Asian Development Bank. 6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines
Tel +63 2 632 4444; Fax +63 2 636 2163; evaluation@adb.org;
www.adb.org/evaluation

Independent Evaluation ADB

Evaluation Approach Paper

Impact Evaluation of Small Towns Water Supply and Sanitation Sector Project in Nepal

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Team Leaders:
Maya Vijayaraghavan, Senior Evaluation Specialist (email: mvijayaraghavan@adb.org)
Garrett Kilroy, Evaluation Specialist (email: gkilroy@adb.org)
Contact: evaluation@adb.org

A. Rationale

1. The project to be evaluated for ex-post impacts is the Small Towns Water Supply and Sanitation Sector Project (STWSSSP) in Nepal[1] implemented during 2000–2009, for which a scoping mission was fielded in November 2016 to confirm evaluability.[2] A key feature of this project was 50% community co-financing for capital costs and community management of water supply infrastructure. Basic data are summarized in Appendix 1.

2. The project completion report (PCR)[3] and the project validation report (PVR) for STWSSSP assessed the project *successful* overall, with a PVR assessment of *moderate* impact based on limited evidence.[4] The PVR recommended that any follow up should examine the sustainability of the institutional arrangements. Enough time has now passed since project completion for outcomes and impacts of STWSSSP to emerge. In the literature on the impacts of WSS, there are gaps in evidence for urban water supply and sanitation (WSS) projects, non-health impacts like income, consumption, poverty, gender, and social inclusion, and intermediate outcomes like household coping costs, time use, and willingness to pay. The proposed evaluation aims to fill some of these gaps.

3. Unlike previous ex-post rural water supply impact evaluations undertaken by the Independent Evaluation Department (IED)[5] and to address key evidence gaps identified for the sector, the proposed evaluation focuses on urban water supply in small towns and in particular on institutional aspects of water supply which are a key determinant of long-term sustainability. During 2005–2015, ADB approved 11 WSS projects worth $612.2 million for small towns in 8 countries across 3 regions;[6] 8 of the 11 projects are ongoing. With the increase in urbanization in Asia and the Pacific and the need for basic infrastructure to support these populations, findings from this evaluation can help improve development impact of future WSS projects in small towns in the region.

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[1] ADB. 2000. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Kingdom of Nepal for the Small Towns Water Supply and Sanitation Sector Project.* Manila.
[2] Peersman et al. 2015. *Evaluability Assessment for Impact Evaluation.* London: Overseas Development Institute.
[3] ADB. 2010. *Project Completion Report: Small Towns Water Supply and Sanitation Sector Project (Nepal).* Manila.
[4] IED. 2012. *Validation Report: Nepal: Small Towns Water Supply and Sanitation Sector Project.* Manila: ADB.
[5] IED. 2009. *Impact Evaluation Study of Rural Water Supply and Sanitation in Punjab, Pakistan.* Manila: ADB; and IED. 2012. *Impact Evaluation Study of Shallow Tubewell Irrigation in Nepal.* Manila: ADB.
[6] South Asia (Bangladesh, Nepal, Sri Lanka), Southeast Asia (Cambodia, Lao PDR, Myanmar, Viet Nam) and East Asia (Mongolia).

B. Background

4. Asia's cities already account for more than 80% of economic output in the region, and its urban population is projected to reach 60% by 2050.[7] Like all of Asia, Nepal's urban population continues to grow steadily albeit from a lower base, and is projected to reach about 40% by 2050. A 2016 ADB study identified a widening gap in household water security between rural and urban areas and between rich and poor in the Asia Pacific region.[8] The same study notes that while water security in Nepal has improved in recent years, it remains below average for South Asia, particularly on the two dimensions of household and urban water security.

5. Small towns, estimated to account for one quarter of the world's population, tend to be located on the border between urban/rural or peri-urban/urban, and can serve a variety of purposes, e.g. market centers for a few days a week or growing areas in their own right.[9] The demand for WSS in small towns is rising, as these serve either as extensions to the capital city, or they are epicenters of rural migration. The Government of Nepal has recognized the importance of supporting WSS infrastructure in small towns[10] through its Fifteen-Year Plans for Small Towns Water Supply and Sanitation, with the most recent plan focusing on the period 2015–2030.[11]

C. Sector Context and ADB Support

6. **Sector Context**. The changes in demography in Nepal have been manifested by increasing population density in Kathmandu, along the main east-west and north-south highways and near the border with India, and within this space, infrastructure is a major constraint for leveraging the comparative advantages of these urban centers.[12] Nepal has made good progress in meeting the Millennium Development Goal (MDG) 7 for providing improved drinking water sources, but lags in the provision of improved sanitation. The MDG successor Sustainable Development Goal (SDG) targets for clean water and sanitation will require that countries ensure availability and sustainable management of water and sanitation for all, i.e. 100% coverage. Reaching the SDG drinking water targets will prove more demanding than the MDGs since suggested indicators require that the improved drinking water source is located on premises, be available when needed and be free of fecal (and priority chemical) contamination.[13]

7. Unmanaged urban growth also poses environmental hazards and can lead to rising urban poverty. Recognizing the importance of urban areas, the Government of Nepal's current three-year plan (2014–2016) places a major focus on urban services infrastructure, along with energy and transport, to underpin growth and greater inclusion.[14] The plan aims to improve basic services such as water supply, wastewater management, and urban transport in large,

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[7] ADB. 2011. *Asia 2050: Realizing the Asian Century*. Manila.
[8] ADB. 2016. *Asian Water Development Outlook*. Manila.
[9] United Nations Human Settlements Programme (UN-HABITAT). 2006. *Meeting Development Goals in Small Urban Centres Water and Sanitation in the World's Cities 2006.* UN-HABITAT, Nairobi.
[10] Ministry of Urban Development criteria to define small towns include a population between 5,000 and 40,000 and a population density of more than 10 persons per hectare.
[11] Government of Nepal. 2015. *Updated Fifteen-Year Plan (2015–2030) Small Towns Water Supply and Sanitation.* Ministry of Urban Development and Department of Water Supply and Sewerage. Kathmandu.
[12] Muzzini, E and Aparicio, G. 2013. Urban Growth and Spatial Transition in Nepal: An Initial Assessment. Directions in Development. Washington, DC: World Bank.
[13] UN-Water for the Inter-agency and Expert Group on Sustainable Development Goal Indicators (IAEG-SDGs) Version 1. April 2016.
[14] Government of Nepal. 2013. *13th Three-Year Plan 2014–2016*. Kathmandu.

