Final Report | ENVR 451

From the Source to the Tap:

Investigation of Water Supply Issues and Potential Solutions in the Urban Areas of Colon District

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1.0 INTERNSHIP COMPONENTS

1.1. Number of Days Spent on Project

	Number of Work Days (8 hours) spent in the field (Province of Colon)	Number of Work Days (8 hours) spent in Panama City
January	3	4
February	1	6.5
March	2.5	5
April	1	11
TOTAL	7.5	26.5

Total number of days spent on the internship = 34

1.2. Acknowledgements

This research project would not have been possible without the support of many people. We would like to thank the Smithsonian Tropical Research Institute for use of their facilities during our time in Panama. We wish to express our gratitude to our supervisor, Dr. Stanley Heckadon, who was abundantly helpful and offered invaluable assistance, support and guidance. Deepest gratitude is also due to the staff at Punta Galeta, especially Illia Grenald, Jorge Morales, and Gabriel Thomas, without whose help, this investigation would not have been successful. We wish to convey thanks to all interviewees, whose participation was essential in the progress of our investigation, including José Fierro, Ricardo Ponce, David Michaud, Roberto Galan, Oscar Marin, Carlos Hamilton, and Cirilio Gonzalez. We appreciate the time dedicated to comprehensive plant tours given by plant operators Francisco Arturo Bradley of Sabanitas and Arnaldo Bramwell of Mount Hope. Additionally, we would like to thank Felipe Cabeza and members of the Frento Amplio Colonense, namely Olga Gutierrez for giving us the opportunity to visit local communities. Finally, we are grateful for our professors Dr. Rafael Samudio and Dr. Roberto Ibanez and our teaching assistant, Victor Frankel, for guiding us through our project.

1.3. Contact Information

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1.4. Executive Summary

1.4.a. English Version

In spite of important economic activities, such as the Free Trade Zone, the city of Colon has been ridden with poverty and crime for decades now. Thus, the public infrastructure suffers from underfunding. In this study we focus on the drinkable water supply network, which falls short of providing a satisfying service to the population. As such, most urban areas of the Colon district have been experiencing temporary and frequent water cuts. In other cases in the periphery, some communities have been completely deprived of drinkable water supply. Those people had to cope with the situation by relying on taxis to bring water, a costly solution, or using streams and digging their own wells, in spite of the health risks. However, as the dry season approached, these alternatives, poised to disappear, led the communities to stage protests in January 2012. As a result, they obtained a weekly supply of water by trucks from the national public water company, the Instituto De Acueductos y Alcantarillados Nacional (IDAAN).

The goal of this research paper is to fully understand the water supply situation in Colon from all aspects, and to provide possible ways in which to improve it. In order to obtain the broadest picture of the situation, we conducted interviews with a wide range of people involved in the political, institutional, economic and social aspects of the problem. We also visited the water plants in the Colon district to gain an insight into the conditions of the infrastructure. Finally, we visited several communities affected by the water issues in order to acquire a first-hand vision of the impact the problems have had on the people. The overarching purpose was to obtain different perspectives to provide an objective review of the water situation in Colon.

Our results consist of the investigation of the causes of this unreliable drinkable water provision. We describe the physical condition of the infrastructure responsible for the distribution of water, from the source to the tap, here divided into five components: the source of water, the water treatment plants, the primary pipe network consisting in large pipes, the secondary feeder pipe network and the storage of water in tanks and reservoirs. We believe that the problems of water supply mostly arise from the degraded condition of the secondary feeder pipe network, which may leak up to 50% of the water, and the water treatment plants under the responsibility of the IDAAN, which are not working to full capacity because of technical problems.

We then examine the institutional characteristics, which may explain why the network is currently underfunded. We describe the economic vicious circle in which the IDAAN is trapped, which undermines both its financial sustainability and the quality of service provided. We also identify problems arising from the influence of Panamanian politics in the proper running of the public utility and other administrative inefficiencies. To conclude the results of our paper, we look at several projects that are currently trying to solve some of these issues, such as the World Bank project and the subcontracting of a private firm, the Sociedad Interamericana de Agua y Servicios (INASSA), to lower the debt level of the IDAAN.

In our discussion, we study three potential changes, which could improve the situation of water provision in Panama. The first one is the implementation of a different pricing scheme, which would improve the finances of the IDAAN. The second is the reform of the governance system of the IDAAN, transforming the company into a “Water Authority” emulating the model

of the Panama Canal Authority (ACP). Finally, we also look at the controversial prospect of privatization by examining the advantages and disadvantages it has had on the water supply in various countries of Latin America.

1.4.b. Resumen Ejecutivo

A pesar de la importancia de actividades económicas en Colon, como los puertos y la Zona Libre, esta ciudad ha conocido desde décadas muchos problemas de pobreza y crimen. Por lo tanto, la infraestructura pública es infradotada y sufre de fondos insuficientes. En este estudio, nos centramos en la red de suministro de agua potable que no proporciona un servicio satisfactorio a la población. Tal cual, la mayoría de las zonas urbanas de Colon se han encontrado con cortos de agua temporales y frecuentes. En otros casos, en las zonas más periféricas, algunas comunidades han sido completamente privadas del abastecimiento de agua potable. Esta gente tuvo que enfrentarse a la situación en diferentes maneras, como utilizando taxis para traer agua – una solución costosa – o usando quebradas, o escavando sus propios pozos – a pesar de los riesgos para la salud. Sin embargo, con la estación seca acercándose, estas alternativas, a punto de desaparecer, condujeron las comunidades de organizar protestas en enero 2012. Por lo tanto, obtuvieron un suministro semanal de agua por camiones cisternas de la agencia pública nacional de agua, el IDAAN (Instituto de Acueductos y Alcantarillados Nacionales).

El objetivo de nuestra investigación es entender la situación de suministro de agua en Colón desde diferentes puntos de vista y proveer maneras posibles para mejorarla. Para obtener el panorama más amplio de la situación, realizamos entrevistas con una amplia gama de gente comprometida en los aspectos políticos, institucionales, económicos, y sociales del problema. Visitamos las plantas potabilizadoras en el distrito de Colón para observar y comentar sobre las condiciones de la infraestructura. Finalmente, visitamos muchas comunidades afectadas por el problema de agua para tener una experiencia personal del impacto y la gravedad de los problemas que enfrenta la gente afectada por falta de agua. El propósito global fue obtener perspectivas diferentes para proveer un punto de vista objetivo de la situación del suministro de agua en Colón.

Nuestros resultados consisten de la investigación de las causas del suministro inestable de agua potable. Describimos la condición física de la infraestructura responsable por la distribución de agua, desde la fuente hasta la pluma, dividida aquí en cinco componentes: la fuente de agua, las plantas potabilizadoras, la red de tubería primaria, consistiendo en tuberías grandes, y la red de tubería segundaria, que trae el agua hasta las casas, y finalmente el almacenamiento de agua en tanques y embalses. Creemos que los problemas de agua proceden del estado degradado de la segunda red, cual puede perder hasta 50% del agua a causa de las fugas, y de las plantas potabilizadoras bajo de la responsabilidad del IDAAN, cuales no funcionan a la capacidad máxima a causa de problemas técnicos.

Después, examinamos las características institucionales cuales podrían explicar porque la red está infradotada al presente. Describimos el círculo vicioso económico cual socava la sostenibilidad financiera del IDAAN y la calidad del servicio provisto por la empresa pública. También identificamos problemas surgiendo de la influencia de la política Panameña en el funcionamiento adecuado del IDAAN y otras ineficiencias administrativas. Para concluir los

resultados de nuestro informe, analizamos diferentes proyectos que están tratando de resolver algunos problemas al presente para bajar el nivel de deuda del IDAAN, tal como el proyecto del Banco Mundial y la subcontratación de una empresa privada, la Sociedad Interamericana de Agua y Servicios (INASSA).

En nuestra discusión, estudiamos tres cambios posibles que podrían mejorar la situación de provisión de agua en Panamá. El primer es la puesta en práctica de un nuevo esquema para la política de tasación, que optimizaría las finanzas del IDAAN. El segundo es la reforma del sistema de gobernanza del IDAAN, transformando la empresa en una "Autoridad del Agua", emulando el modelo de la Autoridad del Canal de Panamá (ACP). Finalmente, revisamos también la perspectiva polémica de una privatización, examinando las ventajas y desventajas que ha tenido sobre varios países en América Latina.

1.5. Host Institution

Punta Galeta is a research station of the Smithsonian Tropical Research Institute, located on the Caribbean coast of Panama near the Atlantic entrance of the Canal. Punta Galeta was a previous military base in World War II and was a key component to the defense of the Atlantic entrance of the Canal. In 1964 it was established as a center for marine research. Punta Galeta serves as not only a research base for mangroves, coral, seagrass, and other marine life, but also aims to educate the public about conserving the local ecosystem. Located 10 kilometers from Colon city, it is a nature reserve managed by the Autoridad Nacional del Ambiente (ANAM). Current development projects, such as the expansion of the airport, the electric plants, and the Free Trade Zone are all threats to the surrounding marine life. Punta Galeta shows particular concern for conserving the area in face of development occurring in Colon.

