

SUSTAINABLE CITIES PROJECT (SCP)

Component A: Sustainable City Planning and Management Systems

TERMS OF REFERENCE

Preparation of Non-Revenue Water Management Guidelines to Combat Climate Change for WUDs in Turkey

1 BACKGROUND

1.1 Partner country

Republic of Turkey

1.2 Contracting authority

İller Bankası A.Ş. (ILBANK)

1.3 Project Background

ILBANK and the World Bank (WB) designed the Sustainable Cities Project (SCP) to establish a support mechanism for participating Metropolitan Municipalities (MMs) to plan and invest in a sustainable future. The SCP is designed to support MMs pursue these aims to promote forward-looking, long-term, and informed city planning and development. The SCP aims to help Metropolitan Municipalities to: (i) respond to current and increasing demands for urban services; (ii) plan for future infrastructure service needs sustainably; (iii) mobilize financing to fund investment priorities; and (iv) adhere to new spatial planning mandates and infrastructure service requirements as prescribed by the amended Metropolitan Municipality Law No 6360 in December 2012.

The SCP is organized around two main components:

Component A – Sustainable City Planning and Management Systems, funded by an EU-IPA2 Grant but implemented under the World Bank guidance. This component provides technical assistance to MMs to ensure a more comprehensive and integrated approach to planning,

including support for spatial, social, environmental, financial, and capital investment planning and management. This aims to allow municipalities to improve each dimension of sustainability (environmental, social and financial/economic). Under the EU-IPA2 Grant Agreement, there is a clear focus on outcomes that demonstrate how plans can be developed comprehensively and integrated; these include spatial planning studies and tools, financial management tools, and capital investment plans.

Component B – Municipal Investments in public transport, water and sanitation, solid waste management and energy, to be financed through an IBRD loan.

Moreover, “Subcomponent A.1: Technical Assistance (TA) Support to Municipalities/Utilities” under Component A specifically targets to provide TA to municipalities and their affiliated utilities to ensure comprehensive and integrated planning, including support for spatial, social, environmental, and financial/capital investment planning and management. This would allow municipalities/utilities to improve each of their dimensions of sustainability (environment, social, and financial/economic) as they move along the spectrum from a planned to a smart city. These sub-components covers preparation for innovative sustainable planning tools for selected metropolitan municipality, including capital investment plans, integrated urban water management plans, sustainable urban mobility plans and sustainable energy and climate action plans.

Integrated Urban Water Management Plans (IUWMP) will be prepared for ten cities including Antalya, Balıkesir, Denizli, Kahramanmaraş, Kayseri, Malatya, Mardin, Muğla, Ordu and Van. Ultimately, IUWMP can contribute to better urban water management in the following ways: (i) it will provide a complete analysis to diagnose a city’s water issues and prioritize interventions, (ii) it will improve planning integration and infrastructure sequencing and (iii) it will inform better engineering practices by providing a more diverse set of options. IUWMPs will report the city-wide current situation and diagnostics as well as vision and action plan for selected areas. They will add valuable input for future project needs and investments. However, for finding effective and efficient solutions to non-revenue water problems of municipalities, there is still a need for concrete and locational decisions as well as pilot applications for innovative solutions.

“Preparation of Non-Revenue Water Management Guidelines to combat climate change for Water Utility Departments (WUDs) in Turkey” will be the continuation of the project. The interim outputs of IUWMP will be evaluated as input of this project.

1.4 Project Rationale

Non-revenue water is an essential topic for drinking water utilities, as it influences the financial sustainability, serviceability and the management of precious water resources to a large extent. According to the World Bank, in developing countries, roughly 45 million cubic meters of water are lost daily with an economic value of over US\$3 billion per year. The International Water Association’s (IWA) definition of Non-Revenue Water (NRW) is the difference between the cubic meters of water distributed into the water distribution network and the cubic meters invoiced with the customer. Figure 1 presents the IWA water balance, the most widely accepted framework for understanding NRW.

Total System Input Volume	Authorised consumption	Billed authorised consumption	Billed metered consumption	Revenue water
			Billed unmetered consumption	
		Unbilled authorised consumption	Unbilled metered consumption	Non-revenue water
			Unbilled unmetered consumption	
	Water losses (UFW)	Apparent losses (Commercial losses)	Unauthorised consumption	
			Metering inaccuracies	
		Real losses (Physical losses)	Leakage in transmission and distribution lines	
			Leakage and overflows at storage tanks	
			Leakage on service connections up to customer meters	

Figure 1 IWA Water Balance

As shown in the table, NRW has the following components:

1. Real losses; also referred to as physical losses (from transmission mains, storage facilities, distribution mains or service connections), and consisting of leakage on transmission and/or distribution mains, leakage and overflows in storage at utilities' storage tanks, and leakage on service connections up to the point of the customer's metering
2. Apparent losses: administrative losses, such as illegal water connections
3. Unbilled authorized consumption: such as water used by firefighters, or for the watering of public parks or use by religious institutions

Figure 2 below elaborates on different components of physical and administrative losses.