medium, and small urban centers. Nepal's Water Supply, Sanitation and Hygiene (WASH) Sector Development Plan (2016–2030) is a strategic framework to progressively ensure effective, efficient, and sustainable provision of WASH services and its aims include provision of universal basic water and sanitation facilities as well as service improvement through improved sector governance and effectiveness.[15]

8. **Sector Issues**. Due to low levels of investment in infrastructure, low availability and poor quality of drinking water are major challenges in the water supply and municipal infrastructure services sector in Nepal.[16] Operational and financial sustainability of institutions in the sector are at risk from low tariffs and insufficient government budgets, poor asset management, and inadequate technical and institutional capacity. Women are disproportionately affected by the poor water supply system because it forces them to spend more time fetching water and fulfilling their household role of caring for those who fall ill from contaminated water. This reduces the time they have for income-generating activities, or leisure, or in the case of school-aged girls, for study. Socially marginalized groups have difficulty gaining equal access to water supply due to discrimination and sociocultural exclusion.

9. **Institutional Setting**. Political, social, economic and administrative systems, together with historical legacies, can all influence the provision of urban water services.[17] A study of WSS delivery in small towns, including Nepal, highlighted the importance of connectivity, demographics, economics and local governance in influencing the demand and supply of WSS services.[18] In Nepal, the Ministry of Water Supply and Sanitation (MWSS) is responsible for formulating national policies and programs, guiding sector activities and administration of the urban WSS sector.[19] The Department of Water Supply and Sewerage (DWSS), and regionally through its water supply and sanitation divisional offices (WSSDOs), is the lead agency in WSS sector and is responsible for provision of WSS facilities in rural areas and small towns. It is also responsible for monitoring tariffs, and supporting local bodies such as municipalities and water user associations in WSS service delivery. It is the implementation agency for the STWSSSP, with the Town Development Fund Board (TDF) engaged as an intermediary financing agency.[20] Water users associations (WUAs), formed by the users under the provisions of Water Supply Regulation 1998 are responsible for project preparation, construction, managing operation, and maintenance of water supply facilities. Water user and sanitation committees (WUSCs), which are elected bodies to manage WUAs, perform all tasks on behalf of associations.

10. The present institutional arrangement, established under the project, will be examined in this impact evaluation. The scoping mission identified some constraints to this arrangement including WUSCs reluctance in some cases to expand the schemes to un-served area for fear of impact on level of service or in case of adjacent hill area due to cost. The technical and financial capacity of WUSCs is variable, which impacts on effective operation and maintenance of assets and overall level of service. Since water supply systems are controlled by the WUSCs,

[15] Government of Nepal. (Forthcoming). *Nepal Water Supply, Sanitation and Hygiene Sector Development Plan (2016–2030). Ministry of Water Supply and Sanitation, Sector Efficiency Improvement Unit.* Kathmandu.

[16] ADB. 2013. *Nepal Country Partnership Strategy 2013–2017, Sector Assessment on Water Supply and Other Municipal Infrastructure and Services.* Manila.

[17] Manghee, S and Poole, A. 2012. *Approaches to Conducting Political Economy analysis in the Urban Water Sector.* Washington, DC: World Bank.

[18] WaterAid/BPD. 2010. *Small town water and sanitation delivery: taking a wider view.* London.

[19] Water supply in small towns is presently governed by water supply regulations 1998, urban water supply and sanitation sector policy 2009 and water supply operations directive 2012.

[20] TDF is a Government-owned autonomous body authorized to receive loans and grants from the government and development agencies for on-lending or on-granting for the development of towns.

and not the municipalities, expansion of the service can occur in the absence of the overall town planning context.

11. **ADB Operations Supporting Water Supply and Sanitation in Nepal**. ADB support for WSS began in 1982, with a small scale technical assistance (TA) for $50,000 to undertake a review of the WSS sector to determine the potential for ADB assistance in the sector.[21] The following year, in 1983, ADB approved a TA to prepare its first WSS sovereign loan to Nepal.[22] Subsequently, ADB approved a $9.6 million loan in 1984 for the *Rural Water Supply Sector Project* to provide safe water to rural communities Mid and Far Western Regions of Nepal.[23]

12. In 2000, ADB approved its first urban water supply project in Nepal—the Melamchi Water Supply Project.[24] The project aimed to improve WSS services in the Kathmandu Valley, which already had a significant urban population at that time. ADB WSS loans and grants were supported by 20 TA projects totaling $13.5 million, which constitute about 33% of total ADB TA to Nepal. Sixty percent ($8.1 million) of the TA portfolio supported project preparation, $5.4 million (40%) was for advisory services, which included support for project implementation.

13. ADB's Nepal Country Partnership Strategy 2013–2017 supports government strategies and includes urban infrastructure, energy, and transport as its three core sectors for support.[25] As of December 2016, ADB has financed 14 WSS projects (comprising 14 loans from the Asian Development Fund and 3 grants) amounting to $689.7 million. Sixty one percent of total approved loans and grants ($421.4 million) was for urban water supply interventions (Table 1). ADB's operations in support of improved water supply and sanitation accounted for about 14% of its total loans and grants to Nepal.

Table 1: ADB Water Supply and Sanitation Operations in Nepal, 1982–2016

Subsector	Loans	Grants	Total	%
Urban Water Supply	375.0	46.4	421.4	61.1%
Urban Sewerage	140.0	0.3	140.3	20.3%
Water Supply and Sanitation	128.0		128.0	18.6%
Total	**643.0**	**46.7**	**689.7**	**100.0%**

Source: ADB Loan, TA, Grant and Equity Approvals Database (as of December 2016).

