupled with a dependence on government transfers, but are insufficient to sustain asset improvements, resulting in poor service delivery.

6. Poor drinking water quality resulting from polluted water sources or intermittent water supplies is a key concern in South Asian cities. Water source development in many South Asian cities exhibits a common pattern: groundwater is overexploited, thereby lowering the groundwater table and causing cities to shift to surface water as an alternative water source. This shift in source exacerbates the situation, as water resources become continuously depleted or polluted. At the same time, high levels of residue pesticides, heavy metals and other toxic chemicals resulting from agricultural and industrial practices have adversely affected the water quality of many South Asian cities. Failure to address water pollution at the source means that large-scale programs and action plans are ultimately needed to rehabilitate degraded streams and depleted aquifers, often at huge cost. Systemic quality monitoring of ground and surface water sources is rarely undertaken, especially of those sources used as water supply intakes. Many local governments fail to recognize the importance of water quality, and transfer huge economic costs from water pollution to the national economy.

7. In addition, systemic reduction of nonrevenue water (NRW) is not undertaken as a conscious strategy in many Asian urban areas, even though it is one of the most critical and desirable interventions for improving water security. Deficiencies and lack of metering (bulk or individual) make the proper assessment of water production and consumption and examination of NRW and operational efficiencies difficult. Regular O&M does not include leak detection and replacement of leaking, worn-out, corroded, and polluted pipelines. Some electro-mechanical equipment (e.g., pumps and motors) is worn out and energy inefficient. Water operators rarely conduct asset inventories and there is an absence of accurate spatial (e.g., digital maps of pipelines) and attribute (e.g., characteristics of pipelines) databases. Water audits are not generally used to assess NRW.

8. AWDO 2007 provides insights on achieving water security for Asia and the Pacific. One of its key findings is that sufficient knowledge, technology, and expertise is available in the

region to mitigate future urban water crises, but that this should be supported by adequate and appropriate water governance, and proper management practices, institutional arrangements and sociopolitical conditions. AWDO 2007 recommends: (i) enhancement of skills and capacity and development of innovative approaches to foster new mindsets and new partnerships to improve water sector governance; (ii) better management of water quality in connection with health, social and economic advancement; (iii) rationalization of tariffs, keeping in mind the rationale of economic viability and generation of sufficient surpluses to cover O&M costs; and (iv) improved availability and reliability of relevant data on physical, social, economic, and environmental factors and composite indicators. Accelerating urbanization has made management of the entire water cycle in the urban context a priority.

9. As pointed out in AWDO 2007, if a water crisis occurs in the future, it will probably not be caused by an actual physical scarcity of water, as many predict at present, but because of continuing neglect of proper water management practices. Continuation of present trends will result in increasing contamination of available water sources, and will increase the cost, complexity and management difficulties of providing clean water. Given this paramount challenge, the proposed TA will focus on the important underpinnings of urban water security in selected South Asian urban centers by helping to (i) evaluate the current situation, (ii) generate information for policy decisions, (iii) formulate action plans, and (iv) implement such action plans for better governance to achieve water security.

III. THE TECHNICAL ASSISTANCE

A. Impact and Outcome

10. The impact of the TA will be enhanced economic opportunities and reduced waterborne diseases in South Asian urban centers through improved water security, such as better understanding of service areas and coverage, improved water quality, increased operational efficiency, and better O&M of drinking water supply systems. The outcome of the TA will be (i) increased understanding of key policy parameters for water security and water sector governance; and (ii) reduced risks and vulnerabilities caused by lack of understanding in water-related knowledge; technology; and expertise in water sector governance and management in South Asian urban areas in India, Nepal, and Sri Lanka.

B. Methodology and Key Activities

11. Urban water security is a broad concept, as defined in para. 4. Given the scale of water security challenges in South Asia and the limited resources available under the TA, it is important to limit the scope of the TA to the most important and critical issues. The following key issues are identified for detailed study in a maximum of 30 selected urban centers under the TA:

(i) **Coverage.** Extent of service area (geographical and population) coverage, intermittent versus continuous (24 hour/day, 7 day/week) water supply coverage, piped water supply coverage, etc.