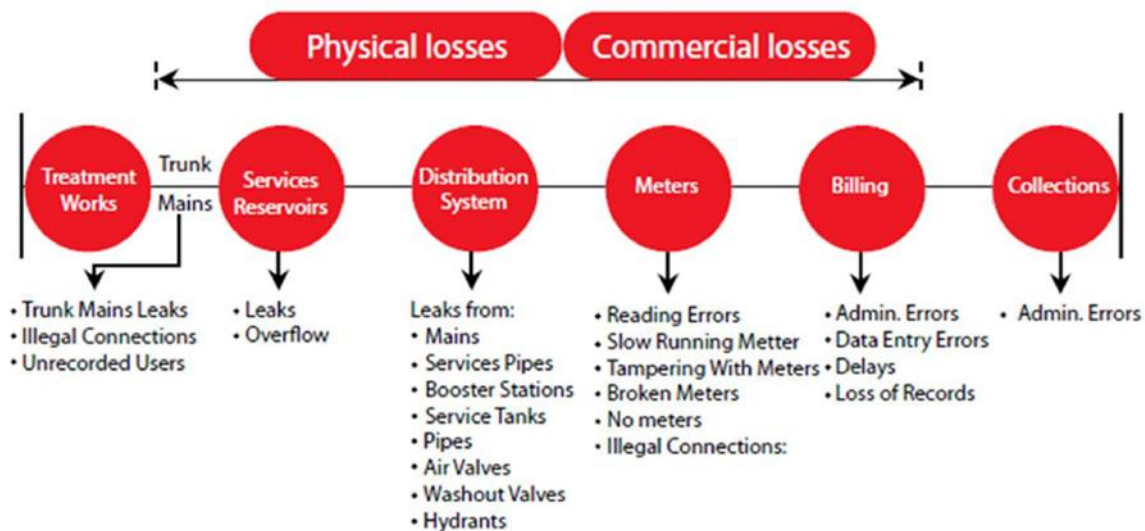


Figure 2 Main Components of NRW

(Source: The Manager's Non-Revenue Water Handbook: A Guide to Understanding Water Losses, 2008).

High levels of NRW are detrimental to the financial viability of water utilities and the quality of the water itself. NRW is typically measured as the volume of water "lost" as a share of net water produced. NRW is very often still expressed in percentages, which is easily calculated and looks pretty intuitive. However, saying NRW as a percentage of system input volume is a misleading and imprecise method, particularly in systems with intermittent supply and very low operating pressures, as in many developing countries¹. Furthermore, when the losses are expressed in litre/connection/day, the actual performance of utilities with a lower percentage of NRW might be worse than utilities with a higher rate of NRW. Therefore, monitoring and performance measurement on NRW should be done through alternative indicators selected based on characteristics of utilities, geographic conditions and system requirements.

NRW reduction and management is a challenge; it needs vision and commitment from the management of the WUD, contributions from many departments, coordination with related departments of the MM and other institutions and intensive collaboration between

¹ (i) Ranhill Utilities Berhad and the United States Agency for International Development (USAID) (2008). The Manager's Non-Revenue Water Handbook, A Guide to Understanding Water Losses, 2008.

https://www.pseau.org/outils/ouvrages/ranhillutilities_manager_non_revenue_water_handbook.pdf

(ii) Frauendorfer, Rudolf; Liemberger, Roland. 2010. The Issues and Challenges of Reducing Non-Revenue Water. Asian Development Bank. <http://hdl.handle.net/11540/1003>. License: CC BY 3.0 IGO.

(iii) JICA (2020). Project research key points on non-revenue water reduction projects: final report.

<https://openjicareport.jica.go.jp/pdf/12353611.pdf>

(iv) GIZ (2011). Guidelines for water loss reduction.

<https://www.icafrica.org/fileadmin/documents/Knowledge/GIZ/Guidelines-water-loss-reduction.pdf>

(v) M. Farley, R. Liemberger; Developing a non-revenue water reduction strategy: planning and implementing the strategy. Water Supply 1 March 2005; 5 (1): 41–50. doi: <https://doi.org/10.2166/ws.2005.0006>

employees. Also, the challenge to reduce NRW includes technical, cultural and organizational changes. Usually, quick wins can be achieved within 2-3 months, but sustainable results can only be achieved after several years of effort when structural changes are implemented.

NRW does not have to be only the result of an underperforming WUD; another cause can be a lack of investments that are sometimes out of the scope of a WUD.

Many programs to reduce NRW have failed in the long run, as they often focus on real losses without sufficient attention being paid to apparent losses. As a result, policies and human resources have to be changed to achieve permanent results, management procedures related to a WUD's organization. Additionally, implementing a pressure management system is an efficient approach to reducing the long term's total real losses. It is one of the most basic and profitable forms of optimizing a system and generally provides fast investment paybacks.