14. **Small Towns Water Supply and Sanitation Sector Project.** The rationale for the STWSSSP arose from the rapid population growth in urban centers along major highways due to rural migration. These towns were important links with rural areas acting as markets, transport depots and agricultural processing centers. However, basic services such as WSS were inadequate. The project was completed in 2009 and follow-up second and third phase projects are on-going.[26]

[21] ADB. 1982. *Technical Assistance to Nepal for Water Supply and Sanitation Sector Profile*. Manila. (TA 482-NEP, $50,000 approved on 15 September).
[22] ADB. 1983. *Technical Assistance to Nepal for Rural Water Supply and Sanitation.* Manila. (TA 514-NEP, $150,000 approved 12 May).
[23] ADB. 1984. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to Nepal for the Rural Water Supply Sector*. Manila. (Loan 719-NEP, $9.6 million approved on 11 December).
[24] ADB. 2000. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to Nepal for Melamchi Water Supply.* Manila. (Loan 1820-NEP, $120 million approved on 11 December).
[25] ADB. 2013. *Nepal Country Partnership Strategy 2013–2017*. Manila.
[26] ADB. 2009. *Report and Recommendation of the President to the Board of Directors: Proposed Asian Development Fund: Second Small Towns Water Supply and Sanitation Sector Project*. Manila; and ADB. 2014. *Report and*

15. **STWSSSP objectives and components**. The objectives of the project were to (i) improve the health and quality of life of people living in the 40–50 new small towns with average populations of 12,000 each, by constructing water supply, drainage and sanitation facilities, and providing health and hygiene education; (ii) support community participation by developing the institutional capacity of community-based WUSCs, and by requiring the beneficiaries to make contributions in cash or kind to cover partial project costs; and (iii) promote community-based water quality monitoring. The components to achieve these objectives were (i) Part A: Public awareness campaign and health and hygiene education; (ii) Part B: Water supply and sanitation facilities; (iii) Part C: Technical support to WUSCs; and (iv) Part D: Project implementation assistance.

16. The project's expected impact was enhanced human development and reduced poverty through improved and sustainable WSS systems in small towns. This was to be achieved by improving health conditions, increasing the number of children attending the town's schools, and increasing the productive time available to residents who previously would have had to travel to fetch clean water. The project framework in the report and recommendation of the President provided no quantitative indicators or targets, however.

17. The PCR of the STWSSSP (footnote 3) indicates that 29 small towns were selected for participation in the project based on the criteria of community willingness to share 50% of the capital cost for water supply facilities, the condition and service level of existing WSS facilities and services, and the willingness of local bodies to participate. Of the total project cost amounting to $51.0 million, civil works comprised $38.9 million for water supply compared with $2.7 million for public sanitation, drainage and private latrines. Improved water supply access was provided for 593,000 beneficiaries, representing 76% of houses connected in the project service areas. Additional water supply outputs were 2,115 institutional taps provided for hospitals, schools, and government offices. For sanitation, 10,022 on premise latrines were provided for ultra-poor households, and 54 public latrines were built.[27] Health and hygiene education reached 3,152 users, half of whom were women.

D. Previous Evaluation Findings and Gaps in Evidence

18. **Findings of Relevant Completed IED Evaluations**. An impact evaluation of rural WSS in Punjab, Pakistan found that the time saved from fetching water documented in the evaluation had not been translated into more income generation, contrary to projects' expectation.[28] The evaluation also noted that the majority of community-based organizations managing these subprojects lacked resources for capital replacement and routine maintenance work. An ex-post impact evaluation on ADB support for shallow tubewell irrigation in Nepal surveyed farmers and water user groups (WUGs) in 5 of 12 project districts.[29] The evaluation found that while expenditure on education and health rose in project households, neither the number of sick days of household members nor child absenteeism from school declined. The evaluation also noted that half of WUGs were inactive at the time of the evaluation. WUSCs and WUAs in the proposed impact evaluation differ from the WUGs in that they are more formalized, serve many more people (a few households in WUGs versus up to 100,000 people in WUAs) and their location is more urban.

Recommendation of the President to the Board of Directors: Proposed Loan to Nepal for the Third Small Towns Water Supply and Sanitation Project. Manila.

[27] Limited surface drainage of 16,450 meters was constructed whose impact was assessed to be insignificant.

[28] IED. 2009. *Impact Evaluation Study of Rural Water Supply and Sanitation in Punjab, Pakistan.* Manila: ADB.

[29] IED. 2012. *Impact Evaluation Study of Shallow Tubewell Irrigation in Nepal.* Manila: ADB.

19. An impact evaluation of ADB support in the WSS sector in Indonesia found that operations and maintenance was inadequate in most cases largely due to weak institutions and heavily subsidized tariffs.[30] The project was only partly successful in targeting low-income communities because of high up-front connection charges. A wider but more limited evaluation of WSS projects in seven countries using a case study approach highlighted that it was not enough to simply provide adequate quantities of good quality water–sanitation, hygiene, and health promotion programs are needed in parallel and these complementary actions are key factors for success.[31] A more recent and wider IED evaluation on urban WSS emphasizes the importance of institutional reform for long-term sustainability, something that all too often eludes completed projects in this sector.[32]

20. The PVR for STWSSSP assessed the project *successful* overall based on validation criteria assessments of *relevant, less than effective, efficient* and *likely sustainable* (footnote 4). The assessment of less than effective was due to the reduced coverage of 29 towns against the 40–50 towns planned at appraisal, a lack of focus on the poor and questions over the viability of the TDF. Project impact was assessed as *moderate*, but based on limited evidence.

21. As noted in the PVR, the PCR reported several project impacts based on a benefit monitoring and evaluation study conducted by the DWSS in 2008. The PCR lacks information about the achievement toward the intended impact of the project and corroborated this information through focus group discussions (FGDs) with stakeholders. The envisaged project impact was improved health condition, a higher rate of school attendance by children, and an increase in productive time, particularly for women but the PCR provided no conclusive evidence that this was achieved. In the absence of valid quantifiable data to indicate otherwise, the PVR considered that at completion project impact would have been moderate.