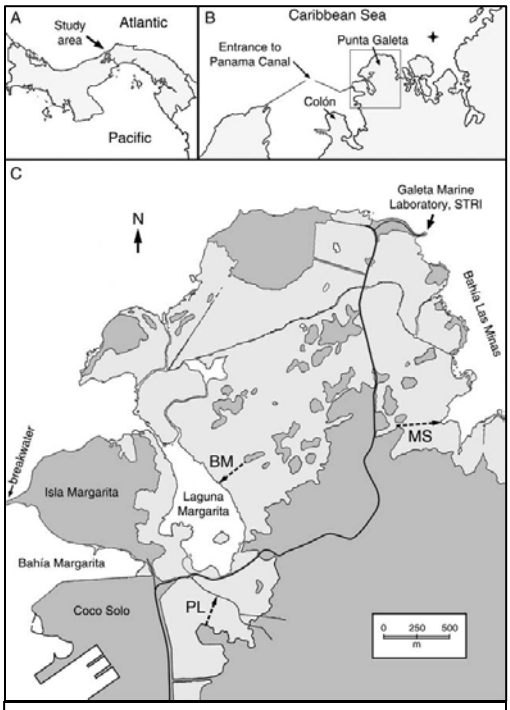

Figure 1: (A) Location of study area (B) Location of host institution (C) Enlargement of location of host institution and surrounding areas (Sousa et al., 2007)

1.6. Geography and History of Study Site

Our investigation is based on the city of Colon and its urban peripheries. Today the second largest city in Panama, Colon was founded in 1850, during the construction of the Panama railroad. It was originally established on Manzanillo Island, and was only connected to the mainland when the railroad was constructed (Bullard, 1914). Colon has been named the crossroads of the world due to its location, which facilitates travel across the Isthmus of Panama. Ever since the Canal came into existence, it has been one of the most important ports of the

Caribbean Sea, having three major container terminals. With the construction of the Canal, the city gained prestige and became a large commercial center as well as a tourist destination. The Free Trade Zone was started in 1948 as the largest of the Americas and the world's second largest duty-free area (Zimbalist and Weeks, 1991). With the closures of many American military bases after World War II, Colon's economic prestige declined. Since then, the city has been ridden with unemployment and violence in spite of the wealth generated by the Free Trade Zone and the ports.

Colon's first development of public sanitation system was a key element in the construction of the Canal. Having being built on a swampy island, Colon was originally unsanitary and taken by disease. For this reason, during the construction of the Canal, a new system of waterworks and sewerage was built by Americans to drain the surrounding swamps in Panama City and in Colon. The Panamanian government continued to extend pipelines to serve areas developing in the periphery of the city (Fierro, 1999). With the increasing population in Panama City, water supply began to be a problem, which resulted in the creation of the Water and Sewer Commission of Panama (CAAP) in 1956, but Colon's slow expansion kept it functioning under the original system set up by the Americans (Fierro, 1999). By 1961, the development of urban areas became so large that CAAP was transformed into the IDAAN to service all of the urban areas of Panama (Fierro, 2012). The IDAAN was to implement projects to improve the waterworks system of Panama as a country, and meet the water demand.

1.7. Justification

Our initial research topic was very different than what we have been working on. In fact, it was much more closely related to what the Punta Galeta Research Center usually investigates. However, our topic took a drastic change of direction when one day, while we were

at the Punta Galeta laboratory, the tap -water suddenly stopped running. Surprised, we asked the staff what was going on. What surprised us even more is that they were *not* surprised by this unexpected water shortage ("*el agua se fue...*").

This sparked our interest, and we decided to take on this new research topic. We believed it was important to investigate because it clearly concerned the local population of Colon city and surroundings – including the staff at Punta Galeta. It also related to the situation of Colon in general as a neglected and poor city that faces many difficulties – which seemed essential for us to address considering we were stationed at Punta Galeta. Generally, it appeared there was a lack of a comprehensive understanding of the exact reasons for such frequent water shortages. Finally, as we were making our final decision on the choice of topic, the problem turned into a crisis, as protests and roadblocks occurred in January 2012.

2.0 INTERNSHIP BACKGROUND AND INITIATION

2.1. Introduction

Although Panama possesses both significant economic resources and a wet climate, the country still experiences problems of water supply. This contradiction is even more obvious in the province of Colon. Colon is one of the wettest areas in Panama with roughly 3.5 m of precipitation per year in average, about double the amount of Panama City (Empresa de Transmision Electrica, S.A., 2012). Colon is also essential to the national and international economy with over $15 billion worth of goods transiting through its Free Trade Zone in 2011. However, since none of these goods are taxed at the municipal level, the city of Colon benefits little from this situation. Colon's unemployment rate is high compared to Panama City, since, for example, about 80% of the 33,000 workers of the Free Trade Zone commute daily from the capital (Bragg et al., 2008). This is why most of the public infrastructure, such as roads, schools and the rainwater removal system, has been in a degraded state for decades.

The provision of water supply by the IDAAN has also been poor, although the incapacity of the municipality to levy a tax is not to blame, since water supply is managed at the national level. The situation regarding the supply of drinkable water has been precarious for many people within the city of Colon, and maybe even more so in its periphery. Indeed, the extent to which the population has been affected varies greatly. Thus, a large proportion of people experience frequent and temporary water cuts, such as the one we have experienced at Punta Galeta. Others, living in about 30 communities in the semi-rural periphery, have had no access to water in the past months; if not years in some extreme cases (see Appendix 1 for a map of the affected communities). For those without water supply, alternatives had to be found. For instance, in Nueva Esperanza 2, the families would use a nearby stream for cleaning themselves and washing

clothes, in spite of the risks of diseases, since some streams in the area are contaminated. Wells have also been dug in many areas, in particular in Nueva Italia. However, with the Panamanian dry summer, most wells and creeks have dried up, leaving the communities vulnerable once again. Water then had to be purchased and loaded onto taxis and clothes needed to be brought to a laundry service. Those decisions can represent a significant expense for many humble families.

After months of complaining, some inhabitants felt that authorities were not dealing with the problem appropriately. They then decided to form an organization called the Frente Amplio Colonense (FAC) and staged protests, blocking the Transistmica highway on various occasions, starting in January 2012. The police intervened, using tear gas and arresting about 20 people during one of these protests (Grinard, 2012). In response, the IDAAN has begun to distribute water with trucks (Redaccion La Estrella Online, 2012; Cabeza, 2012). This solution, coupled with the local water cuts, is deemed as palliatives by the people and is insufficient to provide a satisfying service, although it has brought some relief for many of them. Our paper investigates the technical and institutional causes of the drinkable water supply problems in the district of Colon, studies current projects trying to tackle this issue, and finally, examines some potential solutions that could improve the situation.

2.2. Objectives

Our investigation is guided by three main objectives:

- In our results, we first aim at understanding why and how the situation deteriorated to the extent that some people are deprived on a regular basis of one of the most basic human needs –water. This problem is even more surprising since Colon has not been affected by

any particular exceptional climatic events (whether it is floods or droughts) that could have degraded the infrastructure.

    - In this paper, we establish the main technical problems in the water supply network, which cause those issues.
    - We also identify the major institutional factors (economic, political, and social), which may have impacted the way the IDAAN functions as a public company.
    - We also look at what investment programs, such as the one by the World Bank, have been initiated to tackle the more technical issues.

- In our discussion, we study various paths that could aid in making the provision of water supply more efficient. This includes technical points, which have a large role on the water supply system, but also broader structural initiatives, on a longer time-scale.
- Finally, because this is an issue that directly concerns people's daily lives, our last objective was to share our results with the community and with the staff at Punta Galeta.

2.3 Methods

The main methods we used to meet the objectives discussed above were a series of in-depth interviews, and several visits of places of interest, which we complemented with an extensive literature review.

We conducted interviews with a total of twelve people (see Appendix 2 for a full list of interviews). Our sampling technique for the selection of these interviewees was purposeful, since the point of our research was to come to a comprehensive vision of the water supply problem by listening to the different actors and stakeholders in this complex situation.

Thus, we targeted different categories of people. Firstly, we spoke with several institutional players. We started with an interview with José Fierro, a former director of the

IDAAN. He provided us with a general overview of the situation, focusing on historical and political issues to consider. We met with Carlos Hamilton, the current director of the IDAAN-Colon, as well as Roberto Galan, director of integrated water resource management at ANAM. We also interviewed David Michaud from the World Bank, and Oscar Marin, from the IDAAN, who are both working on the current investment project of the World Bank in Colon.

Secondly, we interviewed people who had a more technical perspective on the water issues in Colon. We interviewed the engineer of the IDAAN-Colon, Ricardo Ponce, who provided us with a technical as well as a socio-institutional perspective. We also met with Francisco Arturo Bradley, the plant operator and laboratory assistant at the Sabanitas plant, Arnoldo Bramwell, the supervisor of operations at the Mount Hope plant, and the plant operator at the Rio Gatun plant.

Finally, we sought out members of the communities affected by the water shortages. We contacted Felipe Cabeza, the union leader at the FAC, as he was the representative in the media of the protests that occurred in January 2012. Thus, we interviewed Felipe Cabeza, and his fellow member of the FAC, Olga Gutierrez. We also interviewed Cirilio Gonzalez; a member of the Quebrada Bonita community, that Mrs. Gutierrez put us in contact with.

The interviews were in-depth, since each lasted between 45 minutes to 1 hour and a half. The interviews were also formal and semi-structured. In other words, for each interview, we devised a list of questions and topics we wanted to address and which would guide the interview. However, we conducted the interviews more as discussions, in which the interviewee was left enough freedom to address topics that perhaps we had not emphasized. Our scripted questions varied depending on whom we were interviewing.

We conducted a total of 5 visits (see Appendix 2). These were meant to gain a hands-on understanding of the situation. We wished to evaluate, from our personal observations, the

current conditions of the three water plants in the district of Colon (Sabanitas, Mount Hope and Rio Gatun), and of a sample of the communities affected (Nueva Providencia, Quebrada Ancha, Nueva Esperanza, and Quebrada Bonita). We also had the chance to follow two social workers of the IDAAN to assist with the surveys that they conduct with the poorer households of Colon (this is commonly called the "Casos Sociales"). These surveys are done to assess the eligibility of the households to receive subsidies from the IDAAN to aid in the payment of their water bills.