(ii) **Quality.** Supply of drinking water conforming to acceptable quality standards, and issues of wastewater management where these affect the quality of groundwater and/or downstream aquifers and/or waterbodies.

(iii) **NRW reduction, operational efficiencies, and O&M system.** Assessment of the level of NRW, of operational efficiencies, and of the O&M system (involving O&M costs, revenues from user charges, tariff structures, etc.).

12. Following key outputs are expected:

(i) The status of and problems and/or constraints relating to the three issues identified in para. 11 will be analyzed, and time-bound action plans prepared for each urban center, which specify the resources required to achieve desired outcomes.
(ii) Based on the studies of the selected urban centers, a generalized conceptual framework will be developed to assess and evaluate water security that is applicable to any urban center.
(iii) Based on the studies of the selected urban centers, monitorable indicators for water security and vulnerability will be developed for use in assessment of water security in any urban center. A model for intercity comparison with a composite index (if possible) will also be developed.
(iv) A detailed case study report for selected cities will be prepared, including physical as well as social, economic, and environmental factors affecting efficient water planning and management. The impact of ADB projects on the improvement of water security will be examined and included in the report for the selected cities in which ADB-financed projects were or are being implemented.
(v) Special consideration will be given to the measurement and management of water quality, as past projects have typically emphasized quantity over quality. A review of policies, regulations, and practices for water quality management will be undertaken.
(vi) Synergy will be established with ongoing capacity-building programs under water sector projects in India, Nepal, and Sri Lanka to increase awareness of water security and vulnerability assessment.
(vii) Multimedia products will be prepared to promote experience sharing and dissemination of knowledge to subregional, national, local, and project levels.
(viii) Detailed terms of reference and recommendations for future water supply and sanitation projects to be financed with ADB assistance will be formulated. The terms of reference will be included in the request for proposals for contractors that will implement NRW-reduction and water quality-enhancement programs under ADB loan projects.

13. The following key activities will be undertaken:

(i) Quality assessments, involving taking a sufficient number of samples, with testing performed at standard laboratories.
(ii) NRW assessments will be conducted in all the selected urban centers.
(iii) Equipment efficiency (e.g., of electro-mechanical machinery in drinking water systems) will be assessed in all urban centers by expert agencies.
(iv) Vulnerability assessment studies will be undertaken that include collection of relevant data, surveys, seminars, pilot project cases, trainings, and forums for sharing best practices, good pilot schemes, and knowledge.

C. Cost and Financing

14. The total cost of the TA is estimated at $850,000 equivalent. The TA will be financed on a grant basis by the Investment Climate Facilitation Fund[5] under the Regional Cooperation and Integration Financing Partnership Facility, and administered by ADB.

D. Implementation Arrangements

15. ADB's South Asia Department is the executing agency for the TA. ADB's South Asia Urban Division, acting as the implementing agency for the TA, the Division will engage consulting firms in accordance with the *Guidelines on the Use of Consultants* (2007, as amended from time to time). Selection will be based on quality- and cost-based selection, using the simplified technical proposal method. A total of 16 person-months of international and 36 person-months of national expert services are required during the 12-month implementation period, comprising the: (i) project coordinator and NRW specialist or team leader (international, 8 person-months); (ii) NRW and water quality specialists (two international experts for a total of 8 person-months); (iii) NRW and water operation specialists (four national experts for a total of 24 person-months); and (iv) water quality specialists (four national experts for a total of 12 person-months). Disbursements under the TA will be made in accordance with the ADB's *Technical Assistance Disbursement Handbook*.[6] The TA will start in June 2009 and be completed by December 2010. A no-objection has been obtained from each of the participating developing member countries; i.e., India, Nepal, and Sri Lanka.