22. **There are Gaps in Evidence for Urban, Institutional, and Non-health impacts**. A 2016 review of the WASH knowledge base identified three areas for improving effectiveness of WASH interventions: (i) technology options and WASH practices, (ii) service delivery models, and (iii) strengthening the enabling environment for WASH service delivery.[33] The review also highlighted the importance of cost-benefit analysis in the sector to ensure the efficiency, affordability, and relevance of the investment. Benefits are harder to evaluate comprehensively and the limited number of rigorous impact evaluations tend to focus on health impacts. The review called for more rigorous evaluations on wider issues such as social welfare impacts and the benefits that WASH services contribute to gender equality.

23. A review of the evidence on outcomes of WASH interventions is summarized in a gap map prepared by the International Initiative for Impact Evaluation (3ie).[34] While the health impacts of WASH have been the focus of many studies, there are gaps in evidence for non-health outcomes and impacts[35] and intermediate outcomes.[36] Most impact evaluations in the

[30] IED. 1999. *Impact Evaluation Study of Bank Assistance in the Water Supply and Sanitation Sector in Indonesia*. Manila: ADB.
[31] Operations Evaluation Department. 2002. *Impact evaluation study on water supply and sanitation projects in selected developing member countries.* Manila: ADB.
[32] IED. 2015. *Sustainability of Urban Water Supply Sanitation Operations: Findings and Lessons*. Manila: ADB.
[33] Hutton and Chase. 2016. *Int. J. Environ. Res. Public Health,* 13, 536.
[34] http://gapmaps.3ieimpact.org/evidence-maps/water-sanitation-and-hygiene-evidence-gap-map
[35] Like income, consumption, poverty, gender, and social inclusion.
[36] Like household coping costs, time use, and willingness to pay. The only study in Nepal to estimate averting expenditures focused on households in Kathmandu, Nepal and found that coping activities like collecting, pumping, treating, storing, and purchasing water imposed costs of up to 1% of household income, representing hidden but

sector have been on rural WASH projects, with little focus on urban WASH or institutional aspects.[37] The few studies of piped water supply focused on access, and did not address institutional issues of maintenance and water quality, although poor water quality is discussed in some of the studies on urban water supply.[38] As outlined in the next section, the proposed IE will attempt to fill some of these gaps in evidence which will contribute to better estimates of financial and economic rates of return on projects, and better consideration of institutional sustainability issues in future small towns WSS projects.

E. Evaluation Scope and Approach

24. **Objectives of the Evaluation.** The primary aims of this ex-post impact evaluation are to assess the impact of STWSSSP on: (i) household welfare in small towns; and (ii) capability and sustainability of WUSCs in small towns.

25. **Scope of the Evaluation.** The object of the ex-post impact evaluation is the STWSSSP implemented during 2000–2009. Small towns that participated in the project are the unit of analysis for capability and sustainability of WUSCs, and households in these towns are the unit of analysis to assess improvements in household welfare.

26. **Conceptual Framework of the Impact Evaluation**. The theory of change (TOC) is a statement of how the inputs provided to a project lead to the intended outcomes and impacts. The TOC identifies the steps in the causal chain linking inputs to outcomes and impacts, and the underlying assumptions which need to hold in order for the theory to operate as expected. Indicators along the results chain are required to test the plausibility of the impact pathway, to check the availability and ease of collecting data to track these indicators (i.e. evaluability), and to develop the evaluation framework. These indicators will also feed into the design of the primary data collection tool, a survey questionnaire.

27. The TOC is presented in Figure 1 and reflects our interpretation of the design and monitoring framework presented in ADB project documents. The TOC focuses on the provision of water supply infrastructure and corresponding institutional support, as this was the dominant intervention supported by the STWSSSP (para. 15). In summary, the hypothesis is that investment in water supply infrastructure and institutional support result in improved household welfare and sustainable water supply utilities in project towns compared to non-project towns. At the level of the household, the changes are manifested in the outcomes of access to safe, reliable, and affordable piped water, lower coping costs, higher quality and quantity of water,