To bring this all together, we conducted an extensive literature review. We examined newspaper articles, since our topic had often been mentioned in the local news in the last few months. We also consulted governmental documents and reports. This included the IDAAN Memorias from 2006 to 2010, and the IDAAN statistical reports from 2006 to 2010. We also reviewed institutional documents published by the World Bank on their current work in Panama. Finally, we sought out academic literature and institutional documents about urban water management in other Latin American countries.

2.4 Limitations

We faced several difficulties undertaking these methods. Firstly, concerning interviews, we had trouble getting in touch with certain governmental and institutional actors to organize meetings with them. Some interviewees were also reticent to answer our questions directly and often emphasized other points than what the question was trying to address. We also had trouble accessing public documents published by the IDAAN. It was difficult obtaining accurate and up-to-date information on the current on-going projects, on the state of the water network (the pipes, for example) – mostly because the overarching databank (in theory provided by the IDAAN) is quite incomplete, and some of the documents published are inconsistent from year to year. For this reason, our main source of information was often only what our interviewees knew and

shared. In our opinion, some of these limitations actually come to represent 'results' in themselves. For example, they highlight the heavy bureaucracy of the IDAAN. We were often sent from one department to another without finding what or who we were looking for. It also shows the lack of accountability (difficulty of accessing public documents), and the lack of planning of certain governmental agencies.

In addition, urban water management is a broad topic that has multiple aspects to consider. Not only is it difficult to gain an understanding of all the actors and forces in play, but also, we were not experts on the topic before starting this project. Thus, we learnt about the issues of water management in general at the same time as we discovered them in Colon. Furthermore, our topic was not assigned to us, so we were given a lot of freedom on the way to conduct our research. Being independent in this way was challenging at times, for example to get in touch with interviewees and governmental agencies. Also, we had to organize our time with care because we had to navigate between offices and interviews in Panama City and in Colon.

It proved difficult to investigate the water supply issues in Colon in an objective manner, since we were gathering information from opposing stakeholders. Giving the right kind of recommendations – humble and realistic – after investigating such a complex problem is challenging. Consequently, we decided to offer an exploration and discussion of possible solutions, instead of giving a rigid list of recommendations.

Another important limitation we encountered was that we were unable to organize the community meeting during which we wanted to share our results with the staff at Punta Galeta and some of our interviewees. Instead, we will be sending them our final report and inviting them to ask us questions about our investigations.

A final limitation we faced was a lack of quantitative information on the extent to which the communities of Colon were affected by the water problems (frequency and length of water cuts,

number of households without access to running water from pipes, etc.) In other words, we could not find any statistical data about this from any governmental agency, and it was not the mandate of our research to quantify this ourselves. However, this could be a promising potential future research project. It would be worthwhile to examine because statistical data could show the actual weight of the problem, and maybe help push for change in the region.

2.5 Ethical Considerations

Because our methodology consisted mainly of interacting with human subjects, we had to take into account important ethical considerations. Throughout the interview process and visits, we followed the McGill Code of Ethics. This implied stating our affiliation to McGill University and to the Smithsonian Tropical Research Institute. Before starting our interviews, we made sure to state the purpose and objectives of our study. We asked for interviewees' consent to use the information they gave us, as well as to quote them or publish their name in our final report. If information wished to be given anonymously, we made sure to follow this request as well.

3.0 RESULTS

3.1. Technical Issues

In this section, we will present the results we obtained that relate to the *technical* causes of the current water supply issues in the urban areas of Colon district. By 'technical issues', we refer to problems in the physical resources, infrastructure and facilities that are causing households to not have sufficient, constant, and if any, access to potable water. We will start with an overview of how the water supply network is organized in the urban areas of Colon district. We will then break down this network into five main components, and analyze them consecutively to evaluate their contribution to the current situation of water provision.

3.1.a. The Water Supply Network

In order to understand why the system is not working, or where the problematic areas are, we must first geographically understand the area and the network as a whole. There are three water plants that supply the district of Colon. The first is the Sabanitas plant, which is run by the IDAAN. It supplies a large area that includes communities such as Sabanitas, Cativa, Puerto Pilon, and Santa Rita Arriba. It currently produces 12 million gallons of water daily, although its actual capacity is 16 million gallons/day. The second water plant is Mount-Hope, which is run by the Panama Canal Authority (ACP in Spanish). It supplies Colon City and surroundings. It currently produces 35 million gallons a day, which is full capacity. The exact distribution network for both plants is shown in Appendix 3. The third is the Rio Gatun plant, also run by the IDAAN. It is located near the community of Rio Gatun, and in theory, it serves the area of Rio Gatun until Buena Vista, Quebrada Bonita and Nueva Esperanza. It is the smallest plant since it produces only 100,000 gallons/day.

3.1.b. The Five Components of the Water Supply Network

We will now look at the entire water network, as broken down into five components, to understand how water flows from the initial source all the way to people's homes. We will also evaluate the current conditions of each step. Once the structure is broken down into smaller components, it is easier to identify the ones that are weak and that are causing the entire network to be shaky. The framework we adopt was modelled on the description given to us by José Fierro during an interview (Fierro, 2012). Figure 2 illustrates the relationship between these five components.

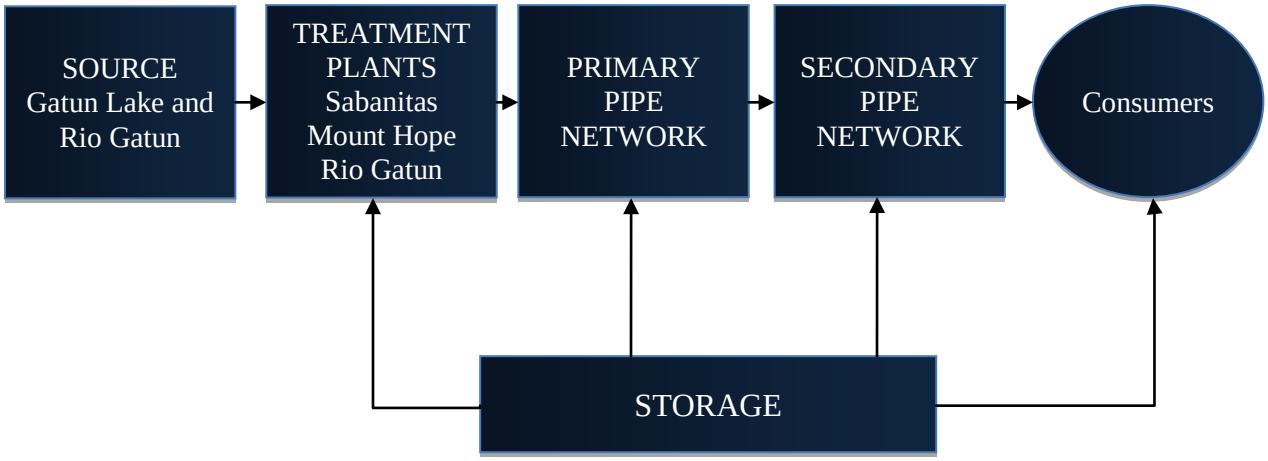

Figure 2: The Five Components of the Water Supply Network

The first component of the water supply network is the initial source of water. In Colon, it is mainly Lake Gatun, for the Sabanitas and Mount-Hope plant, but the Rio Gatun plant sources its water from Rio Gatun. This first component of the network was not identified as problematic by any of our interviewees. The sources available in Colon offer good quality and quantity of water for now and the future (Fierro, 2012). The only issue mentioned was the turbidity problems that occurred temporarily in Lake Gatun in 2010, because of the construction occurring

on the highway. This affected the water quality in the Colon area (Ponce, 2012; Bradley, 2012). Similarly, high water levels in the Rio Gatun have caused recent sedimentation problems in the Rio Gatun plant (Plant Operator at Rio Gatun water plant, 2012).

The second component of the water supply network is the water treatment plants. The role of a water plant is to remove the bacterial and physical (color, turbidity) impurities of the water in order to process and elaborate it as a potable product.

To begin, the Sabanitas plant is facing several difficulties. It is in a run-down state and according to A. Bradley (2012) and R. Ponce (2012); it has received no major investments in the last 28 years. Looking into more specific technical issues of the plant, a first problem is that only four of the five water pumps are currently working. We received conflicting information from the plant workers as to why only four were functioning, but it seems like it is related to a broken sluicegate – which is a dam or gate used to control the water flow in a channel. The sluicegate cannot close properly, which leads to a loss of 4 million gallons of water daily (Bradley, 2012). Thus, the plant is only producing water at 75% of its total capacity. Bradley (2012) also explained that the sluicegate was not easily fixable because they could not obtain the missing piece from the German company who had built the plant because the company had closed.

The plant also is also understaffed: there is officially no plant director, and there is no permanent engineer working on the plant, although the engineer R. Ponce is often present. In addition, the automated electronic system to monitor and control the plant is no longer functioning, which further complicates the task of the plant operators. Finally, our interviewees mentioned potential future investment in the plant. Different people cited different numbers, for example R. Ponce (2012) and C. Hamilton (2012) spoke of a US$ 5 million investment, while Bradley (2012) mentioned an amount of US$ 25 million. We tried contacting the project director from the IDAAN, Mario Rodriguez, to obtain more details about the future project, but he did not

answer our request. Either way, from our personal observations at the plant and from speaking with our interviewees, it seems like the plant is receiving little maintenance for an infrastructure supposed to support one of the largest urban areas in Panama.

