

## Efficient 2011

# Challenges and Lessons Learnt from a major Performance Based Contract for Non Revenue Water Reduction - North-Western region - JAMAICA (2005-2010)

Fabrice Lupo, Antoine Erout

fabrice.lupo@vinci-construction.com antoine.erout@vinci-construction.com

Water Management International,  
a subsidiary of Vinci Construction Grands Projets, France

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### ABSTRACT

A Consortium formed by Vinci Construction subsidiaries was contracted by the National Water Commission of Jamaica (NWC) to execute a 15.5 Million US Dollars Performance Based Project on Non Revenue Water (NRW) Reduction in the semi-rural North-Western Region of the Caribbean island (60,000 customer accounts) – the NWP Project.

The project was conceived as a Design and Build contract and scheduled for 5 years, including a 2-year Implementation phase followed by a 3-year Sustainability phase.

The project started in July 2005 and was satisfactorily completed by August 2010, achieving the main contractual goals during the Implementation phase. While during the initial year of the Sustainability Phase, considerable success was achieved, a degradation of performance has been observed over the later stages of this phase. This deterioration has been recognised by both the Client and the Contractor as a consequence of the difficulties associated with knowledge transfer from the Private Company to the State Owned Company, and with achieving appropriate changes in the organizational structure and business practices of the State Owned Company,

to restructure procedures and practices in a manner most appropriate for sustained NRW Control.

### Introduction

Jamaica is an island nation of the Greater Antilles, 234 kilometres in length and as much as 80 kilometres in width, and amounts to 10,990 square kilometres. It is situated in the Caribbean Sea, about 145 kilometres south of Cuba. Population is estimated around 2.8 millions in 2010. The Jamaican economy depends on services, which accounts for more than 60% of Gross Domestic Product. The country derives most of its foreign exchange from tourism, remittances, and bauxite/alumina.



Figure 1 : Jamaica in the Caribbean Sea

## **Corporate Profile of the NWC**

The National Water Commission (NWC) is a statutory body in charge of providing the majority of the Jamaican population with potable water and sewerage services. The NWC produces more than 90 % of Jamaica's total potable water supply (900 Millions Litres per Day) and distributes it through a network of over 7,000 kilometres length.

## **Non Revenue Water in Jamaica**

Non Revenue Water (NRW) in NWC water supply systems varies between 50% and 80%. The distribution network is generally an aged one, with large sections over 50 years old. It is assumed that Physical Losses account for between 50% and 70% of the total NRW. Apparent Losses are responsible for the remaining 50% to 30%.

NRW Reduction & Control remains one of the most challenging operational issues which the National Water Commission faces, as it adversely impacts the Utility's level of efficiency and service delivery to its over 400,000 customers. Despite this challenge, the NWC remains committed to reducing NRW to manageable levels.

## **Origin of the Project**

The NWP Project originated in 2004 when the French group Vinci Construction Grands Projets (VCGP) was planning in conjunction with the NWC the rehabilitation of the second largest treatment plant in the tourist city of Montego Bay with a capacity of 27 Millions litres per day (MLD), after having successfully completed another similar project in the same year for which a 68 MLD treatment plant was rehabilitated.

A NRW component was foreseen in the Project, in order to preserve the financial equilibrium of the NWC after

making such a level of capital expenditure i.e. the revenue gains and cost savings were to be sufficient to repay total project capital cost plus interest over the period of loan financing. The NRW component would target the network directly supplied by the two refurbished plants.

Water Management International (WMI) was contacted due to the company's over 20-year expertise in water network optimization and NRW Reduction and Control.

## **Integrated Contractual and Financial Approach**

For the purpose of implementing the project, VCGP and WMI set up a Consortium (either called the Consortium or the Contractor below) and conceived a Design and Built Contract, financed through Buyers credits and commercial loans.