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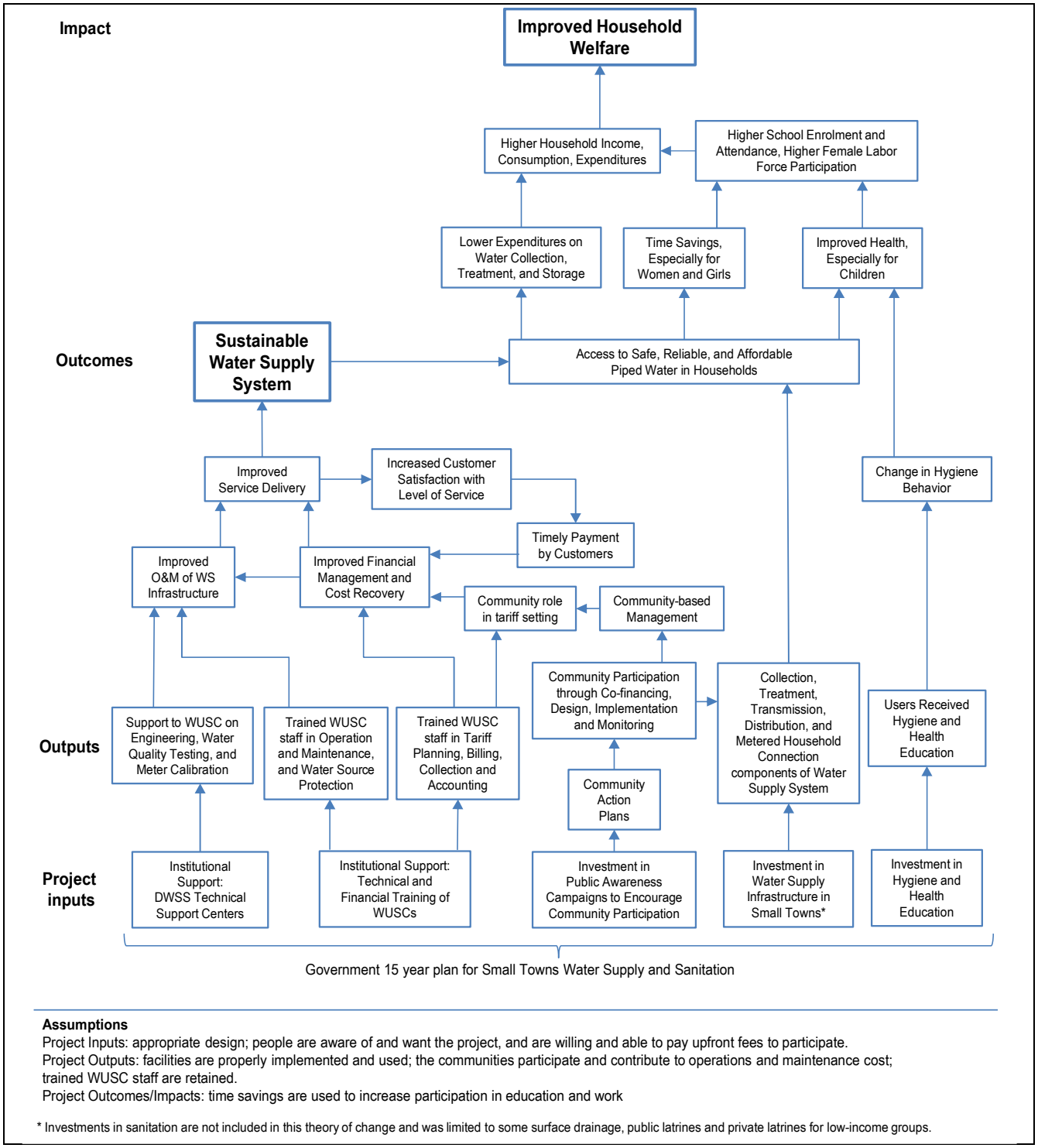
real costs of poor infrastructure service. Pattanayak, Subhrendu K., Jui-Chen Yang, Dale Whittington, and K. C. Bal Kumar. 2005. "Coping with unreliable public water supplies: Averting expenditures by households in Kathmandu, Nepal." *Water Resources Research* 41(2).

[37] See for example, Jalan, Jyotsna and Martin Ravallion. 2003. "Does piped water reduce diarrhea for children in rural India?" *Journal of Econometrics* 112(1):153-173. Pattanayak, S.K., J.-C. Yang, C. Poulos, S.R. Patil, B. Arnold, and J.M. Colford. 2008. "Three years later: Environmental health impacts of a community-demand-driven water and sanitation program in rural Maharashtra, India." RTI International Working Paper 08-01. Pattanayak, Subhrendu K., Christine Poulos, Jui-Chen Yang, and Sumeet Patil. 2010. "How valuable are environmental health interventions? Evaluation of water and sanitation programmes in India." *Bulletin of the World Health Organization* (88):535-542.

[38] A study in urban Morocco found that households are willing to pay a substantial amount of money to have a private tap at home. The connections generated time gains, which are used for leisure and social activities, rather than productive activities; but the connections did not lead to an improvement in the quality of water consumed. Because water is often a source of tension between households, household connections improved social integration and reduced conflict. Devoto, Florencia, Esther Duflo, Pascaline Dupas, William Parient, and Vincent Pons. 2012. "Happiness on Tap: Piped Water Adoption in Urban Morocco." *American Economic Journal: Economic Policy* 4(4):68–99.

and reduced burden of water collection (time savings) which result in more time available for leisure, school or work. These outcomes lead to impacts of additional income, improved health, higher school attendance, and higher household income, consumption, or expenditures resulting from more productive use of water. At the institutional level changes are manifested in better trained technical and financial WUSC staff with a well-managed tariff setting, billing and collection system, and technical back-stopping from DWSS, which yields improved cost recovery and improved service delivery. Community participation through co-financing and design and implementation of the water supply infrastructure fostered greater project ownership. It is expected that better performance by water supply institutions results in consumer satisfaction with water supply services which leads to higher cost recovery, and supports more capable and sustainable WUSCs and infrastructure.

Figure 1: Theory of change for the Small Towns Water Supply and Sanitation Sector Project



DWSS = Department of Water Supply and Sanitation, O&M = operation and maintenance, WUSC = water user sanitation committee.
Source: Independent Evaluation Department.

28. Corresponding to the TOC and the key hypotheses in Table 2 below, indicators and data sources are presented in Appendix 2.

Table 2: Key Hypotheses to be tested

Household Level Hypotheses
Primary hypothesis: Investment in water supply infrastructure and hygiene and health awareness education in small towns improves household welfare. *Supporting sub-hypotheses:* (i) Time savings and improved health result in higher school enrolment and attendance among children; and higher female labor force participation (ii) Additional income from the productive use of time savings, and lower coping costs result in higher household income.
Institutional Level Hypotheses
Primary hypothesis: Investments in community-led water supply utilities through institutional support lead to improved levels of service and sustainability in small towns. *Supporting sub-hypotheses:* (i) Technical and financial institutional support to community-based utilities improves collection efficiency, the sustainability of built assets and the level of water supply service delivery in small towns. (ii) Community based participatory approaches improves cost recovery and the financial sustainability of water supply systems in small towns

F. Methodology and Data Sources

29. Impact evaluations compare the outcomes and impact of a program against a counterfactual that shows what would have happened to beneficiaries without the program. Unlike other forms of evaluation, they permit the attribution of observed changes in outcomes and impact to the program being evaluated by using experimental and quasi-experimental designs. A central feature of IE is to credibly establish causal links between the project and potential outcomes and impact i.e., not just gather evidence that impacts have occurred, but to understand the intervention's role in producing them. For ex-post IE of a project with no baseline data available, this is typically accomplished through a quasi-experimental evaluation design and by applying mixed methods using a combination of qualitative and quantitative primary and secondary data. Crucially, this ex-post IE design requires identification of a control or comparison group to estimate the counterfactual.