IV. THE PRESIDENT'S DECISION

16. The President, acting under the authority delegated by the Board, has approved ADB administering technical assistance not exceeding the equivalent of $850,000 to be financed on a grant basis by the Investment Climate Facilitation Fund under the Regional Cooperation and Integration Financing Partnership Facility for Achieving Urban Water Security for South Asia, and hereby reports this action to the Board.

[5] Established by the Government of Japan.
[6] ADB. 2008. *Technical Assistance Disbursement Handbook.* Manila.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets and/or Indicators	Data Sources and/or Reporting mechanisms	Assumptions and Risks
Impact Enhanced economic opportunities and reduced waterborne diseases in urban centers in South Asia through improved water security	Increase (above the national average) in the number of business and/or industries in selected urban areas in the respective countries; i.e., India, Nepal, and Sri Lanka	Reports on country economic indicators CPS reports Government census and surveys	**Assumption** Sustained steady economic growth in countries in South Asia **Risk** Political or civil disturbances disrupt economic activities
Outcome Enhanced understanding of policy parameters regarding water security and governance Reduced risks and vulnerabilities of water security in view of the changing water management landscape in South Asia	Internationally accepted performance standards and targets adopted by water management bodies in the selected urban areas Vulnerability assessment of water security systems introduced in the selected urban areas Models for a new partnership to secure water governance among governments, water utility operators, and civil society applied in urban centers in South Asia	Assessment report Relevant government decrees	**Assumption** Policy makers or relevant sector managers in the selected 30 urban areas are willing to learn for better governance. **Risk** Lack of urgency in the mindset of policy makers in nonparticipating urban areas
Outputs 1. For each selected urban center, an analysis of the constraints and issues and production of an action plan relating to: (i) drinking water coverage; (ii) drinking water quality; and (iii) NRW reduction, operational efficiencies and O&M of drinking water systems. 2. Pilot programs to restructure the capacity-building programs under ongoing water sector projects in support of water security and vulnerability assessment and management 3. Review of policies, regulations and practices for water quality management to reduce health costs and adverse social impacts	Generalized conceptual framework for assessing water security developed, with general indicators and composite index (if possible) Water security assessment report for selected urban centers produced and widely disseminated A detailed report prepared for each urban center, which analyzes identified issues and presents an action plan to address them. Three detailed reports prepared (one for each identified issue) containing information about all selected urban centers. A special study report prepared that reviews policies and practices for water quality management to reduce health costs and adverse social impacts At least three seminars conducted for sharing issues, challenges, and measures to	Seminar reports Vulnerability assessment data book TA reports TA review missions Acceptance by relevant government offices or water operators of the assessment results	**Assumption** Participating government agencies or offices support the collection and sharing of data **Risks** Data essential for the vulnerability assessment is not available Relevant policy makers or government offices are not interested in adopting better regulations for political reasons

Design Summary	Performance Targets and/or Indicators	Data Sources and/or Reporting mechanisms	Assumptions and Risks
	improve water quality The capacity-building programs of ongoing water projects restructured to boost the level of water security awareness and management At least three workshops conducted to increase awareness and understanding of the importance of management information systems in connection with achieving water security and governance		
Activities 1. Data availability, reliability, and accessibility to enhance water security and governance 1.1 Carefully examine past ADB projects in South Asia and select target cities and towns. 1.2 Develop a methodology to assess performance in terms of water security, and determine if ADB projects helped reduce vulnerability. 1.3 Compare the quality of data among countries in South Asia and identify gaps needing to be addressed to improve the water-related data set. 2. Analysis and action plans for identified issues 2.1 Coverage 2.2 Quality 2.3 NRW reduction, operational efficiencies, and O&M 3. Water quality management 3.1 Develop a framework to compare the status of water quality management in South Asia, and compare the practices of the region with those of other Asian countries. 3.2 Assess the potential health risks and economic costs of poor water quality. 3.3 Undertake a pilot assessment in selected urban areas where water quality is poor, and prepare action plans to improve quality. 4. Studies and/or Surveys 4.1 NRW studies 4.2 Quality studies 4.3 Energy efficiency assessment studies 5. Capacity development programs 5.1 Assess water security and vulnerabilities in the water sector among countries in South Asia, and develop a model and framework for intercity comparison. 5.2 Conduct workshops to increase awareness of good water governance and implement training to improve management information systems. 6. Multimedia products (i.e., CD and video) recording best practices in water governance in the region to develop collaboration among South Asian countries 7. Dissemination of project-level outputs in India, Nepal, and Sri Lanka, financed by ADB			**Input** ADB — $850,000 52 person-months of consulting services (16 person-months of international, and 36 person-months of national services)