The Mount Hope water plant creates a strong contrast to the Sabanitas plant: it is in much better shape, it has better maintenance, more advanced technology and has better overall management. Pictures included in Appendix 4 highlight this contrast. Several interviewees (Bradley, 2012; Fierro, 2012; Michaud, 2012) attributed this to the fact that Mount Hope is run by the ACP, unlike Sabanitas that is run by the IDAAN. We will discuss the institutional differences between the ACP and the IDAAN in a later section, and how this may affect the efficiency of water provision in Panama. The Mount Hope plant runs at full capacity and there are plans to increase the production to 42 million gallons daily. According to A. Bramwell (2012), the supervisor of operations at Mount Hope who has worked there for over 30 years, the water plant has never had major failures since its beginnings in 1914. Contrarily to Sabanitas, the Mount Hope plant operators have used an efficient computer system for the last 10 years. It allows a better monitoring and maintenance of the plant, as it can quickly locates a problem in the network. Some equipment may even be controlled automatically from the computer system (Bramwell, 2012). In terms of staff, there are a total of 30 employees. From this total, there are 4 engineers, and 5 operators who are trained to understand the entire network (Bramwell, 2012). It is important to note that the water produced by the ACP at the Mount Hope plant is *sold* to the IDAAN – for example, the ACP produced 69.6% of the water distributed by the IDAAN in the province of Colon in 2010 (IDAAN, 2010).

Finally, the Rio Gatun plant is currently facing some difficulties. It is presently producing 100,000 gallons/day – which is not full capacity. The plant operator we spoke with – who was the only worker present at the time of our visit - was not able to say what the full

capacity was. In addition, only two of the four water pumps are working right now, and the plant operator explained that this was due to the accumulation of sedimentation in the river – which naturally occurs when the river reaches higher water levels.

The third component of the water supply network is the primary pipe network, sometimes referred to as the water main or the primary feeder. This consists of the larger pipelines that transport water from the treatment plants to the communities. In the case of Colon, this component does not seem to be problematic (Fierro, 2012; Ponce, 2012). There are projects to make the pipes larger and better quality, as well to change them from iron to PVC pipes (Ponce, 2012).

The fourth component is the secondary feeder pipe network. The water main feeds into these secondary, local-scale pipelines. They transport the water directly to consumers' homes. According to Fierro (2012), this is one of the most problematic pieces in the puzzle. The main issue, as identified by different interviewees, is that the piping is failing in several places, causing important and frequent leaks (Fierro, 2012; Ponce, 2012; Bradley, 2012; Cabeza, 2012; Gutierrez, 2012a), and thus a large amount of wasted water. According to statistics from the FAC, up to 20 million gallons a day are wasted because of the leaks in the Colon district. The broken pipes also prevent water from arriving at people's homes, as we directly observed during our visits to different households in Quebrada Bonita and Nueva Esperanza (these communities are under the responsibility of Rio Gatun plant). These pipes are not being fixed on a regular basis. This may be due to the fact that there are only 8 workers in charge of fixing these pipes in the district of Colon (Ponce, 2012). An additional difficulty highlighted by Ponce (2012) is that locating pipe leaks is particularly hard to do within the city of Colon because it is a landfill area with a high water table. Apart from a poor piping network, there has been a lack of urban planning in the district of Colon, especially with the rapid growth of the population, the ports and the Free Trade

Zone. People have been adding themselves to the water network in an ad hoc manner, which has made the provision of water to all difficult to manage (Bradley, 2012; Fierro, 2012; Ponce, 2012). This relates to the problem of communities that are located in high altitudes: they have difficulty obtaining water because of the low pressure in the pipes, which is insufficient to bring the water up to the homes (Ponce, 2012).

What is misleading and problematic about the leaks is that it artificially increases the per capita water consumption of people in Colon. The demand of the network does not correspond to people's actual consumption (Fierro, 2012). For example, an average production/capita of water is about 80 to 100 gallons daily. However, the production of water in the area supplied by Sabanitas is 280 gallons/day/capita and 580 gallons/day/capita in the area of Mount Hope (Ponce, 2012). Clearly, people are not actually receiving all of this water. Basically, this creates enormous water waste and serious water needs in the local populations.

During our visits to communities, such as Quebrada Bonita and Nueva Esperanza, locals have explained that the only alternative they had when water did not get to them from the pipelines was to use the water from the stream, from their own personal wells, water collectors, or directly from the store. Often, they were left with very few options because the stream and wells dry up easily, especially during the summer time. It is only in January 2012 that the IDAAN finally intervened and provided water by using distribution tank trucks (see Appendix 5). This was implemented as a palliative measure in response to the water crisis and the protests organized by the FAC. In theory, there are five trucks for the entire region, and a water distribution schedule has been devised. However, only four of the trucks are currently functioning, and the schedules are rarely followed, according to members of the FAC. Ponce (2012) criticized this alternative, explaining that it was inefficient in providing people with one of the most basic needs. It is a short-term, costly solution that does not deal with the actual problem

(Fierro, 2012). Communities are frustrated because this was presented as a temporary measure, but it has been in place for already four months.

The fifth component is storage in tanks and reservoirs. This is an auxiliary component within the water supply network. Part of the water treated in the plant must be stored, and this is particularly important to regulate daily production-consumption fluctuations (Fierro, 2012; Bradley, 2012). For example, water consumption shoots up during the morning because households are cooking, showering etc. The tanks at Sabanitas have a capacity of 1.5 million gallons, and at Mount Hope a capacity of 2 million gallons. None of our interviewees identified storage as a problematic component of the network.

In conclusion, each of these components is essential, because as soon as one is mal-functioning, the system cannot provide water to consumers. In the case of the urban areas of Colon district, the most problematic component is the poorly maintained secondary pipe network. The water plants of Sabanitas and Rio Gatun are also in need of repair and better maintenance.

Despite these technical issues we have discussed, several interviewees identified other types of issues as problematic. In the following section, we will discuss our results relating to the institutional and socio-economic reasons of the poor water supply system in Colon. Indeed, the protests of January 2012 did not occur because of a sudden broken pipe or damaged sluicegate. There has been a slow accumulation of technical problems that are stemming from deeper, institutional issues.

3.2 Socio-Institutional Problems

After having studied the several technical problems in water supply that are affecting the communities in Colon, it is essential to understand the underlying factors causing them. We have tried to establish a just diagnostic of the situation by interviewing a wide range of actors in the

water sector of Panama. From this broad-picture approach, one of the IDAAN's most obvious problems that emerged is the economic difficulties that the company has been chronically facing for decades. This lack of economic resources seems to explain, for instance, the conditions of the pipe networks and the production facilities. Moreover, the financial difficulties, as we will show, serve as evidence that the current political and institutional structure in place at the IDAAN fails to meet the needs of the people.

3.2.a. IDAAN's Economic Vicious Circle

For many of our interviewees, a clear problem affecting the quality and reliability of the service is the vicious circle in which the IDAAN has been stuck in for many years (see Figure 3). This vicious circle involves the quality of the service provided by the IDAAN, the clients' perceptions of the quality of service and their will to pay their bills, and finally, the IDAAN's financial ability to deliver a good service.

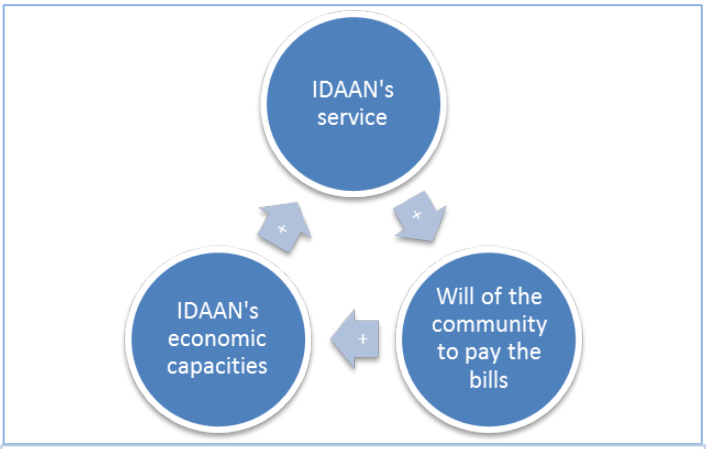

Figure 3: Positive Feedback Loop in Water Supply Service in Panama

Since this circle is a positive feedback loop, or more simply put, a self-reinforcing system, it well represents what impacts the state of the IDAAN's service by making explicit how the will to pay the bills affects the finances of the company (Banco Interamericano de Desarollo [BID], 2009; Fierro, 2012).

It is difficult to determine quantitatively the rate of unpaid bills due to poor service since people do not necessarily provide a justification when they do not pay their bills. For instance, some clients may not pay their bills for personal financial difficulties, although they may benefit

from a good water supply service, as we saw from our visit with social workers from the IDAAN. However, from our encounters with some of the clients experiencing poor quality of service, we came to understand that it is common for people to refuse to pay bills on the grounds that the service provided is not satisfying (Cabeza, 2012; Gutierrez, 2012a). We were even told by the FAC that some of their members still receive bills, in spite of the complete absence of water supply to their homes.

However, even if all of the bills were properly paid by the clients, it is unlikely that that the IDAAN's economic situations would improve owing to the pricing system. As it shall soon be discussed, the tariff system implemented by the IDAAN is neither efficient nor fair. For instance, in 2010, at the national level, 41.8% of the water delivered by the IDAAN was not accounted for and thus not billed to any clients (IDAAN, 2011b). Since increasing consumption is not matched with increasing bills, clients have not been incentivized to use water with moderation.