The Client, assisted by a Consultant, accepted the principle of directly contracting the Consortium based on several advantages:

The Consortium's investment in the project preparation and the turnkey aspect of the package proposed by the Contractor would reduce management constraints for the Client and reduce the overall time between conception and completion of implementation compared with projects funded with the assistance of traditional multilateral agencies

The favourable review of the project by an independent Consultant, who established that the project was "good value for money"

The particular specificity and almost unique know-how of the Consortium, formed by both an international construction group with extensive experience in the design and implementation of multi-disciplinary water supply projects and an NRW specialist company with experienced staff on both the technical and on the

commercial (or Apparent) loss components of NRW

The acceptance by the Contractor of Performance Targets linked with a significant Contractor's Equity Fund placed at risk by the Contractor (see below for details), and the return of investment that the NRW component would provide to the NWC

### Schedule of works

The project was scheduled with a 2-Year Implementation phase (2005-2007) and a 3-Year Sustainability phase (2007-2010).

### Project Cost and Equity

The cost of the project (for the NRW component only) was 12 million US Dollars for the Implementation phase and 3.5 million US Dollars for the Sustainability phase.

The Contractor's Equity Fund was linked with performance targets set on NRW reduction achievements (see below). By mutual agreement, this Equity Fund was set at some 3.25 million US Dollars.

Half of this equity would be released at the end of the Implementation phase - prorated based on to the results achieved - and the other half would be similarly released during the Sustainability phase.

### Performance Targets

The initial performance targets set by the Client were:

- NRW reduction from 65% to 50% (subsequently re-evaluated from 71% to 53% - see below, Section 3.1, Audit)
- Billable consumption increase from 41 MLD per day to 55 MLD (+33%)

The results at the end of the project would be calculated as an average of the last 3 months of the project and each criterion would account for 50% of the target.

The concept of "billable" consumption (as opposed to "billed" consumption) was introduced as a mean of sharing contractual risks between the Contractor and the Client as it regards Apparent Loss reduction, because the latter usually requires the input of the Client to resolve it (illegal connection, meter by-pass etc.)

### Project Area

The project area was defined as the administrative boundaries of the Parishes of Trelawny, St James, Hanover and a small part of Westmoreland (Negril).

The project area can be characterized as semi-mountainous and semi-rural with an area of approximately 2,000 square kilometres. It included 1,800 kilometres of water mains, 100 reservoirs, 3 main treatment plants and 60,000 registered customers.

Within this geographical area, the socially-challenged zones of Montego Bay, commonly called "red areas" were excluded from the project area for safety reason.



Figure 2 : Project Area

### Implementation phase

The Implementation Phase was scheduled for 2 years including an Audit

of the system, which obliged the Contractor to operate under a very tight schedule.

The Audit lasted 6 months and was strongly field orientated due to the very limited data provided by the Client at the beginning of the Contract. It allowed the Contractor to design network partitions (the District Metered Area - DMA - approach was used) and pressure management strategies, recalculating NRW baseline and categorizing better the losses (Establishment of the Water Balance).

Temporary flow measurements on the main production facilities allowed re-evaluating the NRW baseline, until permanent meters were installed.

At the end of this audit, the NRW target was revaluated to 53% as opposed to 50% in the Contract, considering that the actual baseline was 71% instead of 65%.

The works were scheduled for 18 months and involved up to 150 persons employed by the Consortium.

The technical works included the supply and installation of 150 bulk meters (retrofitted and equipped with GSM/SMS dataloggers), 45 Pressure Reducing Valves (some of them with active pressure control systems), 75 reservoirs overflow prevention systems and 58 pumping station control panels.

In addition, an intensive leak detection programme was carried out and more than 2,500 leaks were detected and repaired.

75 District Metered Areas were implemented, which represented an average of 24 kilometres of water mains per DMA, or 800 official service connections.

Most of these DMA were in fact "natural" partitions of the system (discrete outlets from main transmission pipelines etc.). Indeed, it would not have been cost-effective for the Client to operate a large number of DMA considering the financial challenges of doing so, and issues with staff, both in terms of skills and additional work load.

The commercial works involved – amongst other activities - the installation or replacement of 27,000 domestic water meters (15-mm), 600 commercial and large consumers water meters (25-mm to 150-mm) and 400 public stand pipes.

In addition, a consumer survey identified some 2,000 illegal connections and 4,000 illegally reconnected 'T' accounts ('T' accounts are customers appearing as disconnected in the NWC customer accounting database because of outstanding arrears). The geo-referencing of consumers (using GPS units carried by surveyors) was also a key activity for the improvement of the customer database.