NRW reduction will cause improvements on all five principles of the Financial, Institutional, Environmental, Technological, Social (FIETS) sustainability approach introduced by the WASH alliance.²

Financial

To convince the management that reducing NRW will increase the revenue of the WUD, a positive (financial) business case is crucial. The initial business case is made by comparing the revenue currently lost to NRW to what would be lost if NRW targets are met. The calculation shall include an estimation of the investment- as well as operational costs of the means needed for in materials and man-hours. The business case can also having prospects on income from new service extensions enabled through increased revenues and the extra water that will become available.

Institutional

To manage NRW, a WUD needs to be well organized and equipped with competent staff. Reducing NRW will improve customer satisfaction, as the customers will experience fewer interruptions in water supply, sufficient pressure and required water quality defined in water safety plans and national standards. In addition, it will increase the awareness of the value of water, energy efficiency, climate change and sustainability both at the institutional level and customer level.

Environmental

Less NRW will increase climate resilience and support the sustainability of ecosystems (less stress on water resources), decrease carbon footprint (with fewer leakages, pumping need and related energy costs can be reduced) and lower use of chemicals (fewer service interruptions and fewer ruptures in pipes lead to improved water quality).

Technological

² <https://wash-alliance.org/our-approach/sustainability/>

An essential part of NRW management is the managing of assets. Therefore, asset maintenance plans will increase the lifetime of assets and thereby increase overall technological sustainability.

Social

Managing NRW will increase social sustainability and equity by increasing the WUD revenues and making more water available and accessible by reducing physical water losses.

With the Sustainable Development Goals, the UN has created a foundation for a more sustainable future. Water utilities today play a significant role in implementing and overcoming the obstacles that get in the way of reaching the goals. Managing NRW is directly related to Sustainable Development Goals (SDGs), mainly SDG 6 “Clean Water and Sanitation” as well as other SDGs at least SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable cities & communities) and SDG 13 (Climate Action). SDG 6 is set to ensure availability and sustainable management of water and sanitation for all by 2030.

However, reducing the loss-leakage rates in water management is a horizontal issue that cuts many sectors. Due to financial resource shortages and technical capacity insufficiencies, local governments cannot take the desired steps in this area. There is a necessity for preparing guides for local governments in this area, which concerns drought due to climate change, water transfer between basins, ecological balance, biodiversity, financial sustainability, fair and accessible urban service provision, energy efficiency (and resulting in current account deficit) and many other issues. Therefore, managing NRW will serve positive impacts on reaching other relevant SDGs.

The Consultant will carefully review international guidelines and best practices and localize this know-how for effective time management and more concentration on Turkish municipalities.

1.5 Country Background

In many utilities in Turkey, like many other utilities of the world, the exact breakdown of NRW components and sub-components is simply unknown, making it challenging to decide the best course of action to reduce NRW.

Apparent losses for developing countries, in particular, unauthorized connections have been estimated on average to account for about 40% of NRW. In some cities, apparent losses can be higher than real losses. For example, water losses from water distribution networks have become a crucial problem in Turkey, where the average non-revenue water (NRW) is almost 36% of the system input volume. The national development plan aims to decrease this ratio to 25% by 2023.

One of the biggest challenges with water utilities today is the difference between the volume of water placed into a distribution system and the amount of water billed to consumers. This different amount of water is called “non-revenue water”. Non-revenue water (NRW) generally happens to be in three forms:

Physical (Real) Losses: They are caused by leakage from any system parts and overflows at the WUD’s reservoirs. Reasons for this type of loss are poor operation and maintenance capacity of WUDs, the lack of active leakage control, and poor quality of water distribution infrastructure.

- Leakage on transmission and/or distribution mains and service connections
- Leakage and reservoir overflows

Administrative (Apparent) Losses: They are caused by customer meter under registrations, data-handling errors, and water theft in various forms.

- Unauthorized Consumption
- Metering and Billing Inaccuracies

Unbilled Authorized Consumption: Consisting of a relatively more minor amount of water, including water used by the WUD for operational purposes, water used for firefighting, and water provided for free to specific consumer groups.

- Unbilled Metered Consumption
- Unbilled Unmetered Consumption

According to the Ministry of Forestry and Water Affairs handbook in 2017, physical losses are higher than administrative losses in Turkey. According to the data published by the Turkish Statistics Institute (TSI), the total water abstraction for municipal water supply network is equal to 6,19 billion m³. In comparison, the amount of water distributed by the municipal water supply network is 4,04 billion m³ in 2018.

Non-revenue water volume has been calculated to be 346 million cubic meters per day globally, up to 126 billion cubic meters per year. This means that non-revenue water volume is 30% of the water put into distribution systems worldwide. While NRW rates vary by country, it is estimated at around 34% globally. While most governments are taking actions to decrease this rate to about 10%, e.g. it was reduced to 9% in Denmark for the first time.