This situation negatively impacts the IDAAN's finances. In 2010, the company had about $98 million in revenues and roughly $129 million in expenses, leading to a $32 million in loss. This year was not an exception since the IDAAN has had a debt of about $120 million for a few years now (Delgado, 2012). Therefore, from a business perspective, the IDAAN's model clearly fails to be efficient in cost-recovery, which has jeopardized the quality of its services since it could not afford essential investments and maintenance. However, the IDAAN's economic model is not only hindered by its inability to generate enough revenue, since the surrounding political sphere may have also played a negative role on the sustainability of the company.

3.2.b. The Politics of IDAAN

There is hardly anyone we have interviewed who does not think that the role –if not the preponderance- of the political arena is a factor of inefficiency. This situation in which the national water public company finds itself is far from being an exception in the region. A report written for the World Bank by Vivien Foster (2005) explains how the political sphere, through the "clientilist" model, can negatively impact the quality of service of water supply (see Figure 4).

In the description of the model, we have found many elements that could relate to the case of the IDAAN. Thus, in the "clientilist" model, the "state-owned water companies were more often being treated as part of the political apparatus than allowed to function as efficient service providers. Politicians exerted their control over the sector through the appointment (and dismissal) of water company directors [...]" (Foster, 2005).

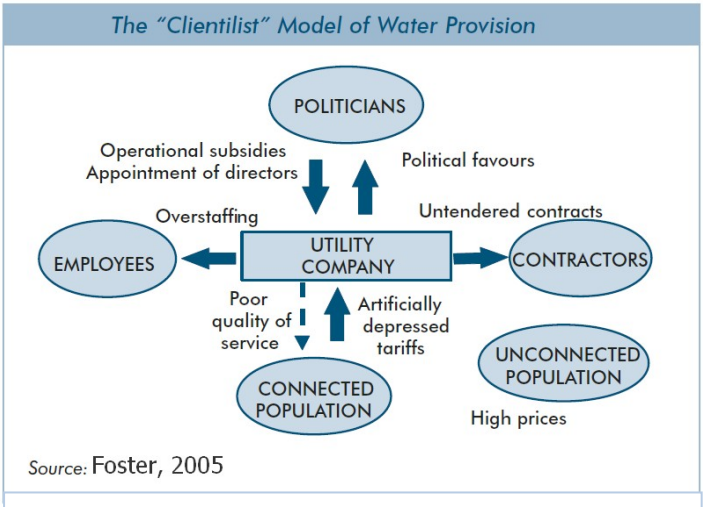

Figure 4: The "Clientilist" Model

The appointment of the IDAAN's directors, made directly by the President of the Republic of Panama, has not led to the most efficient running of the IDAAN, according to Jose Fierro (2012). Fierro points out that only 2 out of 35 directors of the IDAAN were engineers, an evidence for him that the most qualified were not selected. What is more is that most of those directors did not last long: with the IDAAN having 51 years of existence, this means that in average a director would remain in power at the IDAAN for less than a year and a half. This sensitivity to political shifts means that long-term visions have been lacking, a problem felt by

Fierro, the former director of the company, but also by Mr. Ponce, a current engineer at the IDAAN-Colon. This lack of long-term vision has had obvious problems on the planning of investments programs, as the technical issues, such as the degraded pipe network and the Sabanitas plant in Colon, show.

Furthermore, Foster adds: “In return for this patronage, water companies were often obliged to supply political favors in the form of overemployment, artificially depressed tariffs, political targeting of new investments and distribution of contracts based on political rather than economic criteria.” Again, our investigation may indicate some similarities to this description.

Concerning “overemployment,” the IDB points out that the IDAAN employs over 5 workers per 1000 clients (BID, 2009). This figure is deemed too high since efficient companies in the region have about 2 employees per 1000 clients. However, the quantity of employees in absolute terms may not reflect all the problems. Indeed, for Ponce, the reduction of employees in the Colon branch of the IDAAN has led to ineffectiveness. From 295 workers in 1995 to 115 nowadays, overall overemployment may have been limited, but this has led to the understaffing of vital departments of the branch, such as the technical office, which has only 8 repairmen for the entire district.

About the “artificially depressed tariffs”, the financial state of the IDAAN could serve as an example of this unofficially subsidized tariff system. With the average billed price for a gallon of water being near $0.001, one of the lowest prices in the world, the water tariffs may indeed be lowered for political reasons. As Rolando Bocanegra, the director of Commercialization at the IDAAN, claims (Delgado, 2012), this price is too low to sustain the company. However, the transformation of the pricing scheme may be too risky politically to reform, since it would affect every voter in the country (Fierro, 2012).

The "political targeting" of investments and contracts is more difficult to establish. However, from a source that chose to remain anonymous, we have been told that there are plenty of examples of the sort. Politicians would legally obtain funds to finance an investment in their district, with little long-term planning, monitoring, or accountability. This is why some believe that the IDAAN may have received sufficient funds to exist throughout the years, but this money was politically used on a short-term basis.

Finally, Foster concludes by stating that "the consequences of this regime have been spiraling costs, low quality of service, and precarious finances, while the scarcity of resources for investment has left substantial sections of the population unserved and therefore forced to rely on a range of expensive or inconvenient substitutes." With the previous accounts of the deficiency in water provision and the dire financial conditions of the IDAAN, it thus appears that "clientilist" relations have clearly undermined the company.

Clientelism, however, may not have been the only hindrance to an effective meritocratic system in the IDAAN. There have been reports of "cronyism" as well. Cronyism is the bias that one may have when appointing someone to a particular position. Similarly, the reduction of employees in the IDAAN-Colon as described earlier is more likely to reflect a process of accumulation of duties by employees in order to boost wages than a planned decision to be more efficient. A possible explanation for this is the fact that almost all of our interviewees have stated that the wages at the IDAAN are too low (Fierro, 2012; Hamilton, 2012; Marin, 2012; Bradley, 2012). With the particular social situation of Colon, this problem may be aggravated in the district as well (Marin, 2012; anonymous source, 2012).

3.2.c. Administrative Inefficiencies

Adding to the economic difficulties and the problems that politics can create, some of our

interviewees have reported some concern about inefficiencies regarding the administrative functioning of the IDAAN. A recurrent issue mentioned is the heavy bureaucracy that slows down any process (Marin, 2012). On top of that, Ponce finds that the centralization of the IDAAN impedes the flexible running of the company. We ourselves, while conducting our investigation, have been somewhat affected as well by this heavy bureaucracy, as we mentioned earlier in “Limitations”.

Furthermore, as members of the FAC have told us, the IDAAN has problems communicating properly with the community. Even after months of water service disruption, members of the FAC felt that they were not treated with enough respect and were purposely misinformed about the situation. They claim that it is only thanks to their protests that the IDAAN finally decided to implement a system of water delivery with trucks. This is why they have felt, and still feel, that the only effective way to have their voices heard is by protesting and blocking the highway, although they are aware of the danger and the legal consequences.

Finally, the members of the FAC have also shared their concern about the effectiveness of the division of responsibility between the Ministry of Health (MINSA) and the IDAAN regarding water provision. Indeed, MINSA, by law, is responsible to provide water in rural areas with less than 1,500 inhabitants per community while the IDAAN supplies towns and cities with 1,500 inhabitants and above. The situation becomes unclear in the case of rapidly growing, semi-urban communities such as Nueva Providencia, which we visited. This community has experienced an exponential growth of somewhat informal settlements in the near outskirts of Colon. Initially, the MINSA was responsible for the water supply, since the community was sparsely populated. However, as Mrs. Querima, a resident of Nueva Providencia, has told us, there are 8,000 people living in the community and the MINSA is still officially responsible for the community. What is odd is that the IDAAN has been occupying a role of growing importance in the community (with

the irregular delivery of water by trucks). The IDAAN may thus be unofficially acknowledging that Nueva Providencia is a new responsibility.

3.3 Projects Under Development

There have been several attempts in the past to improve water services in Colon; however, none of them have been successful. A combination of the IDAAN's institutional problems and Colon's social issues has contributed to the failure of past projects. In the following section, we will discuss current projects that are under development, and what is being done to ensure their success.

3.3.a. World Bank Project

Since coming into power in 2009, Panama's President Ricardo Martinelli has expressed strong interest in improving water issues in Panama, according to David Michaud, the World Bank project director. He initiated working with the World Bank to undertake a project that primarily focuses on Colon District because in previous decades, there has been no improvement despite the many investments into the area (Michaud, 2012). This project in particular is different from past failed attempts because there are stricter standards and qualifications. In the past, the biggest problems with implementing projects in Colon have been both culturally and socially based, because of both the skepticism of the community and the economic hardships. In an interview with Oscar Marin of the IDAAN Panama (2012), he expressed that the most challenging part of this process will be the social management, and to sell the project to the community. Because of these problems in previous projects, the World Bank has made a deal with the Panamanian Government to divide the investment costs 50%-50%, rather than the usual 73%-27% split, where the World Bank invests more (Marin, 2012). Even with stricter standards,

working with Colon still has its risks, both physical and social, which justifies the hesitance of World Bank's investment. With having this background information, a new project has been put forth with an integrated social component to decrease these risks (Marin, 2012).

"Metro Water and Sanitation Improvement Project" is the name of this new project. The first component focuses on increasing the quality, coverage, and efficiency or the water supply services in low-income neighbourhoods in Panama City. The other two components, of greater interest to us, include the modernization of water supply in the Colon area, and the strengthening of the IDAAN's institutional project management (World Bank, 2011a).

The project was initially approved in May 2010, with a loan totaling US$40 million, and effectiveness date of September 2011 (World Bank, 2011b). The new contract under negotiation differs from previous projects in two ways. Firstly, it is performance based, which means that the subcontracted company will only be paid according to the quality of its performance, and how well it fulfills the contract. Secondly, the project wishes to ensure that the community has an important role in the development of the project. The community was consulted for the contract through workshops (Michaud, 2012). With the completion of the contract between the World Bank and the IDAAN in October 2011, the bid for contractors was planned to begin in April 2012 (Michaud, 2012). Choosing a contractor is a strenuous process and many prequalifications, set by the World Bank, must be met in order to ensure the best option possible.

