SECOND NATIONAL URBAN WATER SECTOR REFORM PROJECT
(Cr 40860)

TERMS OF REFERENCE


(LSWC/2NUWSRP/CON/86)

February 2017
1.0 **Background**

1.1 The Lagos State Government of Nigeria has obtained an IDA credit for financing the Second National Urban Water Sector Reform Project (2NUWSRP) for the improvement and reform of the Water Supply Services in the state. Additional financing to support the realization of the credit objectives has also been obtained from the French Development Agency (AFD). Part of the AFD credit is to be applied towards Consultancy Services for Development of Electronic Lagos Water Assets Management System that will be mapped in a Geographical Information System (GIS) to improve operational efficiency and management of Water Supply system (source to tap) and ancillary facilities.

1.2 Lagos is Nigeria’s economic and commercial nerve center with a population of over 20 million people and projected to be the 3rd largest megacity in the world over the next decade. LWC, the Agency of the State Government, responsible for the provision of potable water supply in the State has an installed production capacity of 210MGD (Million Gallons per Day). The three major surface water treatment plants of Adiyan, Iju and Isashi have a combined production capacity of 119mgd with the balance from ground water treatment plants – mini and micro waterworks. The total installed capacity can only meet 40% of the current water demand. This is also underscored by a limited distribution network of about 2700km within Lagos State.

1.3 **Network Management**

LWC has a Distribution department saddled with the responsibility of operation, management and extension of LWC’s water network. Lagos Water Corporation operates a decentralized management system in which Lagos is divided into 8 Business Regions and 31 zonal offices. Each Region is headed by a Regional Business Manager who has high degree of autonomy to manage distribution activities in his Region except the primary network passing through his Region. He is also assisted by Area Distribution and Zonal Distribution. This arrangement ensures a uniform spread of LWC’s activities all over Lagos Metropolis.

As regards mapping and use of maps, the distribution units at the Zones come to the Distribution department at the head office for zonal maps whenever there is a need to make reference to the network map in the affected zone and return the maps to the Headquarters after completion of the work. However, some zonal distribution units have their own paper maps which are not geo-referenced and have continually improved upon over years by regular manual updates from as-built drawings and feedback from distribution activities and various interventions (leakage repair, network extensions etc.). Data from these interventions including drawings have been fragmented leading to inadequate and incorrect maps which have made accurate location of network infrastructure difficult and or impossible in some cases.

In 2012, LWC created a Network intelligence unit whose responsibility is to carry out surveillance on the network, respond to and quickly address leaks, analyze and study consumption patterns as well as utilize the data from LWC’s pilot Telemetry Scheme which has been scheduled for overhaul. The unit will manage the proposed LWC’s GIS center to be created in this assignment and ensure that maps are obtained and used in a coordinated manner. The Consultant will work in close contact with this unit, Distribution and IT departments for capacity building and hands-on experience prior to taking over of the project upon completion.

1.4 **Available Software and hardware**
LWC has no available AutoCAD software. However, distribution department has 5 computer workstations while the Network Intelligence Unit has a drawing office fitted with 1No. Plotter. There is currently no server for GIS, AutoCAD or Asset management. In 2012, Lagos State Government launched a GIS for Lagos State which has a layer comprising locations of water supply facilities with Input maps provided by Lagos Water Corporation. Recent consultations at the Lagos State Ministry of Science and Technology has shown that LWC will only access the GIS through the internet which may come with some bureaucratic restrictions. Also LWC will incur internet connection costs to access the GIS when it is available for use in the 3rd Quarter of 2017. This will put restrictions on LWC’s usage of the GIS and provide no opportunity for Capacity building of LWC Staff. Hence the need to build a dedicated GIS under LWC control.

1.5 Asset Management at LWC

Entities in the private and public sector are required to accurately reflect in their financial statements the status of assets under their control (in the form of an asset register), and the requirements laid down are becoming increasingly stringent as there is more focus on optimizing operations and maintenance to extend service life of Assets.