1.6 Legal Framework

In Turkey, this ratio varies depending on the development level of the region and water infrastructure, and it can even be as high as 70% in some areas. As well as the rest of the world, efforts to reduce non-revenue water has gained importance in recent years. In this context, the "Regulation on Control of Water Losses in Drinking Water Supply and Distribution Systems" was published by the Ministry of Forestry and Water Affairs on 8 May

2014. The regulation aims to protect water resources and increase sustainable water use by regulating the procedures and principles regarding the control of water losses in drinking-potable water supply and distribution systems. There is an article in the regulation that refers to actions to be taken to decrease the amount of NRW in cities: "The administrations of the metropolitan and provincial municipalities must decrease their water loss rates to the level of 30% within five years and up to 25% within the following four years; other municipalities are obliged to reduce this ratio to a maximum of 30% within nine years and a maximum of 25% within the following five years.". The controls of this regulation were planned to be made through annual reports prepared by the municipalities.

In July 2015, the practical and technical procedure for detecting and reducing water losses was issued with the "Communique On Technical Methods For Controlling The Water Losses In Water Supply And Distribution Networks". It provides a road-map for utilities for the reduction of NRW, including (i) measuring the volume and flow of drinking water supply, (ii) establishment of a Geographical Information System (GIS) database, (iii) Establishment of monitoring systems, (iv) performing hydraulic modelling and calibration of the network, (v) separation of networks into sub-zones in the field, (vi) integration of software and data with the central database, (vii) integrated management of drinking-potable water supply and distribution systems and (viii) detection and reduction of physical losses with active leakage control. In addition, "A Methodological Guide On Water Efficiency" has been prepared under the "Technical Assistance on Economic Analyses within River Basin Management Plans and Water Efficiency Aspects in 3 Pilot River Basins in Turkey Project – IPA/2013/023-651" funded by EU, contracted by CFCU for the beneficiary of Ministry of Agriculture and Forestry. . This Guide provides a methodology on cost and benefit assessment of water measures supporting cost-effectiveness and further implementation of the concept of payment for ecosystem services, which will help, identify water efficiency measures and also implement the polluter pays principle.

1.7 Contribution to Climate Change

Reducing pressures on water resources, preserving water resources in the face of the current growth rate, changing water consumption habits and increasing water demand, and adaptation to the adverse effects of climate change on water resources are among the most critical problems of the century. The main essential sectors for Turkey are drinking and utility water, energy, agriculture and industry. In these sectors, the main measures to be taken against climate change and the adaptation activities to be carried out are reducing the loss/leakage rates for drinking and utility water, rainwater harvesting, using efficient equipment in showers and siphons, reusing domestic wastewater. Physical and administrative loss in the city's water supply system negatively affects resource capacity and contributes to GHG emissions. Surplus water treated, pumped and transmitted to the cities increases energy consumption and consequently GHG emissions. The other crucial negative effect of water loss is preventing water tariff optimization.

Rapid socio-economic developments and increasing climate change pressures negatively affect water resources and raise concerns about water scarcity. Specifically, the Mediterranean region was pointed out as a threatened area for water scarcity in the near future. Therefore, water utilities should have a highly efficient process to sustain a sufficient water supply quantity. Hence, minimizing water losses is crucial in getting the maximum benefit from a unit of produced water in an efficient municipal water supply system. Bringing attention to water loss may be difficult because it is mostly invisible, and it may negatively impact government budgets, environmental resources, and user's health. However, the variety of impacts can help increase the importance of real costs associated with water losses from the municipal water supply system.

2 OBJECTIVES

The objective of this assignment is to prepare a Guideline for WUDs to implement NRW management. This Guideline is to be implemented by WUDs for developing the most cost-effective NRW management in WUDs, which would generate the most significant socio-economic benefits in addition to technical and financial benefits. The Consultant will therefore determine the steps for actions, prioritizing the goals of combating climate change, achieving the highest socio-economic benefit, and ensuring the economic sustainability of utilities. The Guideline will be prepared so that each step could be implemented as an individual project.

3 SCOPE OF WORKS

The assignment mentioned in this ToR aims to prepare a Guideline for effective and sustainable management of water resources in Turkish municipalities by reducing non-revenue water (NRW). The Consultant shall analyze in-depth the use of water at the municipal level in the selected municipality to assess water use efficiency, the practices in water pricing (tariffs), and finally propose appropriate measures to prevent water losses as a climate change adaptation activity and improve the pricing.

Based on reviewed documents, the Consultant will prepare a selection methodology under the inception report and send its proposal among Component A cities to ILBANK. As a result, the municipality will be selected by the ILBANK among the provinces supported through Component A cities in cooperation with the World Bank and EUD.

This study will consist of two main tasks:

Task 1: Diagnosis of current situation including site surveys

Task 2: Preparation of guidelines for WUDs in Turkey

The conduct of the studies under this TOR shall focus on the development and selection of the best possible options/configurations/technology for NRW reduction and control, which would yield the highest value-for-money (VfM), e.g., lowest lifecycle costs, taking into

account all alternative ways of delivering the desired outputs, including the associated costs, benefits and risks involved.