A competent contractor is required to carry out the project, and must produce results for the following initiatives: optimization of the hydraulic system, installation of meters, search and repair of leaks, updating the database system, implementation of a geographic information system, connections of aqueducts to new networks in the town, coordination with the IDAAN for proper operation of the system, billing fundraising, training programs, improvement of customer service, and an implementation of a communications program to strengthen ties with the

community (IDAAN, 2012a). The project in particular will replace 30-80 year old pipes in Colon to help with the low pressures problems that have been occurring for years. The primary and secondary networks of the Sabanitas plant are being reinforced, as part of the hydraulic optimization network. Installation of meters will monitor water consumption, so that water can be properly billed. Improving upon the search and repair process for leaks of pipes in the aqueduct system will decrease the amount of water that is wasted. Updating the database is important to have an accurate record of all customers, and to decrease the amount of illegally connected consumers. Having a geographic information system is pertinent for the secondary pipe network, as it will facilitate the management of leaks by electronically mapping what pipes are damaged and what is currently being fixed (IDAAN, 2012b).

The project itself has a closing date scheduled for 2015, ending with a completion report. The planning and consulting process is the first one to two years of the project, and then an additional four to five years is needed for implementation, including the efficiency improvement program (Michaud, 2012; Marin, 2012). The efficiency program consists of three steps over a total of three years. Step one includes a six month diagnostic and planification process between the hired contractor, the IDAAN and the World Bank. Step two is plan execution, which is two years of installing meters, fixing leaks, and other technical goals outlined in the contractor bid. Finally, the last six months is dedicated to training and transfer of knowledge from the hired company to the IDAAN workers (Marin, 2012).

Besides the technical issues laid out in the project goals, the last component involves discussions on how to reform the IDAAN. The World Bank has put forth a guideline for a reform of the IDAAN, which only works to facilitate knowledge and present options for the IDAAN to consider (Michaud, 2012). In particular, US$3 million of the contract has been allotted to the institutional strengthening of the IDAAN (World Bank, 2011a).

Implementing a new project with the IDAAN has been challenging. Since the IDAAN has been inefficient in managing investment funds in the past, the World Bank now has to work in closer collaboration then is normally the case. A revolving account payment has been established to closely monitor spending. How it works is the World Bank gives the IDAAN an advance, the IDAAN spends the loan, and then must produce a report on how the funds were spent (Michaud, 2012). This ensures efficient spending and proper abiding of the contract.

3.3.b. INASSA Debt Collection

Over the years the IDAAN has acquired over US$120 million in debt in unpaid bills (Delgado, 2012). The IDAAN has been focused on recovering the debt ever since President Martinelli was elected in 2009. In August 2011, the IDAAN made a contract with the INASSA as a bill collector (Delgado, 2012). According to the IDAAN's 2010-2011 Memorias, they have begun a program for an increase in the number of water cuts for clients with high debt. The contract between the two companies involves water-cutting methods as a tactic for debt collection. The contract states that the INASSA is to collect US$1.8 million of debt each month, and if they fail to do so, they must pay a percentage of the debt based on what is left to collect (Delgado, 2012). One of the major problems that the IDAAN is facing is that the debt amount remains constant, due to people being unofficially connected to the network and still not paying their bills. To help with further debt, they are attempting to decrease the number of people illegally connected to the water system. Additionally, the IDAAN is looking towards micro metering as a general objective of increasing metering, and decreasing the amount of non-paid-for water (IDAAN, 2011a). It is with hope that new projects involving the IDAAN will prevent further debt and eradicate their current debt.

3.3.c. Other Projects as Published in IDAAN Memorias

As published in the IDAAN's Memorias, several projects have been completed or are still in progress in several areas surrounding Colon over the past five years (see Appendix 6 for a map of planned projects). Starting in the 2006-2007 Memoria, the completed projects were the B/.20,000 remodelling of the Sabanitas plant, the B/.8,700 000 installation of a new sewage network in Colon city, and the changing of pipelines from asbestos cement to PVC. They stated projects to begin in 2007, such as the construction of a new water plant, the installation of aqueducts in Colon city as step 4 of an already existing project, and finalization of the new sewage network.

In 2007-2008, the IDAAN described many projects that were to positively affect the community. To follow up, there was not another plant constructed, there were still plans to complete the new sewage system for Colon city, and step four of the Colon City Aqueduct was still underway. There was mention of expanding the Sabanitas Water Plant as a new project in 2007, but no details were provided. Additionally, an 18 month project was put forth to conduct a pipeline from the Chilibre Water Plant through Buena Vista to the Sabanitas Water Plant.

The only update for the Colon Region in the 2008-2009 Memoria was the progress of the Chilibre-Sabanitas connection pipe. The design phase was over and 50% of the pipe had been constructed.

According to Memoria 2009-2010, they had plans to reformulate a project to have connections established and install pipelines totaling over US$350 000 to improve the distribution networks in Nueva Providencia, Buena Vista and Sabanitas. The Chilibre-Sabanitas project was still in execution in 2009. Also in that year, a five-year plan to expand Sabanitas Water Plant was budgeted for US$8 million starting in 2010 for completion in 2014. However,

there has been no progress on this project.

Although the Memorias claim that projects have either been completed or initiated, during our visits to the different plants and communities, it was difficult to find evidence of the improvements. Many projects seem to still be in progress, well past their projected deadline dates.

4.0 DISCUSSION

After having presented the technical and institutional issues affecting the IDAAN, along with some projects which try to tackle these technical deficiencies, it is relevant to present potential solutions for a longer time-scale. There seems to be little disagreement among Panamanians about the fact that the IDAAN needs to be reformed in order to have a reliable service. The President of Panama declared last year that it was time to “end the collapse” of the IDAAN (Radio Panama, 2011). Even the current director of the IDAAN declared that he agreed with a total reform of the water sector that would include the IDAAN (Redacción de Prensa.com, 2012). Almost all of our interviewees also seemed to think that the IDAAN had to be restructured.

However, where the political controversy begins is on the nature of this reform. The theme of the reform of the IDAAN has been a hot political topic. By its very nature, water supply and how it is managed can have tremendous consequences on the livelihoods of many people because of all the sanitary and economic implications. This is why we present three possible alternatives, explaining their advantages and disadvantages, and discussing them from an objective standpoint. First, as a less drastic change, we offer our insight on how to improve upon the current water tariff system. This does not presuppose a total reform of the IDAAN, but rather a revision of the way the tariff and subsidy systems are currently devised in Panama. The second reform idea, of which many have been talking about in recent times, consists of emulating the organizational framework of the ACP. The third idea, which has occurred in several Latin American countries, is the full or partial privatization of the water supply sector, a more controversial topic.

4.1. Water Tariffs

One essential component to consider when exploring options for reform of the water management in Panama is water tariffs. This includes a tariff system as well as a subsidy system. Because water is such a basic need and is perceived as a basic human *right*, water tariffs are a controversial topic and leads to much debate. This is also due to the fact that tariffs try to meet four different 'conflicting' objectives (Whittington & Boland, 2002). The first objective is cost recovery: the main purpose of the tariff is to generate revenue that will cover the cost of supplying potable water to people's homes. The second objective is economic efficiency: water is considered a commodity, which consumers should perceive as having a financial and environmental cost. This objective is supposed to promote water conservation. The third objective is equity: people in similar situations should face similar prices, while those in different situations should face different prices, meaning that one should pay differently according to how much one uses. Finally, the fourth objective is affordability. In other words, it is the idea that water is a human right that should be accessible whether or not one can pay (Whittington & Boland, 2002).

4.1.a. Tariff System

There are several tariff design systems, such as fixed charges, uniform volumetric charges, block tariffs, increased linear tariffs and two-part tariffs (see Whittington & Boland, 2002, for a detailed description of these techniques).

Currently, the tariff system used in Panama is the increasing block tariff (IBT) method. It is defined by the Whittington and Boland (2002) as a system in which "consumers face a low volumetric per-unit price up to a specific quantity (or block); and then for any water consumed in addition to this amount, they pay a higher price up to the limit of the second block, and so on"

(p.6). For residential clients in Panama and Colon, when one consumes between 0 and 10,000 gallons/month, the tariff is of B/0.80 per 1,000 gallon. When one consumes between 11,000 and 15,000 gallons/month, the tariff is of B/1.36 per 1,000 gallons, for the gallons counted above the 10,000 block. The third block, between 16 and 20 thousand gallons is charged at B/1.51 per 1,000 gallons, and this goes on for several other blocks of consumption. Finally, there a fixed minimum tariff of B/6.40 per month since it is assumed that there will be a minimum consumption of 8,000 gallons/month (IDAAN, 2010).

The first prerequisite to implementing any good tariff system is metering. Without it, the only option is a fixed-price tariff system – which is not the case in Panama, and is inefficient in any case (for example, it does not encourage saving water and facilitates illegal connections to the network). Therefore, the first problem to deal with is improving the amount of water that is currently metered. The metering is particularly poor in Colon: in 2010, 60% of clients of the region of Colon were not subject to any metering. At the national level, this number averages to 51% of clients who are not metered (IDAAN, 2010). Clearly, this lack of infrastructure defeats the purpose of having an IBT system in place, and impedes the IDAAN from meeting its objectives of cost recovery and of economic efficiency.

