Mission 5 – Report

Institutional and Organisational Strengthening of WASCO Saint Lucia and Regional Water Utilities

Saint Lucia

Transaction number: 81225247
Project processing number: 16.2208.3-001

May 2019
| **Title** | Mission 5 Report  
Institutional and Organisational Strengthening of WASCO Saint Lucia and Regional Water Utilities  
Saint Lucia |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date</strong></td>
<td>May 2019</td>
</tr>
</tbody>
</table>
| **Consultant** | JOINT VENTURE  
CONSULAQUA Hamburg Beratungs-GmbH - Como Consult GmbH  
CONSULAQUA Beratungsgesellschaft mbH Hamburg  
Ausschläger Elbdeich 2, D-20539 Hamburg, Germany  
Como Consult GmbH,  
Winterstraße 4-8, D-22765 Hamburg |
| **Contacts for this report** | Cornelis de Jong | Cornelis.deJong@hamburgwasser.de  
Marc Luedtke | Marcluedte@consulaqua.de  
Jan Overbeek | jw.overbeek@gmail.com |
INHALT

List of Abbreviations.................................................................................. iv

1 Introduction .......................................................................................... 5

2 Mission Objectives, Activities and Deliverables ........................................ 5

3 Field of Action 1 - Hydraulic Analysis ....................................................... 6
   3.1 Evaluation of Capacities for ‘Hydraulic Analysis’ at WASCO .................. 6
   3.2 Analysis of Raw Water Transmission Line from JCD to Theobalds WTP (Additional works, not in ToR) .............................................................. 7
   3.3 Hydraulic Analysis of Northern Transport System ................................ 9

4 Core Field 2 – District Metered Areas (DMAs) ........................................... 10
   4.1 Analysis of Status Quo ........................................................................ 10
   4.2 Development of Pilot Zone DMA.......................................................... 10

5 Strategic Issues Water Supply ................................................................... 12

6 Conclusion and Way Forward ................................................................... 12

Annexes ........................................................................................................ 13

Annex 1: ToR for this mission ..................................................................... 13

Annex 2: Agenda of the mission .................................................................. 13

Annex 3: Training on Hydraulic Analysis ...................................................... 13

Annex 4: Draft SOP on ‘DMA Development’ ............................................... 13


Annex 6: Presentation Strategic Issues .......................................................... 13

Annex 7: Pilot Zone Boundary Map .............................................................. 13
## List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAH</td>
<td>CONSULAQUA Hamburg Beratungsgesellschaft mbH</td>
</tr>
<tr>
<td>CAWASA</td>
<td>Caribbean Water &amp; Sewerage Association Inc.</td>
</tr>
<tr>
<td>CIS</td>
<td>Customer Information System</td>
</tr>
<tr>
<td>CSD</td>
<td>Customer Service Department</td>
</tr>
<tr>
<td>Como</td>
<td>Como Consult GmbH</td>
</tr>
<tr>
<td>DN</td>
<td>Nominal Diameter ('Diametre Nominal')</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>GIZ</td>
<td>Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH</td>
</tr>
<tr>
<td>GM</td>
<td>General Manager</td>
</tr>
<tr>
<td>HW</td>
<td>HAMBURG WASSER</td>
</tr>
<tr>
<td>LDU</td>
<td>Leak Detection Unit</td>
</tr>
<tr>
<td>MGD</td>
<td>(imperial) Mega Gallons per day</td>
</tr>
<tr>
<td>MSL</td>
<td>Mean Sea Level</td>
</tr>
<tr>
<td>NA</td>
<td>Network Administrator</td>
</tr>
<tr>
<td>NRW</td>
<td>Non-Revenue Water</td>
</tr>
<tr>
<td>O&amp;M, O+M</td>
<td>Operation and Maintenance</td>
</tr>
<tr>
<td>SCADA</td>
<td>Supervisory Control and Data Acquisition (Program)</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard Operating Procedure(s)</td>
</tr>
<tr>
<td>SPD</td>
<td>Strategic Planning Department</td>
</tr>
<tr>
<td>ToR</td>
<td>Terms of References</td>
</tr>
<tr>
<td>WASCO</td>
<td>Water Supply and Sewerage Company Inc., Saint Lucia</td>
</tr>
<tr>
<td>WOF</td>
<td>Work Order Form</td>
</tr>
<tr>
<td>WSD</td>
<td>Water Services Department</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

This is the fifth mission report of the project “Institutional and Organizational Strengthening of WASCO Saint Lucia and Regional Water Utilities”. The project started on 1st of November 2018, it has a duration of 13 months and is carried out by a joint venture between CONSULAQUA Hamburg, which is a 100% subsidiary of HAMBURG WASSER, public Water Utility of Hamburg, and COMO Consult, both from Germany. The project objectives are depicted in Figure 1.