LWC has an existing Fixed Asset register which is in hardcopies. Although updates to the register are carried out during the regular Financial Audits, the register is only updated to provide mainly financial data. There is less focus on operational use in terms of monitoring and asset assessment for maintenance and replacement. There is a need to setup an Asset Management system which will aid the formulation of maintenance and rehabilitation plans towards minimizing the costs of asset ownership; Maintaining required service levels and sustaining the infrastructure.

2.0 Overall Goals / Objectives

Asset Management best practices require utilities to undertake asset hierarchies and compensation structures studies; Asset verification and establishment of infrastructure inventory; Determination of useful lives and residual values; Servitude and deed searches; Condition assessment of infrastructure, failure mode analysis and risk profiling; Asset valuation and International Financial Reporting Standards (IFRS), and then produce Generally Recognized Accounting Practice (GRAP) /Generally Accepted Accounting Principles (GAAP) compliant asset registers.

The services to be engaged will establish a complete and up-to date record of relevant data on LWC properties, plant and equipment and then develop an Electronic Assets Management System integrated with a GIS platform capturing key LWC water assets including main trunk lines and ancillary infrastructures (3 major water treatment including intake plants). The main purpose of the maps will be mainly for inventory and maintenance planning. Also to be mapped and geo-referenced are the 48 other small treatment plants of 1-4mgd capacities). With a proper GIS and Asset management system in place, LWC’s supply services infrastructure can be better managed and maintained.
2.1 **Specific Objectives**

The objectives of the assignment are as follows:

- Develop and manage the creation of an Asset Management System. Under this aspect of the assignment, the Consultant will identify and locate selected LWC assets; assess their current state and identify any asset remedial requirements, and define the required maintenance to ensure that the assets perform optimally in line with the overall goals and objectives in para. 2.0. The System will also enable Asset monitoring and maintenance planning.

- Develop and manage the creation of the Lagos Water GIS at the LWC Headquarters. This GIS will provide accurate geo-referenced LWC assets information which will enable proper location of assets, maintenance and operations planning.

- Build in-house capacity by providing detailed hands-on and classroom training to LWC staff. This will ensure that LWC staff can continue operation and maintenance of the installed GIS and Asset management system to ensure continuous updates and capturing new Asset extensions and improvements beyond the project duration.

This asset management system will be integrated into the GIS that will enable LWC Capture, analyze, and display assets and their locations and support a robust ordered maintenance structure. This will improve operational efficiency and management of Water Supply Assets.

3.0 **Scope of Consulting Services**

The services to be provided shall be as follows:

3.1 **Asset Management**

The Consultant will be required to perform the following:

3.1.1 **Asset Assessment, Valuation and Register Development**

a. Review LWC’s current fixed and moveable assets register and prepare an updated asset inventory at each location, develop an updated Asset Register in an adequate software (to be provided by the consultancy), and label all assets inventoried.

b. Prepare a system’s map locating all assets identified.

c. Develop a condition assessment and rating system.

d. Assess remaining useful life by consulting projected-useful-life tables or decay curves.

e. Determine asset values and replacement costs; and arrive at the total assets value of the Corporation. (identify assets utilized by the system but not owned by the utility)

f. Identify redundant/unneeded assets and quantify its commercial value.

In considering depreciation, the Consultant shall allow for multiple depreciation methods and factors, such as Straight Line, Sum-of-the-years-digits, Declining the Balance, Current Cost Depreciation.

3.1.2 **Asset Management - Condition Assessment & Evaluation**

This involves the capture of data from condition assessment surveys and the assessment of the condition of the assets.
a. List assets according to how critical they are to system operations.
b. Conduct a failure analysis (root cause analysis, failure mode analysis) for assets considered critical.
c. Determine the probability of failure and list critical assets by failure type.
d. Analyze failure risk of critical assets and consequences.
e. Prepare critical assets decay curves.
f. Prepare a system’s vulnerability assessment.