The objective of the Guideline is to guide the WUDs in implementing NRW reduction strategies by addressing each of the issues and designing solutions tailored to the WUD's specific needs. The summary of the scope is summarized below:

- Determination of all components of NRW by using the site survey results as described in Section 3.1.3 of this ToR and by calculating the water balance in line with the principles explained in Section 1.4 of this ToR;
- The Guideline will be the action plan for the WUDs to implement in their system,
- The action plan will start with due diligence of the current system,
- The Guideline will present the international standards to identify the extent of the problem and targets to reach and benefit from international practices
- Pressure control of the system is one of the essential aspects to control energy consumption and system efficiency together,
- The Guideline will identify investment needs in a phased approach. The investments for NRW reduction shall include administrative and managerial measures and physical interventions, including rehabilitation/renewal of existing systems. Such measures defined in the section 1.6. Any physical interventions that necessitate civil works in the future would need to consider the World Bank's environmental and social safeguards policies and the Good International Industry Practices (GIIPs). The WUD guidelines prepared by the Consultant should be consistent with the relevant national legislations and the World Bank's environmental and social safeguards and standards³. While none of the proposed measures and interventions should harm the people and environment (i.e. leading to the displacement of people and workers, impacting critical habitats and protected environmental areas, etc.), it should also seek the best feasible environmentally and socially sustainable option. Suppose such improvement measures lead to limited adverse impacts. In that case, these potential impacts should be highlighted in the WUD guidelines with the appropriate mitigation measures recommended as per the World Bank safeguards policies.
- The Guideline will propose a monitoring and ex-post evaluation system to ensure the continuity and expansion of the outcomes of NRW projects.

3.1 Task 1: Diagnosis of the Current Situation

3.1.1 Current Status Assessment

The current status of the municipal water supply systems in the selected municipality shall be assessed within the context of physical (real) losses, administrative (apparent) losses and

³ For details please visit: <https://www.worldbank.org/en/projects-operations/environmental-and-social-framework>

water system management to make an action plan for reduction of non-revenue water and to improve municipal water use efficiency.

The consultant shall review the Municipality's existing "Standard Water Balance Sheet" before the site survey. The Consultant will also review any previous studies conducted by the WUD for NRW reduction.

3.1.2 Selection of the Study Areas

To collect actual data for NRW, the Consultant shall prepare selection criteria for selecting representative DMA and/or PMA in close communication with the selected WUD, as defined section 3. for a site study. DMA, which is a separated independent network, allows detecting and monitoring possible leakages within its boundaries. It is a well-known and extensively used system to decrease physical losses in water networks. These establishments are guiding to comprehend water consumption and water losses in a network.

The. The Selection process shall be based on these approved selection criteria. DMAs and PMAs are one of the most advantageous and significant ways to reduce leakage in the water supply systems.

The current municipal water system of the study area must be determined to understand the sources of non-revenue water. The diagnosis of the municipal water system of the selected study area shall cover as many water supply system components as possible. The selection shall be carried out together with the WUD and ILBANK. The site survey shall be carried out in a survey area minimum of 2 months. The WUD shall allocate adequate personnel to prevent service interruption during the site survey.

3.1.3 Determination of Current Water Balances in Selected DMAs

Before the site survey, the WUD supplies the following data to the Consultant for an efficient survey.

- Number of billed authorized subscribers in the survey area (both metered and unmetered)
- Number of unbilled authorized consumers (both metered and unmetered)
- Water sources and amount of water supplied to the survey area

Furthermore, after the completion of the Consultant's site survey, the WUD will provide the following data on apparent losses:

- Meter error detected in the survey area during the survey period
- Unauthorized consumption detected in the survey area

During the site survey, the Consultant shall carry out on-site control of the flow measurement equipment. Monthly basis, the Consultant site survey record sheets shall be checked with WUD's records (if any).

As a result of the survey, the consultant shall prepare a site survey report including a “Standard Water Balance Sheet” for the selected area. For the selected DMAs, water balance sheets shall be designed to define the sources of NRW.

3.1.4 Performance Assessment of Water Management

The Consultant will compare the existing water balance of the WUD with the water balance they develop under Task 3.1.3 in the evaluation report to be prepared under this task. This report also contains the performance assessment of the WUD regarding the survey studies. To assess the diagnosis of the water sector in the selected DMAs, internationally known efficiency ratios and indexes will be used. This will allow us to compare those calculated values with similar systems at an international level. The water production index, NRW ratios, administrative losses, physical losses shall be calculated. To calculate these ratios and indexes, a comprehensive data collection has to be done with the support of the WUD.

Infrastructure Leakage Index (ILI), a performance indicator recommended by the International Water Association (IWA) and American Water Works Association (AWWA) for comparison of leakage management in water supply systems, will be used to define the physical (real) losses in the selected water systems.