ADB = Asian Development Bank, CPS = country partnership strategy; O&M = operation and maintenance, NRW = nonrevenue water, PPIS = project processing information system, TA = technical assistance.

COST ESTIMATES AND FINANCING PLAN
($'000)

Item	Total Cost
A. Investment Climate Facilitation Fund under the Regional Cooperation and Integration Financing Partnership Facility[a]	
1. Consultants	
a. Remuneration and Per Diem	
i. International Consultants	388.0
ii. National Consultants	144.0
b. International and Local Travel	62.0
c. Reports and Communications	15.0
2. Equipment[b]	40.0
3. Trainings, Seminars, and Workshops[c]	50.0
4. Surveys (NRW, energy efficiency, and water quality surveys)	62.0
5. Miscellaneous Administration and Support Costs	4.0
6. Contingencies	85.0
Total	**850.0**

NRW = nonrevenue water

[a] Administered by the Asian Development Bank (ADB).

[b] Leak detection, water meter calibration, water quality testing equipment, and any other needed to undertake surveys and monitoring, at each participating country. Upon completion of the technical assistance, ADB retains the said equipment.

[c] The part of the funds will be used to finance ADB's participation as resource speakers in selected training sessions and workshops.

Source: ADB estimates.

OUTLINE TERMS OF REFERENCE

A. Introduction

1. The technical assistance (TA) will be implemented over a period of 12 months, beginning in June 2009, in selected urban centers in South Asia (in, India, Nepal, and Sri Lanka). A total input of 52 person-months of consulting services (16 person-months of international and 36 person-months of national services) is anticipated, including: the project coordinator and nonrevenue water (NRW) specialist or team leader (international, 8 person-months); NRW and water quality specialists (two international specialists, 8 person-months total); NRW and water operation specialists (four national specialists, 24 person-months total); and inputs of water quality specialists (four national specialists, 12 person-months total). The Asian Development Bank (ADB) will select and hire consultants on a firm-basis, using the quality- and cost-based selection method, according to its *Guidelines on the Use of Consultants* (2007, as amended from time to time).

B. Scope of Work

2. Outputs will include an analysis of the status and any problems and/or constraints, and development of time-bound action plans—and, for (i) and (ii), monitorable indicators—along with the required resources for achieving desired outcomes.

(i) **Coverage.** Extent of service area (geographical and population) coverage, intermittent versus continuous (24 hour/day, 7 day/week) water supply coverage, piped water supply coverage, etc.
(ii) **Quality.** Supply of drinking water conforming to acceptable quality standards, and issues of wastewater management where these affect the quality of groundwater and/or downstream aquifers and/or waterbodies.
(iii) **NRW reduction, operational efficiencies, and O&M system**. Assessment of the level of NRW, of operational efficiencies, and of the O&M system (involving O&M costs, revenues from user charges, tariff structures, etc.).