3.1.3 Asset Management – Financial Asset Valuation
The main purpose of financial valuation is to be able to determine the Replacement Costs & remaining useful life to be used for maintenance & rehabilitation planning; Financial reporting for Balance sheet purposes; and Satisfying regulatory requirements as required by authorities. The financial valuation should include: multiple costs, removal & purchasing costs and market and residual values and results should be presented in a comprehensive manner. Drill down templates for evaluation of Compound Assets and valuation info per component should exist. The Consultant shall therefore:

a. Prepare the costs and benefits of rehabilitation (on-time maintenance) versus replacement (reactive maintenance) for each of the assets identified as critical.
b. Identify the budget required to operate and maintain (replace) the system (current and expanded once the project is implemented)
c. Propose a fund for managing the O&M resources and establish how that fund could work

3.1.4 Long-term Funding Plan and Asset Management Planning
a. Develop World-class asset management plan to establish a long-term vision of infrastructure needs of LWC that will support service delivery. Highlighting risk and the financial and institutional implications.
b. Develop an Assets management Policy for the Corporation including assets maintenance, repair renewal and upgrade guidance; and advice on legislative and other developments.
c. Install and implement a commercial assets management system capable of being adapted to LWC’s capacity and practices.
d. Prepare a maintenance plan (for at least the agreed critical assets) to move from reactive maintenance to predictive maintenance. The plan should include:
   i. A descriptive title for each maintenance task to be performed
   ii. A frequency assigned for performing of each task
   iii. Assignment of a specific craft or workgroup and the number of each craft or workgroup required to perform the task
   iv. Equipment condition required for performance of the task (i.e. running or shut down)
   v. Type of Work – Preventive Maintenance (PM), Predictive Maintenance (PdM), Corrective Maintenance (CM), Situational Maintenance (SIT), etc.
   vi. Estimated time and cost to perform the task
   vii. Special tools, materials and equipment
   viii. Define what maintenance capacity, organization, skills, staff, equipment, etc, is required to carry out properly the proposed maintenance plan

e. Provide training and capacity building for staff on the asset management Policy and the assets management system including how to create and use Work Order task.
f. Test run the system together with the staff of the Corporation for an agreed period of time enough to transfer adequate knowledge.

3.1.5 Maintenance management services
Prepare a management framework for maintenance of the assets that is consistent with the organizational objectives. The framework shall demonstrate commitment at policy level to maintenance philosophies; resourcing principles; strategy development, decision-making based on relevant data and appropriate support systems; and, at operational level, to tasks, frequencies and resourcing arrangements. Accordingly, the Consultant shall prepare using participatory approach:
   i. Maintenance management policies
   ii. Maintenance management strategies
   iii. Maintenance management plans
   iv. Maintenance budget needs

3.1.6 Data Required
Specific Data to be captured for each individual asset will be in-line with the LWC asset register and include the following
a) Location of the asset, GPS coordinates
b) Asset name,
c) Asset description,
d) Date of purchase,
e) Age,
f) Maintenance schedule,
g) History of repairs,
h) Condition,
i) Asset Owner department, unit or (and ) Section

3.1.7 Categories of Assets to be Included in the Asset Management System
The Asset management System will capture the following classes of LWC Assets
a) All Sites and Buildings Owned by LWC
b) All major Fixed Items of Equipment used for Water or Waste Processes on these Sites
c) Water network Infrastructure (At least the Main trunk lines, meters, valves and meters etc.)
d) Vehicles
e) Portable Lifting or Safety Equipment
f) Portable Electrical Appliances, Power Generators
g) Non-Process items, e.g. Furniture and Fittings, IT Equipment
h) Each asset will be given a unique identification code to be placed on the asset.