30. This evaluation will combine primary data collection at the household level in project and comparison areas with complementary analysis of nationally-representative secondary datasets to provide context and benchmark findings from analysis of primary data. FGDs with households, staff of health centers and schools will provide qualitative evidence to support household level findings. Semi-structured interviews with WUSCs and WSSDO in project and comparison towns will form the basis of the institutional analysis. Key informant interviews with central government and district agencies, NGOs and other development partners will be conducted to examine the wider political economy context within which the WUSCs operate.

31. **Sample selection.** Since the ex-ante selection of project towns was not random, a quasi-experimental design will be used to select comparison towns and estimate the outcomes and impacts of the WASH intervention. From the list of 29 small towns in which the project was implemented (Appendix 3), 10 will be purposively selected to capture heterogeneity in

geography and water sources in the north-south direction, and development status in the east-west direction. These will be matched with 10 comparison towns with similar observable characteristics at the start of the project period, as described in the paragraph that follows.[39] Household-level and institutional impacts of the project will be assessed based on analysis of data from these 20 towns. The population of these 20 towns will constitute the universe for collection of primary data, from which a sample of households will be selected in each town using probability sampling methods.[40] In the absence of baseline data on the outcomes of interest which can be used to determine the appropriate sample size for the IE, this evaluation adopts the rule of thumb of approximately 2,500 households in project and comparison areas combined.[41]

32. **Innovative Matching Approach**. In the absence of baseline data, a double-matching approach will be used to estimate the counterfactual. Project and comparison towns will be matched on characteristics at the start of the project period, and households will be matched on ex-post observable characteristics. An innovative and objective approach to choose the comparison towns will use remotely sensed data (e.g. built-up area, proximity to major roads) to match project towns with candidate comparison towns of similar levels of urbanization at the start of the project. Remotely sensed spatial data on land cover for the year 2000, when the project started, will be sourced from freely available earth observation datasets and used to identify spatial characteristics to better match project towns with comparison towns. Urban density, proximity to major highways and ratio of built-up area to other land cover classes will be calculated for the 10 project towns and up to 30 candidate comparison towns. This matching based on spatial data combined with census data on population size will reduce bias and add rigor to the estimation of the counterfactual.

33. **Household-level Outcomes and Impacts.** Primary data will be collected through survey of households in selected project and comparison towns. This will be supplemented by qualitative information from FGDs with household members in small towns. One or more of the secondary household survey datasets identified during the scoping mission will be analyzed to estimate national level outcomes and impacts of piped water supply in households, which will serve as the benchmark for findings from analysis of primary data.[42]

34. **Analytical approach.** To estimate the outcomes and impact of WASH interventions at the household level, treatment and control households in both the primary and secondary household survey data will be matched using propensity score methods (PSM),[43] and analyzed using regression-adjusted estimators to control for individual and household level covariates. Treated households are those that live in the service area of the WASH project and have the potential to benefit from it, while control households are those that live in non-project towns with characteristics similar to the project towns. Although use of a regression-adjusted difference-in-difference estimator is preferred to control for unobserved factors that differ between the treatment and control households, in the absence of baseline data for the project, a single

[39] Population, proximity to major road, and built-up area. If data on municipality budgets are available, the towns will be matched on this additional observable characteristic.

[40] In project towns, the sample will be drawn from populations in wards or village development committees covered by the project.

[41] Lohr, S. 2010. *Sampling, Design and Analysis. Brooks/Cole.* Boston.

[42] Secondary datasets are (i) Nepal Living Standards Survey (1995/96, 2002/03, and 2010/11); (ii) Multiple Indicator Cluster Survey (2014); and (iii) Demographic and Health Survey (2011; 2016 ongoing).

[43] See Rosenbaum, P.R. and D. B. Rubin. 1983. *"The Central Role of Propensity Score in Observational Studies." Biometrika 41–55.* Rubin, D. 1979. "*Using Multivariate Matched Sampling and Regression Adjustment to Control Bias in Observational Studies." Journal of the American Statistical Association* 74:318–328.

difference measure i.e., ex-post difference between project and control households, will be used to estimate the project effect on the outcomes and impacts of interest. Control function methods which are an alternative class of evaluation estimators will be explored to overcome some of the limitations of PSM.[44] Control function estimators explicitly recognize that nonrandom selection of small towns can lead to an endogeneity problem, and they aim to explicitly model the source of endogeneity to obtain unbiased parameter estimates.[45]

35. **Limitations**. There are a few limitations associated with a quasi-experimental method like PSM, especially when no baseline data are available.[46] Matching on observable characteristics assumes that there are no unobserved differences in the treatment and comparison groups that are also associated with the outcomes of interest. This is a strong assumption since there may be unobserved characteristics that differ between treatment and control group which affect the outcome, and could result in biased estimates. Further, since no baseline data are available at the level of the household, the ex-post treatment and comparison households can only be matched on a small number of characteristics that are not affected by the project, such as age and gender. Although a matched difference-in-difference method can reduce the risk of bias in the estimation, this is not feasible due to lack of baseline data at the household level. Matching the treatment and control small towns using baseline characteristics at the start of the project period can mitigate the bias to some extent. Control function methods need identifying restrictions on functional form or exclusion of some variables to separate the estimated treatment effect from the control function.