2 MISSION OBJECTIVES, ACTIVITIES AND DELIVERABLES

A mission was undertaken by the Key Expert C “Hydraulic Modelling”, Mr. Cornelis de Jong and the Water Balance Expert, Mr. Marc Luedtke, from 31st March to 13th April 2019. The mission had the following objectives:

- Strengthen the following capacities within WASCO related to NRW Reduction:
  - Hydraulic analysis for transport and distribution systems
  - Develop, implement and operate DMAs in a sustainable manner
  - Analyse the present and project future hydraulic capacity of the transport line between the junction tank at the John Compton Dam and the Theobalds WTP as well as the northern transmission line between the Theobalds WTP and Cap Estate.
- Prepare SOPs, guidelines and recommendations for improvement. The terms of reference for the mission is attached as “Annex 1: ToR for this mission”.

The agenda for this mission is attached in “Annex 2: Agenda of the mission”. Main activities were

i. site visits and meetings with relevant departments
ii. conduction of one training (‘Hydraulic Analysis of Transport Systems’) and two workshops (‘DMA Development’ and ‘Action Plan for NRW Reduction in Pilot DMA’)
iii. simplified conceptual design for new Raw Water Line from Jon Compton Dam to Theobalts WTP (hydraulic analysis & cost estimation)
iv. Development of a SOP (‘DMA Development’) and an Action Plan (‘NRW reduction’)
3 FIELD OF ACTION 1 - HYDRAULIC ANALYSIS

3.1 EVALUATION OF CAPACITIES FOR ‘HYDRAULIC ANALYSIS’ AT WASCO

The capacities at WASCO on hydraulic analysis and modelling have been analysed during various meetings and a training workshop on the 4th of April with participants from the following departments: Water Services, Strategic Planning, Design and Construction. Details of the Training on Hydraulic Analysis, incl. presentation and exercise, are attached in Annex 3.

The main finding is that much experience exists in the operation of the network systems but hydraulic engineering knowledge, needed for a holistic hydraulic evaluation of networks and optimisation of transport and distribution systems is non-existent at WASCO. The few engineers at WASCO are all in management positions and we therefore strongly recommend strengthening the technical capacity at WASCO by increasing the number of engineers within the company.

In the Strategic Planning Department (SPD), there is specific hydraulic modelling software available (InfoWater) but presently none of the staff is capable of conducting hydraulic modelling tasks. We recommend recruiting and training a hydraulic modelling engineer in this department, as there is a strong linkage between the GIS team and hydraulic modelling.

During discussions with the Water Services Department - Leak Detection Unit (LDU) on the 6th of April, we found that pressure and flow measurements are conducted on a regular basis but there is no link to a hydraulic department/engineer to analyse these data. The responsibilities of the Leak Detection Unit are not limited to detecting leaks, but also include all flow and pressure measurements in the water transmission and distribution networks. We therefore recommend a restructuring of the unit, to adequately address the tasks in an effective manner; this also includes a renaming of the unit into something like: "Network Monitoring and Leak Detection Unit". Further, there seems to be only little communication between the Leak Detection Unit and the GIS Unit, but between the LDU and the Design and Construction Services Department for updating network data.

We recommend that in future the GIS Unit (within Strategic Planning) validates and manages all network data. All information concerning new constructions and changes within the system should be submitted to the GIS Unit to update network information.

Deliverables

Training in Hydraulic Analysis of Transport Systems
3.2 **Analysis of Raw Water Transmission Line from JCD to Theobalds WTP (Additional works, not in TOR)**

The raw water transmission system between the junction tank at the John Compton Dam and the Theobalds WTP has a total length of 15.2 km and consists of two pipe sections, one section DN 600 (24’’) of 5.2 km and a section of ND 800 (32’’) of 10 km.