3.1.8 Training and Reporting
a) Provide training and capacity building for staff on the asset management Policy and the assets management system
b) Test run the system together with the staff of the Corporation for an agreed period of time enough to transfer adequate knowledge
3.2 Geographical Information System (GIS)

3.2.1 Infrastructure and Equipment Installation
As part of the requirements under this service, the Consultant will be required to review LWC’s current IT infrastructure at the head office and make provision for design, procurement (preferably from local dealers if available) and installation of equipment required for creation of a GIS data center which may include but not limited to the following components:

a) 1 Server installed with latest ArcGIS Software of appropriate specifications in line with GIS Software minimum hardware specification at http://server.arcgis.com/en/server/latest/install/windows/arcgis-for-server-system-requirements.htm and in addition to other imaging, document processing and production software. The Server will utilize RAID technology which uses multiple physical disk drive components into a single logical unit for the purposes of data redundancy and performance improvement. This will ensure there is a fail over (online back-up) in case of hard disk failure.

Specific Software that may be required include:
- ArcGIS Server Advanced Edition 1 unit
- ArcGIS Desktop Advanced 1 license
- ArcGIS Desktop Standard 4 licenses
- AutoCAD Map 3D 5 licenses
- Internet Security and Antivirus 5 licenses
- ArcPad Software 5 licenses
- Windows Server 2012 R2 Standard and Datacenter 1 license

The software above will be used to operate, update and run the GIS.

(d) One (1) server above will also be installed with a Water Supply Assets Management Software which will enable data inputs/outputs, standing alone and integrated with the GIS

(e) 5 No. GIS Workstations installed with AUTOCA D software for generating sketches and maps

(f) 5 External Drives (1TB) for added Storage and backup of GIS system

(g) 20 Hand-held GPS data collection devices for field collection of data

(h) 20KVA Uninterruptible power supply to boost power supply at the Data center

(i) 20 Electronic Android Tablets with not less than 9” Screen Size, 1GB RAM or more, 12GB ROM or more, Rear Camera, Android version 5.1 or higher, support 3G or 4G SIM card, wifi with rugged full body casing for mobile field regional staff for field information gathering and update after the handover of the GIS system to LWC

3.2.2 GIS Development and Integration with Asset Management
After installation of all required GIS software, the Consultant will proceed to acquire and upload LWC’s assets and network data in line with the following step:

a) Acquire base map (at the Consultant’s cost)

b) Digitize Existing paper maps available at LWC Distribution department and perform verification on the field.

The paper maps will be digitized according to the following layers:

i. Major Treatment Plants (IjuAdiya n, Isashi and Ottalkosi)

ii. Mini/Micro Treatment Plants
iii. Primary Mains + appurtenances
iv. Secondary and tertiary mains only in Lagos LWC North East Region - Ikeja and Oshodi which is bounded on the east by Apapa –Oshodi expressway, on the West by Ikorodu Road and on the North by Lagos Ibadan Express way).

c) The Consultant will install and configure an asset management system that could stand alone and also linked to the created GIS system. The Asset Management System will enable LWC to:
   i. Capture, analyze, and display assets and locations, from a geospatial perspective on the GIS platform
   ii. View assets in proximity and context to other spatial features like roads and popular landmarks
   iii. Track linear assets such as plants, offices, pipelines, fire hydrants, valves and similar assets
   iv. Identify features and configurations between linear asset sections
   v. Identify the location where one linear asset is paired with another
   vi. Include signage and other physical features and their location
   vii. Include a robust process of Work Ordering which guides the process of repair, replacement and maintenance of individual Assets. This system will also enable work cost and quantitely estimation. Work orders can be created manually (by authorized staff) or by the Asset Management System (e.g. Scheduled Maintenance). The Work order creation process will enable provision of all required information (owner/dept., asset involved, equipment history, risk assessment, replacement details, reasons for failure etc.)

d) Capacity Building
The consultant will also be required to provide capacity building and specialized training to support the management and continued operation of the GIS center beyond the contract period according to the following
   o Training on how to digitalize maps in GIS
   o Training on how to digitalize maps on AutoCAD
   o Demonstration of how to Update a GIS and geo-locate water infrastructure in Ikeja zone
   o Training on how to Utilize GIS for daily operations of LWC

The exercise will provide hands-on training on how to gather network information and translate to a GIS as well as how to verify and correct map data in a GIS. The training will involve locating and geo-referencing the Lagos Water Distribution network infrastructure in the Lagos LWC North East Region. The activity in Para 3.2.2, b (iv) will be used to carry out this training exercise.