The second issue is exploring the tariff method selected by the IDAAN. The IBT method, although popular, does not always yield the expected results (Whittington & Boland, 2002; Boland and Whittington, 2000). One problem is that the first block, charged at a low price, often comprises all residential consumers' needs. Also, the other blocks are often not charged at high enough prices. Thus, cost recovery and economic efficiency are not always reached. According to Foster and Yepes (2006), the average price per m^3 of water in Latin America is $0.41, which is equivalent to $1.55 per 1,000 gallons of water. To situate this in comparison to other global standards, this Latin American average is about 40% of what developed countries charge.

Therefore, in the case of Panama, water tariffs are cheap even in comparison to the Latin American average. The national average that the IDAAN charges for 1,000 gallons of potable water is $0.98. The average for the province of Colon is approximately $1.15 per 1,000 gallons (personal calculations based on IDAAN *Boletin Estadistico*, 2010, p. 27, 28). Also, for the first block (0 to 10,000 gallons), the IDAAN charges slightly about *half* of the Latin American average. Only the prices set for the third block (16 to 20,000 gallons) start to reach the Latin American average.

Finally, IBT can also be problematic because this method does not necessarily reach the objective of affordability. It does not take into consideration the household size, and since the poorer families are usually large in size, they end up having high water prices anyways (Dahan & Nisan, 2005).

Therefore, in the case of a reform of the IDAAN, it would be worth investigating into a better design of the IBT system, or even exploring other tariff methods such as the uniform volumetric tariff. This method is simply the volume of water consumed multiplied by the price of a given volume of water. According to the Whittington and Boland (2002), this method is appropriate to meet all four objectives – on the condition that the price for a given volume of water is differentiated according to the client's ability to pay.

4.1.b. Subsidy system

The subsidy system that often accompanies water tariff is also essential to examine when talking about potential reforms. In Panama, the IDAAN has currently three approaches to subsidies (Foster, Gomez-Lobo and Halpern, 2000). The first is direct subsidies given to the *casos sociales*, or 'social cases'. In 2000, this represented 7% of all consumers, who had their bills

paid up to 85% by the government. The second method is cross-subsidies, representing a 33% rebate on the water bill. In 2000, this benefitted 60% of consumers. Finally, there are also cross-subsidies for pensioners representing a 25% discount. Figure 5 provides a simplified explanation for this dual subsidization system.

The World Bank has identified several problems with this approach. Discussing alternatives is another way of looking for improvements that could be done to the functioning of the IDAAN and of water management in Panama. Firstly, a set of clearly defined and justified eligibility criteria is lacking. We witnessed this during our visit with the IDAAN social workers during their surveying of houses in Colon to update their list of 'social cases'. In addition, the documents published by the IDAAN do not explicitly make any of these criteria (Foster et al., 2000). Finally, the idea of subsidizing the bills of the 'social cases' up to 85% is perhaps to be revised, because this provides very little incentive to save water.

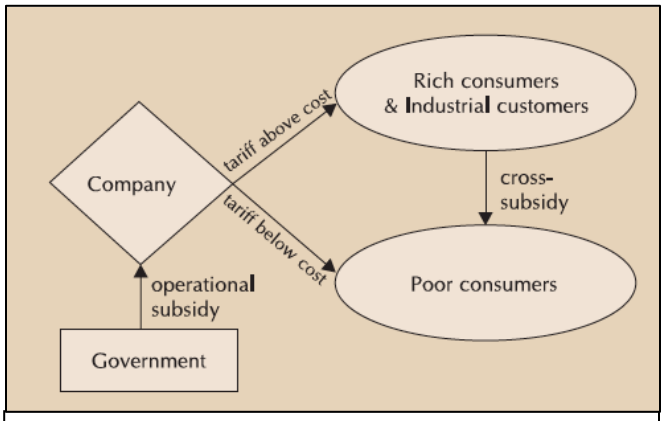

Figure 5: Schematic representation of subsidy system (Whittington & Boland, 2002).

Therefore, one possible solution would be to develop a closer collaboration with the regulatory agency ASEP (Autoridad Nacional de los Servicios Publicos), who is responsible for approving the water tariffs (BID, 2009). Together, they could work on a better design of the tariffs and of the eligibility criteria. Thus, the IDAAN would not have so much discretion in choosing the distribution of its subsidies, and would have to be clearer about its standards. Another possible solution, more complex, would be to use the water tariff only to achieve the objectives of economic efficiency and cost-recovery - while affordability could be addressed by a

"parallel subsidy scheme" (Whittington & Boland, 2002, p. 15), not necessarily related to the tariff.

4.2. The ACP model

The ACP is recognized by many Panamanians as a model of a public entity running with efficiency. Ensuring the transition of ships from one ocean to the other, the ACP claims that the number of incidents has decreased ever since it took over the control of the canal operations in 1999. What is more is that the ACP runs on a profit-maximizing basis which has led to tremendous financial benefits for the State of Panama: each year, approximately $800 million worth of canal fees go into the State's finances (The Economist, 2009).

In order to have the IDAAN follow a cost-recovery plan, which cannot be implemented with its current governance, the logic supported by many politicians is that the IDAAN should be turned into a national Water Authority ("Autoridad del Agua"), following the governance model set up for the ACP. Thus, the ACP has financial and executive autonomy regarding its operations. The organizational structure of the ACP consists of an Administrator as the CEO of the ACP supervised by a Board of Directors. This Board of Director is made of eleven members: nine are appointed by the President of Panama and require the approval of the Cabinet Council of ministers and a majority of the National Assembly, one director is appointed directly by the National Assembly, and the chair of the Board is appointed by the President of Panama. The chair also serves as the Minister of State for Canal Affairs. The Board of Directors then chooses the Administrator (Autoridad del Canal de Panamá, n.d.)

The Directors of the Board all serve terms of nine years, except the two directors appointed by the Assembly and the Chair who may be revoked at any time. Moreover, as the ACP website states: "The members of the first Board of Directors were appointed for overlapping terms to

ensure their independence from the country's administrations." This means that every three years, three directors have to be reappointed. Finally, the Administrator of the ACP serves a seven-year term, and may only serve twice.

Through this system, the control of the ACP is more independent from the politics than the IDAAN's governance system. Obviously, Panamanian politics impact the running of the ACP since the President and the National Assembly appoint all of the directors. However, the ACP maintains its ability to remain more detached from political shifts since the directors serve long, overlapping terms, unlike in the case of the IDAAN, where the director can be removed at the President's will. Moreover, the Board of Directors should theoretically have a neutral composition since the directors are appointed by the successive Presidents of Panama. The long terms that the directors serve would also ensure that a long term vision is implemented.

Recently, the Minister of State for Canal Affairs has announced that the creation of the Water Authority was on its way (Garrido and Fonseca, 2012). Leading the commission supervising the project to reform the water sector in Panama, he has ensured that "what was being sought with this restructuring is the financial and operative independence of the entity in charge of the production and distribution of drinkable water in Panama" (Garrido and Fonseca, 2012). It seems that by copying the organizational framework of the ACP, the hypothetical Water Authority could indeed obtain more independence. However, Jose Fierro (2012) warns against a mere change of name, a superficial restructuring without actually going into the deeper issues that have undermined the IDAAN. Also, the economic situations of the ACP and the IDAAN are very different: the ACP benefits from an economically advantageous position in the global trade, enabling it to make astounding profits, while the other water agency in Panama will face the problem of generating enough revenue from the sale of water, a human need.

In the end, if the new Water Authority were to adopt a similar organizational structure to that of the ACP, there is potential that the service will improve.

4.3. Privatization

Another possible path for reform, which remains a lot more controversial in Panama, is private sector participation (PSP), or privatization. Privatization involves transferring responsibilities from the public sector to the private sector. Especially in the case of water services, there is controversy on the issue, due to the argument that water is a public service and a basic human need. The main reasons for concern center around the fact that price will increase, thus denying service to low income households, who are unable to afford it. It is often believed that when PSP is introduced, private operators retain monopoly power, resulting in control over price regulations (Clarke et al., 2008). For example, in the short-lived PSP attempt in Bolivia, water prices for poorer consumers increased 43% on average (Nellis, 2003). People favour public ownership because they frequently set prices well below marginal costs, and depend on subsidies to further decrease prices for those who cannot afford the services (Clarke et al., 2008). Privatization opposes the use of subsidies because they misrepresent the true cost of water provision.

However, it should be stated that water pricing is not straightforward, as it is difficult to put a price on water. To determine a reasonable price requires careful monitoring through meters, which is expensive and difficult to maintain (Budds and McGranahan, 2003). The structure of privatization is heavily based on the concept of cost-recovery, which has been overlooked by many public companies. Because of this, connection charges are also unaffordable for low-income groups. Setting up new connections, especially in unplanned and peripheral settlements where low-income groups tend to cluster, is significantly more costly than areas closer in range,

thus resulting in higher water prices for those regions (Budds and McGranahan, 2003). New connections require a connection fee for the pipes that have to be put in place to join the main network. To demonstrate, connection fees in the privatized areas of Buenos Aires were between $1,000 and $1,500 for payment over 24 months, in areas where monthly income was only $245 (Nellis, 2003). Charges this high discourage low-income groups from connecting to the network.

In addition to economic issues, there has been serious social criticism of privatization. Privatization has influenced water service provision in Latin America in the past two decades (Nellis, 2003). It is believed by many to be a primary contributor to the rising poverty levels and income inequality (Nellis, 2003). In his paper, Nellis (2003) explains that privatization has been said to have a negative effect on employment levels and on access and affordability of services, but there is no clear evidence that privatization is the direct cause. It appears that privatization has become an outlet for socioeconomic problems in general. Many case studies performed in other countries that have participated in PSP have shown little negative and even neutral effects of privatization. Studies conducted in Argentina, Bolivia, Mexico, and Nicaragua found that privatization only contributed slightly to unemployment levels, inequality, and either reduced poverty or had no effect on it (Nellis, 2003).