## **Sustainability phase**

The Sustainability Phase started with a handing over process, during which the Client, assisted by the Contractor, put in place a new operational structure (NRW Department and Revenue Recovery Department) which would ensure the continuity of the Implementation phase and would give a new focus towards revenue collection.

The revenue collection component was requested by the Client due to the decrease in the collection rate, from 95% to 92%.

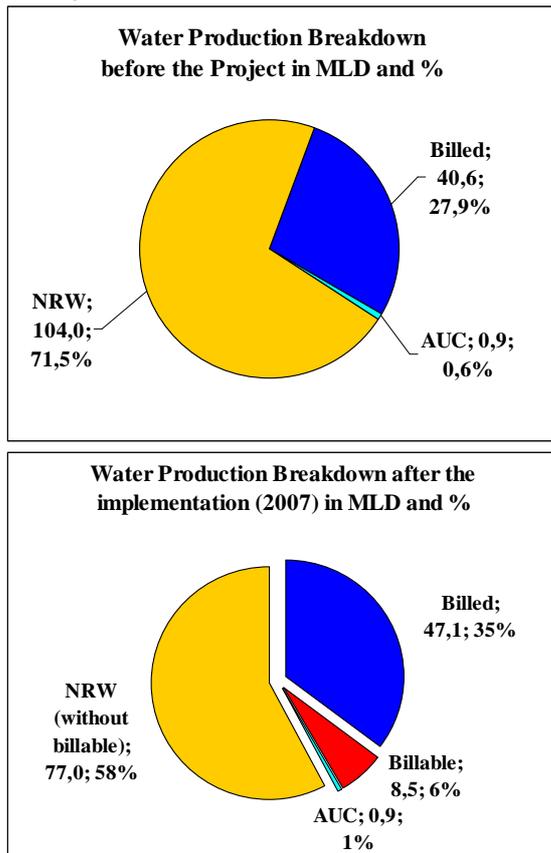
At this stage, there was a significant decrease of the Contractor's staff. Only 5 WMI experts remained as permanent advisors to the Client.

The Sustainability Contract had a provision for the supply of repair fittings and spare parts but all the NRW activities were directly carried out by the NWC.

## **Achievements and Evaluation of Performance**

The Water Balance before and after the Implementation Phase can be

characterized as follows (Carteado, 2006):



**Figure 3: Water Balance – before and after implementation**

This Water Balance is expressed as per Contract definition and may not strictly comply with the International Water Association standard guidelines.

Combining NRW reduction target and billable increase target, the overall performance was established by the Supervision Engineer at **79%**.

The actual billing increase (from 40.6 MLD to 47.1 MLD) generated an extra income for the NWC of over 3 Millions US Dollars per year, despite enterprise-wide decreasing collection ratios.

As noted, the billable consumption concept was not retained for the Sustainability phase, and the billed consumption at the end of the implementation phase was used as the baseline to be sustained (47.1 MLD as shown in figure 4, above).

Combining both NRW control and billed consumption targets, the overall performance has been reviewed by the

Supervision Engineer who established the performance at **92%** for Sustainability-year 1 and **77%** for Sustainability-year 2, in both cases after having allowed adjustments to the targets due to circumstances having affected the Consortium's performance (see chapters 4.8 and 4.9 below). Sustainability-year 3 performance targets are currently under review by an independent Consultant but the Contractor is expecting it to be **below 50%**.

## Challenges and Lessons Learnt

It is the view of the Contractor that the implementation phase (which included an essential 6-month audit and only 18 months of works), was too short for a proper completion of the works. It would have been better to have more time for the audit, such as 1 full year followed by 2 to 3 full years for the implementation phase.

A longer audit period would have allowed a better definition of the baseline for the project and the establishment of a more accurate initial water balance.

A longer implementation period would have allowed the Contractor to achieve more in terms of optimization of the network and NRW reduction.

## Too large project area

The project area was defined based on administrative boundaries of Jamaican Parishes (equivalent to regions or departments). Some of the distribution networks were located in the mountains at more than two hours drive from the main cities, resulting in an inefficient use of resources for the Contractor.

The project area should have been better defined and should have only encompassed areas served by the main treatment plants or interconnected to it.