36. **Institutional Outcomes and Impacts.** A semi-structured questionnaire of project and comparison WUSCs and WSSDOs will be fielded to estimate outcomes and impact of the project's institutional support interventions. This evaluation aims to explore the institutional space within which the WUSCs operate to better understand the political economy, governance issues, and stakeholder relationships that influence urban water sector performance in small towns. Within this context the evaluation will examine how WUSCs operate and what characteristics determine better performance in service delivery and better outcomes for customers. Scoping mission findings suggest that institutional capacity of the WUSCs has a key role in determining the success of each scheme. A pilot project by the Japan International Cooperation Agency (JICA) to improve DWSS technical support to WUSCs through technical standard operating procedures and business planning has demonstrated improvements in WUSC performance.[47] The focus will be on learning what steps were taken in high performing WUSCs that distinguish them from WUSCs that are not performing well, and understanding how the project facilitated better performance. Key metrics of performance include staffing levels and composition, debt service and cost recovery capacity, timeliness of bill payment, daily hours of water supply, water pressure achieved, non-revenue water losses and water quality. Government support, such as technical backstopping from DWSS, will also be examined. Specific institutional outcome and impact indicators that will be collected and their data sources are listed in Appendix 2. The wider political economy context will be explored through key

[44] PSM can be viewed as a restricted form of a control function estimator, referred to as selection on observables. James J.Heckman and Richard Robb. 1985*. Alternative Methods for Evaluating the Impact of Interventions: An Overview. J. Econometrics.* 30:239–267.

[45] Jeffrey M. Wooldridge. 2015. *Control Function Methods in Applied Econometrics J. Human Resources* 50:420–445.

[46] Gertler, Paul J., Sebastian Martinez, Patrick Premand, Laura B. Rawlings, and Christel M. J. Vermeersch. 2016. *Impact Evaluation in Practice, second edition.* Washington, DC: Inter-American Development Bank and World Bank.

[47] JICA. 2013. *Project for Capacity Development on Water Supply in Semi-urban Areas – Project Brief Note*. Kathmandu.

informant interviews with central government ministries and agencies, advocacy groups and other development partners.

G. Resource Requirements

37. The IE will be undertaken by an evaluation team led by Maya Vijayaraghavan, Senior Evaluation Specialist and Garrett Kilroy, Evaluation Specialist to be supported by Ma. Patricia Lim, Evaluation Officer and Jennifer Llaneta, Evaluation Assistant. Internal peer reviewers are IED Principal Evaluation Specialists Hyun Son and Tomoo Ueda; and David Raitzer, Economist, Economic Research and Regional Cooperation Department. Shreena Patel, Director, Evaluation, Department of Policy and Evaluation, Monitoring and Evaluation, Millennium Challenge Corporation, was the external peer reviewer for the evaluation approach paper. The evaluation report will be peer reviewed by external experts.

38. The evaluation will require the inputs of (i) a national consulting firm for collection of primary data; (ii) two international experts in econometrics, one each for primary and secondary data analyses; (iii) a GIS expert; (iv) a national consultant for evaluation of the institutional impacts of STWSSSP; and (v) a national consultant for the FGDs. The terms of reference of Consultants' are in Supplementary Appendix A.

39. The cost estimate for this evaluation excluding IED staff expenses is $200,000 (Supplementary Appendix B).

H. Tentative Schedule

40. The proposed schedule for the evaluation is:

Activity	Tentative Schedule
Approval of the evaluation approach paper	IV March 2017
Recruitment of Consultants, Selection of Project and Comparison Towns, Preparation of Primary Data Collection Tools, Analysis of Secondary Data	IV March–II June 2017
Evaluation Missions, Primary Data Collection and Analysis, Report Writing	III June–II November 2017
Peer Review (internal and external)	II December 2017
One Stop Review Meeting	II January 2018
Interdepartmental Circulation	II February 2018
Heads of Department meeting *(if needed)*	III March 2018
Editing	II April 2018
IED Director General Approval	IV April 2018
Report Circulation	IV May 2018

I. Risks to Timelines

41. In the wake of proposed amendments to Nepal's Constitution, there was civil unrest in the Terai region in late 2016. Reemergence of unrest, the schedule of local elections in 2017, and the timing of the monsoon pose moderate risks to the timeline for primary data collection. Any delays in collection of primary data will affect the overall timeline of the evaluation.

Appendixes:

1. Basic Data Table
2. Indicators and Data Sources for Testing Hypotheses
3. List of 29 small towns of the Small Towns Water Supply and Sanitation Sector Project

Supplementary Appendixes *(available upon request)*:

A. Terms of Reference
B. Cost Estimates

LOAN 1755-NEP: Small Towns Water Supply and Sanitation Sector Project

BASIC DATA

KEY PROJECT DATA (in $ million)	As per ADB Loan Documents	Actual
Total Project Cost	53.9	51.0
Foreign Exchange Cost	29.7	31.3
Local Currency Cost	24.2	19.7
KEY DATES	**Expected**	**Actual**
Appraisal		8 May 2000–10 May 2000
Loan Negotiations		10 August 2000–12 August 2000
Board Approval		12 September 2000
Loan Agreement		18 March 2001
Loan Effectivity		16 March 2001
Loan Closing		3 December 2009
	31 December 2006	
DMC: Nepal **Executing Agency:** Department of Irrigation		
MISSION DATA	**No. of Missions**	**No. of Person-Days**
Type of Mission		
Inception	1	8
Special Loan Administration		
Project Administration		
Review	13	399
Mid-term	1	60
Project Completion Review		24
PROJECT PERFORMANCE REPORT RATINGS		
Implementation Period	**Development Objective**	**Implementation Progress**
1 January 2008–30 November 2008	S	S

Source: ADB. 2010. *Project Completion Report: Small Towns Water Supply and Sanitation Sector Project (Nepal).* Manila.
DMC = developing member country, S = satisfactory.