3.2 Task 2: Preparation of a Guideline for WUDs in Turkey

Assisting WUD to prepare its sustainable NRW management strategy is one of the main goals for the Guideline. Therefore, NRW management will be considered in an integrated manner by implementing action plans for each component.

The Guideline will be designed to provide systemic guidelines (in the form of a set of procedures described through flowcharts) that WUD managers can adopt, engineers and operations staff to plan and implement a phased, sustainable NRW program encompassing the full-service area and customer base.

The Guideline shall include the methods for assessing the economic level of losses to identify the target level of NRW for WUDs. To evaluate the overall water supply system of WUD, the NRW target will be set as litre/connection/day. Percentages, however, will be charged to assess the improvements made throughout a step of action.

The Consultant will therefore determine the steps of actions, prioritizing the goals of combating climate change and achieving the highest social benefit in an environmentally sustainable manner. The Guideline will be prepared so that each step could be implemented as an individual project. Furthermore, the Consultant should work with various technical experts in the WUD, including the environmental engineers, sociologists-if any- to ensure that the proposed measures in the NRW guidelines for WUD do not lead to any adverse environmental and social impact and do not deteriorate the social equity of the water consumers, as well as the real estate and expropriation offices of the WUD in case the proposed physical intervention may require any land acquisition or not.

The Consultant shall have a holistic perspective and be cognizant of the requirement for cost-effective projects, sustainability of project and resources, financial viability and sustainability, operational economy and simplicity, most comprehensive possible coverage, health-improving schemes, and other considerations for the options analysis or value engineering (VE)/ value analysis (VA).

The NRW reduction activities in the guideline document will be clearly defined in the quick action, annual and multiyear action plans. Performance indicators and the monitoring methods for WUD will be clearly defined. Guideline and sample calculations should be provided for measuring the expected benefits of NRW interventions.

The Guideline shall also state the road map for WUD for information management, including implementing geographic information management systems introducing real-time management components.

The Guideline will serve all WUDs in Turkey regarding the different requirements.

Minimum three workshops shall be organized in the scope of work with the participation of related stakeholders. Workshops might be held virtually or hybrid method in line with the Covid-19 restrictions. Current methods, goals, structural and non-structural measures of NRW and its components in the service area of WUDs will be discussed in these workshops. These workshops will also serve to exchange information and knowledge with the Consultant's expert. There shall be 3 sample case studies presented in these workshops with detailed guidance on methodologies followed and results achieved elsewhere. These case studies shall be included in the Guideline as boxes and annexes. The outputs of the workshops shall be integrated into the Guideline. Participants will be selected from decision-makers and key technical staff in WUD. Participant list and schedule of workshops will be worked on with the ILBANK, and approval will be obtained.

While preparing the guideline document, the Consultant shall assess the best practice studies-including the GIIPs- in countries similar to the administrative structure in water management and financial structure.

The Guideline shall include the methods and action plans for the establishment of the following management systems regarding the statements given above;

- Asset Management System: The most cost-effective way of asset management for sustainable NRW management shall be proposed in the guidelines.
- Pressure Management: The establishment of PMAs ensuring optimum pressures to the distribution network homogenously shall be assessed by the Consultant as an action of the Guideline.
- Network and Pressure Management System: The Consultant shall assess DMAs and/or PMAs formation as a Guideline action.

- Performance Assessment System: All indicators shall be determined in the Guideline for both financial and operational performance assessments
- Management Information System: Recommendations for digital applications for customer engagement, leak detection, pressure management, energy-efficient pumping, energy management, and wastewater treatment shall be given in the Guideline. The digital transformation of resource-efficient water management shall be assessed in terms of challenges and opportunities.
- Active NRW Management System: The Guideline shall explain the process for preparing a Standard Water Balance based on the outputs of Task 1. The Active NRW Management system shall include the methods and recommendations for all components of NRW. For the current water balance sheet control work described in Task 1, the Consultant will identify the problems on the site and develop suggestions for the Guideline, taking into account international standards. (Including leakage monitoring and sustainable leakage repair, water reservoirs monitoring with appropriate water level indicators, overflows at reservoirs due to lack of controls, testing and calibrating production and district meters, testing customer meters, reduction of unauthorized consumption, managing authorized unmetered consumption, reducing data handling errors, description of the appropriate meter type and class, improvement of the quality of materials, installations and repairs etc.)
- Financial Management System: (including collection efficiency and debt management (Although the collection efficiency is not part of the IWA definition of NRW, it is a crucial issue to consider when implementing an NRW strategy as cash always counts.)
- Monitoring and Ex-post Evaluation System: The Guideline will propose a monitoring and ex-post evaluation mechanism for non-revenue water projects, including state of the utilization of the technologies and techniques introduced by the project, the sustainability of the activities carried out in the project, and any ripple effects (impacts) such as expansion and development of the activities after completion of the project.
- The Guideline will present and communicate the positive impacts of NRW projects of municipalities in combating climate change.