4.0 Expected Outputs/ Deliverables

4.1.1 Systems
A fully functional Asset Management Software loaded with captured LWC assets and integrated with the GIS. The details of the assets can be accessed through the software (without the GIS) and from the GIS i.e. clicking on an asset in the GIS will display the asset details (age, name, description, etc. as required) and display a link to the Asset management software for further information or input.
The above software systems will be housed in an adequately setup GIS / digital mapping center-space to be provided by LWC

4.2 Reporting

4.2.1 Inception Report

The Consultant will be required to submit an inception report within **two (2) weeks** of contract award, detailing plans to carry out the assignment including illustrations and detailed, realistic and timed work plans.

4.2.2 Survey Report

The Consultant will be required to submit a report after conducting the initial project area survey within **One (1) week** after conducting the study and within **two (2) weeks** after the Inception report, detailing findings from the survey and particularly highlighting issues that may affect project delivery.

Two sections will be required in the document,
- **Section 1 – GIS**
  This will contain Specific design of the GIS software, hardware and data center including findings from the survey and particularly highlighting issues that may affect project delivery
- **Section 2 – Asset Management**
  This will contain the Consultant’s findings on the Current Assets management system after his review and highlighting issues that may affect project delivery.
  Details of the Asset Management Software to be deployed should also be included.

4.2.3 Specialized Training

Within **twenty two (22) weeks** of contract award or after the completion of all Installations, the consultant will be required to design and implement a specialized training for not less than 20 LWC staff in line with the project objective. The details of the training will be designed in line with requirements in Para. 3.1.8 and 3.2.2(d). This is in addition to the hands-on trainings that will be ongoing throughout the period of the assignment. Hard and softcopies of all training materials, product manuals, software manuals etc. will be submitted along with this deliverable.

4.2.4 Asset Management Report

After the upload of verified field data into the Asset Management System (at **25 weeks** of contract award), The Consultant will provide a report detailing methodology adopted, analyses and current Assets captured and integrated into the Asset management System. The Report will also show all characteristics of each asset that was captured including age, cost etc. The Report will also include the gaps identified between the current assets state and optimal state. The report should also propose detailed actionable implementable recommendations that shall allow for the achievement of the optimal state of the assets. This report will also be accompanied with the Asset Management Policy, Asset Management Plan, details of Asset
management software system installed, operating procedures and address all the requirements under para 3.1.

4.2.5 Draft Final Report
The draft final report is required to be submitted within twenty five (27) weeks of contract award and expected to describe how the project has been carried out inline with the objective and scope of work specifically addressed under the subheadings in line with paras 2.1 and 3.0
The report shall be comprehensive enough covering the whole exercise(s) and shall describe the achievement to date in respect of all scheduled activities and deliverables of the service(s). The report should reasonably contain necessary documentary evidences supporting positions in the report, as well as observations, conclusion and recommendations related to the service(s) objectives. The client shall review the draft report in a timely manner to include deliverable(s) outcome and if there are any review comment, it would be passed to the consultant(s) within 2 weeks of receipt of the draft to be incorporated into the final report.

4.2.6 Final /Close out Report
After comments and reviews by all the stakeholders, the Consultant will be required to incorporate these comments as provided into a final report that should be submitted within two (2) weeks from date of receipt of comments from LWC.
The final report will contain a narrative of all that has been achieved on the project. It will describe all actions taken to achieve each deliverable, devices installed, with pictures and any supporting document. It will also include all the names and designations of all LWC staff and outside stakeholders who contributed or worked on the project. Challenges, constraints and problems faced on the assignment will be highlighted including how they were resolved. Suggestions, recommendations and probable solutions to the Corporation against problems identified during the project.