Indicators and Data Sources for Testing Hypotheses

Outcome/Impact	Indicators	Data Sources
Household access to piped water supply	% households with piped water supply, by income or wealth quintile	Primary data from households in project and non-project towns Secondary data from Living Standards Measurement Survey, Demographic and Health Survey, and Multiple Indicator Cluster Survey
Time savings	Average number of hours spent collecting water for household, per week, by gender.	Primary data from households in project and non-project towns.
Use of time savings	Types of new income-earning activities, by gender; Average additional time spent on income-earning activities, by gender; % of women engaged in wage labor; and % of women running household businesses.	Primary data from households in project and non-project towns; and Focus group discussions with household members.
Coping costs	Average monthly household expenditures on collecting, pumping, treating, storing, and purchasing water.	Primary data from households in project and non-project towns; and Secondary data from the Living Standards Measurement Survey.
Household income or wealth	Average household income or wealth	Primary data from households in project and non-project towns; Secondary data from the Living Standards Measurement Survey.
Health	Diarrhea rate among children under 5 and household members, during the 2 weeks before the survey; and Incidence of other water-borne diseases among children under 5 and household members, during the 2 weeks before the survey.	Primary data from households in project and non-project towns; Focus Group discussions with households and health center staff; and Secondary data from the Demographic and Health Survey and Multiple Indicator Cluster Survey.
Education	Average days of school attendance, during the 2 weeks prior to the survey, by gender; and Primary and secondary school enrolment rate for children, by gender.	Primary data from households in project and non-project towns; Focus Group discussions with school administrators; and Secondary data from the Demographic and Health Survey and Multiple Indicator Cluster Survey.
Water quality	Perceptions of color, odor, and taste of water; National-level E.coli risk level in household water; and National-level E.coli risk level in	Primary data from households in project and non-project towns; and Secondary data from Multiple Indicator Cluster Survey.

Outcome/Impact	Indicators	Data Sources
	source water.	
Water quantity	Average monthly household consumption of water.	Primary data from households in project and non-project towns.
Reliability of water supply	Number of hours of supply of tap water/week; and Frequency of breakdown and supply disruption per year.	Primary data from households in project and non-project towns; Key informant interview with WUSC members and staff
Competent Technical WUSC Staff	Composition of WUSC Technical staff (job title, qualifications, no of years in service); and Time taken to fix breakages in pipeline, water meters, treatment plants.	Key informant interviews with WSSDO, WUSC & TDF staff; and Key informant interview with WUSC staff, members.
Competent Financial and Accounting WUSC Staff	Composition of WUSC Financial staff (job title, qualifications, years in service); and Preparation of financial reports in time, No. of financial complaints.	Key informant interviews with WSSDO, WUSC & TDF staff; and Key informant interview with WUSC staff, office records.
Improved O&M of water supply infrastructure	No. of functional domestic meters; No. of functional bulk meters; and Quality of water meeting national standards, No. of leaks reported and repaired in a month.	Key informant interviews with WSSDO, WUSC staff.
Sustainable Water Supply System	Operation ratio, Annual Financial Statements, Duration of supply.	Key informant interviews with WSSDO, WUSC & TDF staff.
Improved Service Delivery	Duration of supply; Water pressure at consumer tap; Quality of water; and No. of complaints per year.	Key informant interviews with WSSDO and WUSC staff; and Feasibility Study Reports, Utility Databooks.
Timely payment by customers	Collection ratio, Collection period (Arrears).	Key informant interviews with WUSC staff.
Improved Financial Management and Cost Recovery	Operating ratio, Annual Financial Statement, Collection ratio, Tariff revisions frequency.	Key informant interview with WUSC staff.
Community Satisfaction with WUSCs/Level of Service	Water Coverage in service area; No. of Complaints in a year; and Consumer perception of sufficiency in water quantity and appropriateness of quality.	Primary data from households in project and non-project towns; and Focus Group discussions with households and WUAs.
Community Management and Ownership	Community Participation in AGM, WUA meetings and cost sharing.	Focus Group discussions with households and WUAs; and Key informant interviews with WSSDO and WUSC staff.

AGM = annual general meeting, O&M = operations and maintenance, TDF = Town Development Fund, WSSDO = water supply and sanitation district office, WUA = water user association, WUSC = water user sanitation committee
Source: Independent Evaluation Department.

List of 29 small towns of the Small Towns Water Supply and Sanitation Sector Project

SN	Towns	District	Population	Water Supply Status
Eastern Terai				
1	Birtamod Municipality	Jhapa	60,174	Good
2	Budhabare VDC	Jhapa	22,936	Good
3	Surunga (Kankai Municipality)	Jhapa	40,141	Very Good
4	Belbari Municipality	Morang	31,647	poor
5	Itahari Municipality	Sunsari	140,517	Good
Eastern Hills				
6	Fikkal (Suryodaya Municipality)	Ilam	27,040	Good
7	Triyuga Municipality	Udaypur	71,405	Good
Central Terai				
8	Bardibas	Mahotari	37,048	Fair
9	Parsa (Khairahani Municipality)	Chitwan	56,094	Very Good
10	Ratnanagar Municipality	Chitwan	69,851	Good
Central Hill				
11	Kamalamai	Sindhuli	41,117	Fair
Western Terai				
12	Kawasoti	Nawalparasi	56,788	Good
13	Bardghat Municipality	Nawalparasi	34,417	Good
14	Sunuwal Municipality	Nawalparasi	39,843	Fair
Western Hill				
15	Prithvinarayan (Gorkha) Municipality	Gorkha	39,263	Fair
16	Khairenitar (Suklagandaki Municipality)	Tanahu	38,307	Fair
17	Bandipur Municipality	Tanahu	15,591	Fair
18	Lekhnath Municipality	Kaski	68,622	Good
19	Kusma Municipality	Parbat	32,419	Good
20	Waling Municipality	Syangja	24,199	Fair
21	Beni Municipality	Myagdi	28,511	Good
Mid Western Terai				
22	Tulsipur Municipality	Dang	85,601	Fair
23	Ghorahi Municipality	Dang	65,107	Fair
24	Kohalpur Municipality	Banke	62,177	Fair/Good
Mid Western Hill				
25	Birendranagar	Surkhet	93,718	Poor
26	Bijuwar (Pyuthan Municipality)	Pyuthan	38,536	Poor
Far Western Terai				
27	Attariya Municipality	Kailali	72,521	Good
28	Lamki Chuha Municipality	Kailali	61,352	Good
29	Mahendranagar Bhimdatta Municipality)	Kanchanpur	106,666	Good

Sources: Enhance Functionality in Small Towns Water Supply and Sanitation Sector Project (STWSSSP), 2014 and 29 Towns Assessment under Small Towns Water Supply and Sanitation Sector Project (STWSSSP), 2010.