C. Specific Terms of Reference

3. **Project Coordinator and NRW Specialist or Team Leader** (international, 8 person-months). The consultant should be an international expert in his or her area of expertise, with special focus on urban water supply management and NRW in South Asia. The consultant should have (i) an undergraduate degree in civil engineering, and preferably hold an advanced degree in a relevant discipline; (ii) experience in managing water supply projects or water supply utilities, preferably in more than two countries in South Asia; and (iii) demonstrated superior abilities and understanding of urban water security issues in South Asia. It is expected that the consultant will have excellent analytical and communication skills, and familiarity with the procedures of other bilateral and/or multilateral agencies. Knowledge of broad-based urban governance, including institutional development and poverty alleviation and the ability to work with South Asian governments, will be an added advantage. The consultant will lead a team of other consultants and work closely with ADB's project officer and respective national and/or city governments in India, Nepal, and Sri Lanka. The consultant will be required to:

(i) plan specific activities with time-bound actions for all members of the team, and coordinate effective implementation of specific activities by each member with ADB and national and/or city governments;

(ii) for issues identified in the TA scope and for each urban center, (a) conduct an analysis of the status of the issue and identify any problems and/or constraints, and (b) prepare a time-bound action plan and specify the resources required to achieve the desired outcomes, taking into account best international practices;
(iii) develop a generalized conceptual framework to assess and evaluate water security applicable to any urban center, based on the studies of the selected urban centers;
(iv) based on the studies of the selected urban centers, develop monitorable water security indicators for use in assessment of water security in any urban center. A model for intercity comparison with a composite index (if possible) will also be developed;
(v) prepare detailed water security case-study reports for selected cities that address physical as well as social and environmental factors affecting efficient water planning and management. The impact of ADB projects on the improvement of water security will be examined and included in the reports for the selected cities in which ADB-financed projects were and/or are being implemented;
(vi) work with and guide the team regarding the issues identified in the TA scope, lead the team in planning, deploying, and coordinating with national and/or city governments and expert agencies, and effectively implementing NRW assessment studies in all the elected urban centers;
(vii) for each assigned urban center, prepare a time-bound action plan and specify the required resources for achieving desired levels of NRW, taking into account best international practices;
(viii) support national and/or city governments in executing NRW reduction action plans;
(ix) give special consideration to the measurement and management of water quality in the selected urban centers (past projects have emphasized quantity over quality;
(x) review policies, regulations and practices relating to water quality management, and undertake specific studies for quality assessment, along with analysis of wastewater management as it affects water quality;
(xi) prepare recommendation to increase synergetic impacts with ongoing capacity-building programs under water sector projects in India, Nepal, and Sri Lanka to increase awareness of water security and vulnerability assessment;
(xii) prepare multimedia products to promote experience sharing and dissemination of knowledge to subregional, national, and local as well as project levels.
(xiii) formulate detailed terms of reference and recommendations for future water supply and sanitation projects to be financed with ADB assistance. These terms of reference will be included in contractors' requests for proposals for implementation of NRW reduction and water quality enhancement programs under the ADB loan projects; and
(xiv) undertaken any other activity appropriate to carrying out the mandate of the TA.

4. **Subgroup 1: NRW and Water Operation Specialists** (one international specialist for 5 person-months; four national specialists for 24 person-months). Each consultant should have a qualified civil engineering and/or water supply background, with proven expertise in carrying out NRW assessment studies, and developing action plans to reduce NRW in urban water supply systems. The consultants should have experience in implementing such NRW reduction action plans for water supply utilities, preferably in South Asia, and demonstrated superior abilities relating to and understanding of urban water security issues in South Asia. In particular, the national consultants will have excellent analytical and communication skills, and familiarity with

procedures of other bilateral and/or multilateral projects. The consultants should be able to work in a team with other consultants and work closely with ADB's project officer and national and/or city governments in India, Nepal, and Sri Lanka. Approximately one fourth of the total number of selected urban centers will be assigned to each of the four national NRW specialists.