As mentioned earlier, water is a public good and given that the tasks defined here may have social and economic implications in the broader public (all water users), proposing measures to reduce the NRW not only requires financial and technical viability but also has to take environmental and social impact considerations. The Consultant would adhere to both the national legislations and the World Bank environmental and social safeguards policies to ensure that the proposed technical, administrative and/or physical measures are set in an environmentally sustainable and equitable and inclusive manner. The Guideline will cover the technical and administrative measures, including possible difficulties in implementation,

and how WUD will be overcome. These target focused measures will describe (but are not limited to) the following intervention actions;

- Rehabilitation of networks,
- reorganization of water meter reading, application stages for remote reading and control
- installation of temporary flowmeters on network and water meters to subscribers, evaluation of short-medium and long-term results with indicators
- Developing the strategy to reduce illegal connections such as set special tariffs for poorer households, GIS based maps, step testing etc.
- Mechanisms for monitoring performance, including data for setting baselines, targets, cost-estimates

Any of the interventions mentioned above that may lead to civil works would be proposed with the relevant environmental and social risk management measures in line with the national legislative framework and the World Bank environmental and social safeguards policies and standards.

4 IMPLEMENTATION ARRANGEMENTS AND DELIVERABLES

4.1 Deliverables and Payment Schedule

The Consultant shall prepare and submit to ILBANK (referred to as "Client") the following documents and reports:

No	Outputs	Time Due
1	Inception Report and the first workshop	1st month
2	Diagnosis Report for Selected Municipality for NRW and second workshop	6th month
3	Draft NRW Management Guideline and third workshop	7th month
4	Final NRW Management Guideline	8th month

4.2 Implementation arrangements

The total duration of the Project preparation shall not exceed eight months. The Consultant will provide all necessary equipment (including hardware, software, office equipment, and vehicles) required to deliver the services. The Client will provide to the Consultant all available relevant information at no cost. All documentation will remain the property of the Client after completion of the assignment. The Consultant will not dispose of, publish, or use

this document without the Client's written consent. Consultants are reminded that communication with Municipalities/Utilities will be in Turkish. Therefore, the Consultant shall hire respectively qualified experts to carry out the tasks mentioned above and provide interpretation and translation services, as required, which must be covered by the contract price. The reports will be submitted in two languages (Turkish and English).

5 ROLES AND RESPONSIBILITIES

ILBANK has set a Project Management Unit (PMU) within its International Relations Department, responsible for the program's operation at the central level. PMU is the primary unit in charge of the overall coordination and implementation of the Program. A department head and unit managers lead the PMU, and it has staff capacity in business development, contract management, financial management and technical management, including environmental and social risk management.

The Project Management Unit (PMU) and related technical departments at ILBANK, such as the Department of Project, will oversee the work progress and quality of the consultant's deliverables. PMU will ensure coordination between the Consultant, WB and Metropolitan Municipality/Utility while preparing reports and conducting project activities, including field visits. The Contract will be signed between ILBANK (referred to as "Client") and the Consultant, and payments to the consultant will be made upon Consultant's submission of deliverables and approval of ILBANK.

Selected municipality/utility ("Beneficiary") will designate a contact person/unit for the assigned activities. This unit will secure coordination within the municipality and facilitate the contacts of the Consultant with appropriate local organizations. Municipality will provide access to all available related documents, plans, drawings, data and other kinds of information necessary to carry out the Consultant's assignment.

The Consultant will be responsible for debriefing to the Municipality/Utility and ILBANK. The Consultant team will debrief and consult with the Municipality's/WUD's team on the progress every two weeks and flag any problems promptly. The Consultant will be in charge of documenting, keeping a record of activities and meetings and preparing minutes/notes after each meeting and field visit with the decisions made and suggestions. Depending on the need, the Consultant shall compensate any translation, including simultaneous translation, interpreter and translation of documents. The Consultant will also be responsible for considering and integrating the relevant World Bank environmental and social safeguard Policies into the deliverables and guidelines for the WUD during the assignment. It is recommended that the Consultant also hires an environmental and social key expert who is experienced in water use schemes and NRW issues to ensure that the proposed measures are environmentally and socially sound and consistent with the relevant national legislative framework and World Bank environmental and social safeguards policies. All field visits will be planned and realized in consultation with the ILBANK PMU.

The Consultant has a general obligation to be responsible for the safety of all its operations and activities and holds specific health, safety and environmental and social obligations under Covid-19 conditions.

6 REPORTING AND PROCEDURE FOR REVIEWING OF THE REPORTS

The Consultant shall report to the PMU at ILBANK. All deliverables will be submitted to ILBANK both in hard copy and electronic version in Turkish and in English (2 Turkish and 2 English hard copies as well as electronic copies in word and pdf format in two separate flash memory sticks). In the case of any discrepancies, the English version will prevail.

As this assignment is financed from grant funding provided under the European Union Instrument for Pre-Accession, the Consultant shall follow all necessary visibility rules defined by the European Commission.