The DN 600 section of the line (steel without cement lining and without proper outer coating) is in a very poor technical condition (small wall thickness, no inner and outer coating, and many leakages) and this section needs to be replaced. Furthermore, based on the available elevation difference of 53 m and the present diameter, the calculated maximum hydraulic capacity of the gravity transport line is limited to 9.5 MGD (compare Figure 3).

The consultants prepared a hydraulic analysis for 3 options: 1) replacement of the ND 600 line section by a pipe with the same diameter; 2) replacement of the ND 600 line section by a ND 700 pipeline, and 3) replacement of the ND 600 line section by an ND 800 pipeline. The results are summarised in the following graph:
Based on best practice experience, the Consultant estimates all-including pipe costs with roughly $1€/DN/m. Excluding land acquisition, investment costs are calculated to be EC$ 9.5M for a new ND600 line, EC$ 11M for a new ND 700 line and EC$ 12.7M for a new ND 800 line.

We recommend that WASCO should go for the ND 800 transport line for the following reasons:

1. Maximization of hydraulic capacity of the transport line to 14 MGD;
2. Relatively small differences in investment cost compared to ND 700; and
3. Standardization of line using one single diameter ND 800 for easy maintenance and repair.

---

1 Example: supply and installation of 1000m of a DN600 pipe would cost roughly 1000 x 600 = 600,000.00 €
3.3 **Hydraulic Analysis of Northern Transport System**

The water to the northern area is supplied by the Theobalds WTP from where two parallel transport pipes (20” and 14”) go north up to the Choc Tank, feeding Castries and suburbs on the way. After Choc, the rest of the northern area is supplied by a sole 14” pipe up to Cap Estate. This pipe was constructed in the 1970ies and is already **worn out**. Furthermore, its **hydraulic capacity** is assumed to not be sufficient for the projected **future water demand** (horizon 2040).

Therefore, during this mission, it was agreed that the consultants would assist in preparing a **simple hydraulic model** for the northern transport line between the Theobalds WTP and Cap Estate together with the GIS Unit from the Strategic Planning Department (SPD). The objective is to provide recommendations on how to develop the northern transport system, with focus on the ‘Northern Line’ between the Choc Tank and Cap Estate.

The following consecutive steps will be followed:

1. Schematisation of the line in GIS with different relevant sections (SPD)
2. Preparation of a water demand forecast consisting of the following (SPD + CSD):
   - Domestic, commercial/industrial, government, hotels and boats demand
   - Seasonal peak factors
   - Years 2018 – 2025 – 2030 – 2040
3. Nodes will be determined on the following basis (SPD):
   - One reservoir node at Theobalds WTP (104 – 108 maSL)
   - Nodes at change of diameters
   - Nodes at low and high points
   - Nodes at all relevant off-takes along the line
4. Assignment of demand ratio for all nodes in the model (SPD + CSD + Consultant)
   - Determine the percentage of total demand for each node (see 3.)
5. For the pipes the following data will be collected (SPD + WSD):
   - Internal diameter (mm)
   - Length of pipe section (m)
6. Preparation of hydraulic model for 2018 and 2040 water demand (Consultant)
   - Model construction, run and evaluation (Consultant)
4 CORP FIELD 2 – DISTRICT METERED AREAS (DMAS)

4.1 ANALYSIS OF STATUS QUO

According to the ToR the consultant should review WASCO's current practice on DMAs and flow and pressure management and support in development of (further) DMAs and in improved collection, verification and management of measurement data.

The following activities have been carried out in this regard:

- **Interviews** with various departments and units
- **Workshop** on DMA development (with participants from SPD, WSD, DCD, CSD)
- **Workshop** on flow and pressure data handling, with focus on pilot zone DMA (with participants from SPD, WSD, DCD)

It was found, that 10-15 years ago a project had been implemented to create DMAs all over the island. Several DMAs are available ‘on paper’, and regular flow and pressure measurements are taken at various locations by the Leak Detection Unit.

However, at present, it appears that not a single working DMA is in place and regularly monitored. Although various areas are mapped and marked as ‘DMAs’, most of them are probably not completely isolated. Further, many zones do not have bulk meters, or the meters in place are not working. It was also observed in the field, that some crucial bulk meters probably haven’t been read for a long time.