5. The international expert will serve as the group leader and be responsible for managing, coordinating and guiding the four national NRW and water operation specialists. The group leader will be responsible for delivering the draft report, as required by the team leader. Each national consultant will work on the urban centers assigned to him or her and produce the following outputs, under the group leader's management:

(i) work with the group leader, under the guidance of the team leader, on the issues identified in the TA scope, and carry out, for each urban center, an analysis of current status of the issue and any problems and/or constraints;
(ii) under the guidance of the team leader, and in collaboration with other group members, coordinate with national and/or city governments and expert agencies, and effectively implement NRW assessment studies in all selected urban centers;
(iii) for each assigned urban center, prepare a time-bound action plan and specify the resources required to achieve the desired NRW levels, taking into account best international practices;
(iv) based on the studies of the selected urban centers, develop generalized water security indicators and a generalized conceptual framework to assess and evaluate water security that are applicable to any urban center;
(v) develop a model for intercity comparison with a composite index (if possible);
(vi) prepare detailed case study reports for selected cities, which include physical as well as social, economic and environmental factors that affect efficient water planning and management. Examine the impact of ADB projects on the improvement of water security, and include this information in the reports for the selected cities in which ADB financed projects were and/or are being implemented;
(vii) plan, coordinate (with the team leader, other experts and expert agencies) and effectively implement water supply coverage assessment studies in all selected urban centers, with an emphasis on identifying (a) specific coverage constraints and/or issues, and (b) the means to achieve a continuously available water supply for each urban center;
(viii) work with other specialists to identify specific constraints and/or issues affecting and the means by which to provide a piped water supply to all citizens, focusing in particular on measures to reduce NRW (including administrative losses) in each urban center;
(ix) plan, coordinate (with water quality specialists and expert agencies) and effectively implement NRW assessment studies in all selected urban centers;
(x) for each urban center, prepare a time-bound action plan and specify the resources required to achieve desired levels of water security, taking into account best international practices; and
(xi) undertake other activities as assigned by the team leader or as appropriate and necessary in carrying out the TA mandate.

6. **Subgroup 2: Water Quality Specialists** (one international expert for 3 person-months; four national experts for a total of 12 person-months). The international expert will be the water quality group leader and will manage, coordinate, and guide the four national experts. The water

quality group leader will be responsible for delivering the draft report, as required by the team leader. Each national consultant will be assigned to specific urban centers, and will undertake the following:

(i) work with team leader on the water quality issues identified in the TA the scope, and carry out an analysis of the status and any issues and/or constraints relating to water quality in each urban center;
(ii) coordinate with national and/or city governments and expert agencies, and effectively implement the water quality assessment studies in all selected urban centers;
(iii) based on the studies of the selected urban centers, develop monitorable water security indicators and a generalized conceptual framework to assess and evaluate water security that are applicable to any urban center;
(iv) for each assigned urban center, prepare a time-bound action plan and specify the resources required to achieve the desired water quality levels, taking into account international best practices;
(v) develop a model for intercity comparison with a composite index (if possible);
(vi) in coordination with other team members, prepare detailed case reports for selected cities that include physical, social, economic and environmental factors affecting efficient water quality upgrades and management. Examine the impact of ADB projects on the improvement of water security and include this information in reports for cities in which ADB financed projects were and/or are being implemented;
(vii) plan, coordinate (with the team leader, local water quality specialists, other experts and expert agencies), and effectively implement water quality assessment studies in all selected urban centers;
(viii) develop a framework to compare the status of water quality management in South Asia, and compare practices in the region with those in other Asian countries;
(ix) assess the potential health risks and economic costs of poor water quality;
(x) undertake a pilot assessment in selected urban areas where water quality is poor, develop responsive water quality monitoring protocols and guidelines for monitoring of drinking water quality, and prepare action plans to improve water quality;
(xi) prepare and facilitate workshop for stakeholders to discuss the outcomes of the assessment and design of a water quality monitoring strategy; and
(xii) undertake any other activity assigned by the team leader or appropriate in carrying out the TA mandate.