After the approval of the draft, the final version of all deliverables shall satisfy proper editing and graphic design standards following the visibility rules of the project. All documents collected and prepared during/for the field studies conducted as part of the project will also be submitted to ILBANK.

7 Consultant's Staffing and Qualifications

Alternative professional staff shall not be proposed, and only one in curriculum vitae (CV) may be submitted for each position. All experts who have a crucial role in implementing the contract are referred to as key experts.

The consulting team members must demonstrate strong skills in surveys, data collection, doing technical and financial analysis.

The Consultant's team shall include at least the following qualified staff and other professionals who are competent to carry out the duties described within this ToR:

The Consultant will make available the following Key experts:

1. Team Leader / Project Manager
2. Financial Expert/Economist
3. Infrastructure/NRW Expert

The number of the staff mentioned above will be determined by the Consultant Firm and approved by ILBANK to comply with the strict duration limitation of the contract. The consultant is free to propose additional professional experts (such as environmental engineers and social sustainability experts) as deemed necessary to complete the assignment successfully. The Consultant shall provide adequate staff in terms of expertise and time allocation and needed equipment to complete the activities required under the scope of work and finally achieve the project's objectives in terms of time, costs, and quality.

The team leader and the other key experts co-operate with the other consultants and join the meetings whenever required by the Client.

The Consultant's team shall at least have the following experience and qualifications requirements:

Key Expert 1- Team Leader / Project Manager

The team leader/project manager is responsible for the overall quality of the assignment, deliverables, training and consultant contributions, in addition to contract coordination and quality control of contract implementation. S/he will ensure that the engagement of experts is agreed with the Client and that they are engaged on time to deliver the project outputs.

Qualification and Skills

- University Degree in Engineering,
- Excellent knowledge of the English language,

General Professional Experience

- At least 15 of years professional experience in the water sector, preferably with at least five years of international experience.
- Experience as (Deputy) Team Leader/(Deputy) Project Manager minimum in 2 Water Contracts,

Specific Professional Experience

- Experience of 10 years in subjects related to water supply systems, NRW reduction and control, urban water management, operation & maintenance of water supply systems,
- Experience in delivering training, courses or workshops in non-revenue water (NRW) management in water systems contracts in water utilities is an asset.

Key Expert 2- Financial Expert/ Economist

Qualification and Skills

- University Degree in Economics, and Finance or related field,
- Excellent knowledge of the English language,

General Professional Experience

- At least 15 years of professional experience,

Specific Professional Experience

- At least ten years of experience in Municipal Finance and Accounts and knowing economic analysis of urban infrastructure assignments, particularly in tariff analysis of urban infrastructure assessment,

- At least two projects proving the successful experience in collaboration with municipalities and international financial institutions,
- Experience in environment and energy economics would be an asset.
- International experience is an asset.

Key Expert 3- Infrastructure Expert

Qualification and Skills

- University degree in Environmental or Civil Engineering. If having a university diploma other than these requested departments, relevant experience of 10 years would be needed.
- Excellent knowledge of the English language.
- Good knowledge of water network hydraulic and hydraulic modelling programs.

General Professional Experience

- Minimum 10 years of professional experience in the water sector. International experience would be preferred

Specific Professional Experience

- Professional experience at least five years in NRW reduction, control and management, development and analysis of technical surveys, hydraulic analysis and diagnostics of water supply systems,
- Experience in feasibility study, design, design review or validation of at least 3 Water Projects.
- Have a good knowledge of requirements experience in the projects carried on as per Turkish legislation concerning designs, construction, and engineering.

Non-Key Experts

Pool of experts

- a) GIS Expert
- b) Mechanical engineer/Energy Efficiency expert
- c) Environmental engineer/specialist
- d) Social sustainability specialist/sociologist
- e) Other (secretary, translator, interpreter, accountant, document controller etc.)

Other experts, support staff & backstopping

CVs for other experts' will also be submitted in the technical proposal; however, the technical evaluation will be conducted based on the qualification of the key experts. The selection procedures used by the Consultant to select these other experts shall be transparent. They shall be based on pre-defined criteria, including professional qualifications, language skills and work experience.

All experts shall have as a minimum requirement a university degree, at least five (5) years' work experience, be fluent in English, and have proven experience in the field(s) relevant for their specific projects and work experience in Turkey will be an asset.

Costs for backstopping and support staff, as needed, are considered to be included in the financial offer of the consultant. In addition, the Consultant shall provide the adequate administrative staff required to support the expert team to assure the quality of all its activities and outputs.

Consultants are reminded that communication with local Municipalities/Utilities will be in Turkish. Therefore, if necessary, the Consultant has to hire respectively qualified experts or provide interpretation and translation services covered in another "pool of experts" item by the contract price.

8 Duration of the Assignment

The estimated duration of the assignment is 8 (eight) calendar months. The Consultant shall submit all the studies promptly to complete the services on time without any delay.