During the workshops it became clear that a general understanding of the concept of DMAs is available at WASCO, but when it comes to practical details of DMA layout and monitoring and subsequent NRW reduction, further experience is required.

At present, the **Leak Detection Unit** (LDU) is the only unit that deals with ‘DMAs’ and pressure and flow measurements apart from the Water Production Facilities. However, the data prepared by this unit seems to be hardly used by other units or departments. Furthermore, the LDU is far too small (3 staff in north and 2 in south) to conduct all necessary flow and pressure measurements and prepare respective reports.

4.2 DEVELOPMENT OF PILOT ZONE DMA

During previous missions, it was agreed to test the concept of an **ideal DMA** by using the **pilot zone**, before adapting it step by step in other regions. The **activities** in the pilot zone DMA comprise:

- physical isolation of the zone
- installation of required measurement equipment and other assets
- conducting of baseline NRW assessment
- consecutive implementation of measures for NRW reduction

constant monitoring and preparation of water balances
As a pilot zone DMA, the area supplied by the Eleuthere Tank in the Babonneau area was chosen. A higher resolution map of the zone is attached in Annex 7.

![Figure 5: pilot zone DMA with actual geographic boundaries](image)

During the workshop on the 9th of April the participants under guidance by the consultant jointly prepared an **SOP for the development of DMAs**. The SOP can be found in Annex 4, it will be fine-tuned by the Strategic Planning Department with help of interviews with the respective stakeholders. Its application will be tested on the Pilot Zone DMA.

In a second workshop, on the 11th of April, an action plan was elaborated with the same group of participants to define and reduce technical and commercial losses in the pilot zone DMA. The Action Plan can be found in Annex 5.

**Deliverables**

- **Draft SOP: DMA Development (Annex 4)**

- **Action Plan: Measures for NRW Reduced in Pilot Zone DMA (Annex 5)**
5 STRATEGIC ISSUES WATER SUPPLY

A meeting with the Technical Committee of the WASCO board of Directors and some senior technical staff of WASCO was held on the 11th of April to present the consultant’s findings and recommendations on strategic issues concerning:

1. Organisational issues
2. Bottlenecks in Northern Production and Transmission System
3. Northern Line
4. Vieux Fort Project
5. SCADA System

The presentation covering the above-mentioned topics is attached in Annex 6.

6 CONCLUSION AND WAY FORWARD

The following deliverables were presented:

- Training on hydraulic analysis and evaluation of transport systems
- Draft SOP with Flowcharts for ‘DMA Development’
- Draft Action plan for NRW reduction in pilot zone DMA
- Concept design for new raw water transmission pipe in northern system: simplified Hydraulic Analysis and cost estimation
- Work Plan for simplified Hydraulic Analysis, Water Demand Forecast and Concept Design of the Northern Line

WAY FORWARD

The following table shows the next steps as agreed during this mission. Details of the activities are found in the respective chapters of this report and the annexes (SOP, Action Plan)

<table>
<thead>
<tr>
<th>No.</th>
<th>What</th>
<th>Who</th>
<th>Refer to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Development of isolated and equipped pilot DMA</td>
<td>SPD, CSD, WSD, DCD</td>
<td>Chapter 4.2, Annex 4</td>
</tr>
<tr>
<td>2</td>
<td>Water balancing and NRW reduction activities in pilot DMA</td>
<td>SPD, CSD, WSD, DCD</td>
<td>Annex 5</td>
</tr>
<tr>
<td>3</td>
<td>Demand Analysis, simple hydraulic model, demand forecast, concept design for Northern Line</td>
<td>SPD, Consultant</td>
<td>Chapter 3.3</td>
</tr>
<tr>
<td>4</td>
<td>Procurement of Equipment</td>
<td>Consultant, SPD</td>
<td>-</td>
</tr>
</tbody>
</table>
ANNEXES

ANNEX 1: ToR FOR THIS MISSION
ANNEX 2: AGENDA OF THE MISSION
ANNEX 3: TRAINING ON HYDRAULIC ANALYSIS
ANNEX 4: DRAFT SOP ON ‘DMA DEVELOPMENT
ANNEX 5: DRAFT ACTION PLAN FOR NRW REDUCTION IN PILOT DMA
ANNEX 6: PRESENTATION STRATEGIC ISSUES
ANNEX 7: PILOT ZONE BOUNDARY MAP