## **Inaccurate definition of red areas**

The socially challenged areas, commonly called 'red areas', were a permanent subject of concern and discussion between the Client and the Contractor.

The field work done by the Contractor revealed that other than official red areas, new or unidentified socially challenged areas (sometimes as large as the official red areas) were supplied by potable water from the project area.

These areas significantly affected the performance of the Contractor, because of high NRW (between 90% and 95%) and high average demand per household (twice the demand of a 'good paying' customer).

The absence of proper infrastructure in these areas, the security risk and the political implications (which has led to a culture of non payment within those poor communities) did not allow the Contractor to perform there, despite many attempts.

The Contract should have better defined excluded areas, and should have allowed for a more flexible way of redefining them during the project, based on real findings.

## **Transformation of losses**

In a system with both high Physical Losses and high Apparent Losses, the mechanisms of reducing losses are complex. For instance, saving water in a 'good paying' area through leak repair may benefit an adjacent non paying area in term of service improvement. The consequence of that is to have decreased Physical Losses in one area and increased Apparent Losses in another (*Vermersch, 2010*).

This phenomenon of transformation of losses was not taken into account in the Project conception, but it certainly explains why NRW reduction has not been more significant in the Project

Area, despite all Physical Loss reduction efforts.

## **Challenges to transform billed volume into cash**

Although not impacting the performance targets during the main Contract, the decrease in the collection rate has been seen as a negative consequence of the rapid increase in billed volume. Both the Client and the Contractor recognized the need for more revenue recovery actions, which resulted in the Sustainability Contract being more orientated towards revenue recovery activities.

This switch from strict Apparent Loss reduction activities to revenue recovery activities may not have served the Contractor in terms of sustaining the results obtained at the end of the Implementation Contract.

## **Lack of clear legal framework for dealing with illegal connections**

One of the main issues with reducing Apparent Losses, when it relates to illegal water consumption, is the lack of a legal framework to be applied.

Despite the fact that an illegal connection is viewed as a criminal offence under Jamaican law, there is no proper structure in place to enforce the law, and penalties are so low that they cannot be an effective deterrent.

On many occasions, the NWC has attempted to take offenders to the Criminal Court of Justice but the outcome of these attempts has discouraged the Organization from doing it at a scale and on a continuing basis necessary for effective enforcement of legislative regulations.

## **Absence of funds for main replacement**

Due to the very bad conditions of certain portions of the distribution network found in the Project Area, it would have been very useful to have provision in the Contract, or on a separate arrangement, to do replacement of mains and services connections. Certain water mains in very poor condition were identified during the project but have yet to be replaced.

### **Financial constraints during Sustainability phase**

During the Sustainability phase, the NWC faced unprecedented financial constraints resulting in major cash flow problems for the enterprise, which was caused by delays in obtaining a tariff increase. A fuller explanation of the impacts of this issue is beyond the scope of this presentation but clearly was a significant factor decreasing overall project efficiency.

### **The Change Management issue during Sustainability**

The main reason for a decrease of performance during the Sustainability is potentially the Client's inability to initiate change.

The change management issue could not be satisfactorily addressed during the Sustainability Phase, despite the initial reorganization of the Non Revenue Water Department and numerous progress meetings and presentations involving all operational departments within the Company highlighting the need for change.

There is a critical need for managerial and organisational change within the NWC in order to promote innovative and productive work amongst employees.

## **Conclusion**

The formulation of Performance-Based Non Revenue Water Reduction and Control Contracts still remains a challenge, but experiences such as the North Western Parishes Project in Jamaica should contribute to the necessary learning process.

Not only one but several approaches may work, depending on local parameters, which really requires a potential Contractor to know very well the local environment before entering into a Contract of a certain magnitude.

The NWP project clearly demonstrated that NRW can be reduced in a short period of time in the interest of all the parties, even in a very challenging environment, but it works only when the Contractor is fully in charge of the job. The Sustainability Phase however has reinforced that without a strong change on the Client's side, the task of sustaining performance is extremely difficult as soon as the Contractor steps back.

It may just reveal a simple fact: NRW reflects the efficiency and maturity of the Company in charge of the service.

In order to achieve long term NRW reduction in a State-Owned Company, other contractual schemes such as mid-term Management Contracts or other types of delegation of services may be foreseen.

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