All deliverables will be provided in 5 copies (5 hard copies and 5 electronic CD copies).

5.0 Time Frame
It is expected that the Consulting firm will apply its best effort in completing the project according to the schedule below or less.

<table>
<thead>
<tr>
<th>S/n</th>
<th>Items</th>
<th>Duration (Weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preliminary survey</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Procurement and Control center setup</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>GIS and Asset Management software installation, integration, Interphase design and configuration</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Asset Data update, and map digitalization</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Field data collection (GIS and Asset) + Hands-on Training</td>
<td>8</td>
</tr>
</tbody>
</table>
Qualifications and Requirements of Consulting Firms
The Consulting firm is expected to be experienced in developing and deploying GIS and Asset management Systems within the past 10yrs and have the following key staff:

I. Project Manager – Team leader

Tasks
To lead overall project preparation, project management, formulate and initiate project documentation and be responsible for the overall coordination and execution of the assignment to international best practice standards

Qualifications
The Team leader must possess at least a Master’s degree in Engineering/ Management with over 10 years of experience, particularly with 7 years experience in Water Supply projects or management in developing countries. He must also be familiar with technical, financial and risk aspects of project management. Good knowledge of Government Instructional structures and ability to coordinate and deliver infrastructure projects. Membership of professional bodies may be an advantage.

II Water Distribution Network Specialist

Tasks
The Water distribution expert will be required to provide inputs into the assignment as regards location and physical identification of the Lagos Water network infrastructure.

Qualifications
He must possess at least a first degree in Civil/Hydraulic Engineering with at least 10 years general experience, particularly with 7 years in Water Supply Distribution Networks Infrastructure.

III GIS Expert

Tasks
The GIS Expert will be required to perform all the required GIS related aspects of the assignment including the training and setting-up of all necessary GIS equipment at the Data centre according to international best practice standards

Qualifications
The expert must possess at least a 1st degree in a relevant field and an advanced degree/Certification in GIS. He must also possess at least seven (7) years cognate experience, five (5) of which must have been devoted specifically to designing, deploying and working with GIS Systems.
III  Asset Management Expert

Tasks
The Asset Management Expert will be required to perform all the required Asset management related aspects of the assignment including supporting data capture, training and ensuring there is a smooth integration of LWC Assets into the new GIS according to international best practice standards.

Qualifications
Asset Management Expert/Evaluator with experience in assessing and evaluating asset conditions in the in water utilities with a minimum of five (5) years of similar experience. A Master degree in Facility Management will be an added advantage.

IV  AUTOCAD Expert

Tasks
The AUTOCAD expert will be required to plot, transfer, prepare and produce all digitized maps/sketches according to requirements.

Qualifications
The expert must possess at least 1st degree in a relevant field and or an advanced degree/certification in AUTOCAD. He is also required to possess at least 5 years general experience, particularly with 3 years’ experience in Water Supply Projects in Nigeria will provide added value to the assignment.

7.0 Management of the Services
The Services will be carried out under the supervision of LWC Project Implementation unit which will coordinate with the Distribution, Network Intelligence, Production and IT & T departments.

a) Data
LWC will provide available data in Maps and information as required on the project as well as provide access to all LWC sites and formations. However, where information or data is not available, the Consultant will be required to make reasonable efforts to acquire such data or information.

b) Counterpart Assistance
LWC will assign at least 6 Counterpart personnel (including a supervisor) to facilitate the services and access to LSWC formations. These personnel will be drawn from relevant departments of LWC.

c) Support Facilities
It is expected that the Consultant’s financial proposal will include in the minimum, provision for the under listed items as only office space will be provided by LSWC:

- Transportation costs required for the execution of the services;
- Communications costs (Telephones/Fax/E-mail, Courier services etc.)
- Reports, Documents, etc. production costs;
- Preliminary Investigation costs (Provisional) and ground trothing (verification).