What are often overlooked are the long-term effects of privatization and the benefits that can result from it. For example, the unemployment effects of privatization are small in relation to the total workforce, and are often counterbalanced by increased job opportunities that result, in part, from privatization (Nellis, 2003). In most cases reviewed, the number of new private sector jobs created by privatization soon exceeded the number dismissed, and the previously mentioned rising unemployment levels only came after the implementation of privatization and were caused by external influences (Nellis, 2003). Much of this contradicting information regarding the effects of privatization can be credited to the already instilled negative perceptions of

privatization.

While a case can be made against privatization as a cause of problems for low-income groups and increased tariffs, alternatives can be provided. There have been suggestions to make private sector participation more "pro-poor" by having thorough consultation of information relating to conditions in low-income areas (Budds and McGranahan, 2003). One of the main concerns of private sectors is losing money by not completely recovering cost, which is of course a problem when servicing low-income households who are not able to afford the services. There have been cases of private operators attempting to avoid this issue by implementing measures that make low-areas more profitable through voluntary labour, flexible payment systems, and using low-cost technology (Budds and McGranahan, 2003). Although privatization does not favour subsidizing costs, Chile, where water privatization was relatively successful, uses an appropriate pricing method (Budds and McGranahan, 2003). In their paper, Budds and McGranahan (2003) discuss how in Chile, there are regulators in charge of pricing to ensure access to low-income households, while maintaining return of operators' cost. Managing costs works on a case-by-case basis per country, and it is still necessary to fully assess the situation in question to determine the best method available. Considering low-income groups while implementing the privatization process is important to ensure that they are not negatively affected.

Despite having a negative stigma associated with it, privatization should not be completely ruled out as an option for reform. Privatization in other sectors in Panama, such as electricity, has not succeeded in the past, and thus any mention of privatization strikes controversy. However, water privatization is more complex and requires careful regulation, which is not necessarily seen with privatization of other sectors. Water is a special case, being a basic human right, and all aspects need to be thoroughly reviewed, and any previous concerns

with respect to failed privatization attempts in other countries need to be addressed, as to avoid them in the future.

5.0 CONCLUSION

As we have seen, the city of Colon and its urban surroundings present many contradictions. With the Free Trade Zone and multiple ports, this area is the channel for billions of dollars' worth of goods trading through the Panama Canal, yet it is facing tough social problems such as unemployment and crime. This area receives an incredible amount of precipitation every year, yet its inhabitants are subject to water shortages on weekly or daily basis. Water supply is one of the many issues that the district of Colon faces. In the last few months, this problematic situation has even been referred to it as a crisis: although it has been going on for decades, it culminated in January 2012 when people from the 32 communities affected by the poor water provision organized protests and roadblocks across the Transistmica, demanding better service.

Consequently, we were interested in gaining a full understanding of this problem. By conducting a series of interviews and visits with different categories of people, we approached the issue from different perspectives. Our results led us to realize that there are several factors contributing to the continual problem of water supply in Colon. Our research showed firstly that there are important technical issues to address. Within the water supply network, the water treatment plants – particularly the Sabanitas and Rio Gatun plants – and the secondary pipe network – which transports water to people's homes – are in poor physical condition. The infrastructure is failing, and it is receiving insufficient and poorly planned investment or repairs.

However, this technical standpoint is not enough to explain the incapability of providing water to these 32 communities. Indeed, there are also underlying socio-institutional explanations. We found out that there is an economic vicious circle in which the IDAAN and consumers are stuck that is causing serious economic difficulties for the IDAAN. These problems are worsened by the governance structure of the IDAAN, which is not autonomous from the politics of

Panama. Indeed, clientelism and cronyism in the IDAAN are topics that came up from our interviews as factors impeding the IDAAN from providing reliable water service. Furthermore, administrative inefficiencies, such as poor communication with populations affected by the water shortages, and long bureaucratic processes, are hindering the IDAAN.

After reviewing these various explanations for the water supply problems, we looked at what was currently being done about the situation. This is an important time for Colon as significant projects are presently being planned for the region. Namely, the World Bank has been elaborating a project to improve the water supply system in Colon, and to consult with the IDAAN on potential institutional strengthening. Other projects include the INASSA debt collection, as well as various plans projected by the IDAAN. It is exciting to examine these endeavours, since they may have the potential to make a difference in the future. In particular, the World Bank project could have a critical impact from a technical and institutional point of view. This project has been tailored to Colon's situation, by trying to involve the community and being performance-based. It will be important to closely follow the maturation of this project in the next few years.

Nevertheless, we did not limit our research to simply understanding the overall problem: this was a necessary first step to being able to investigate ways of improving the situation. Instead of making a list of specific recommendations, our objective was to bring up certain ideas and explore them as potential solutions. Change can come in many different forms, so we have addressed three main options: a revision of the water tariffs and subsidies, a total reform of the water sector into a model based on the more politically independent ACP, and a partial or full privatization of the IDAAN. Because these are controversial topics that have important political, economic and social implications, these decisions should be discussed with a committee involving a wide range of actors: politicians, economists, 'water experts', but also citizens (who

are the clients).

To conclude, we must specify that in this research report, we focused our attention on the urban areas of the district of Colon, but water supply is a serious issue in multiple other regions of Panama, as well as in rural areas and in indigenous Comarcas. Thus, it is all the more essential to discuss possible solutions and ways of improving the water sector in order to benefit communities in Colon, and all across Panama.

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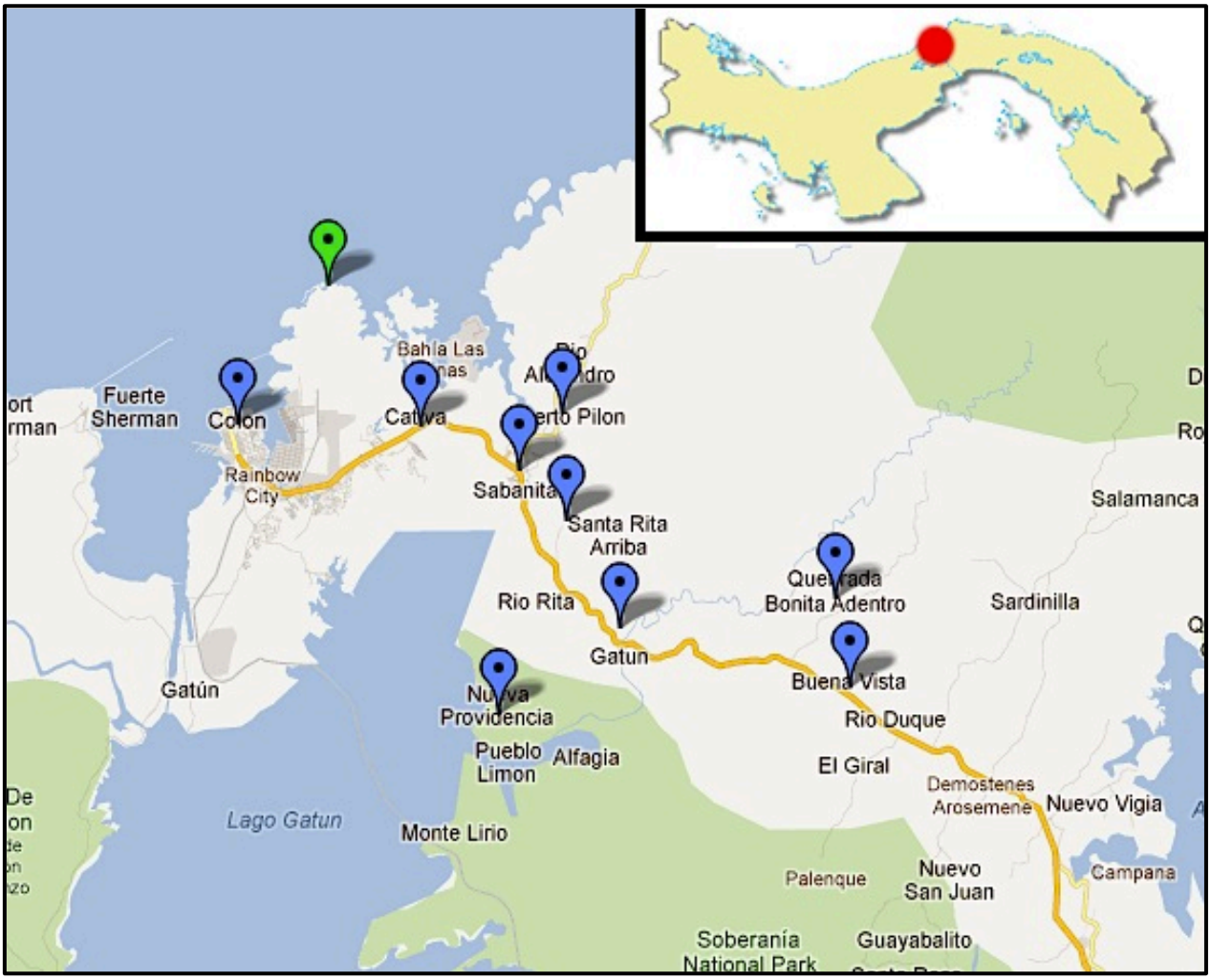
7.0 APPENDICES

7.1. Appendix 1Map of the communities affected by water problems in Colon



Map of Colon city and surrounding areas. Nine of the 32 affected communities have been highlighted on the map (Colon city, Cativa, Puerto Pilon, Sabanitas, Santa Rita Arriba, Gatun, Nueva Providencia, Quebrada Bonita Adentro, Buena Vista).

7.2. Appendix 2 List of interviewees and visits

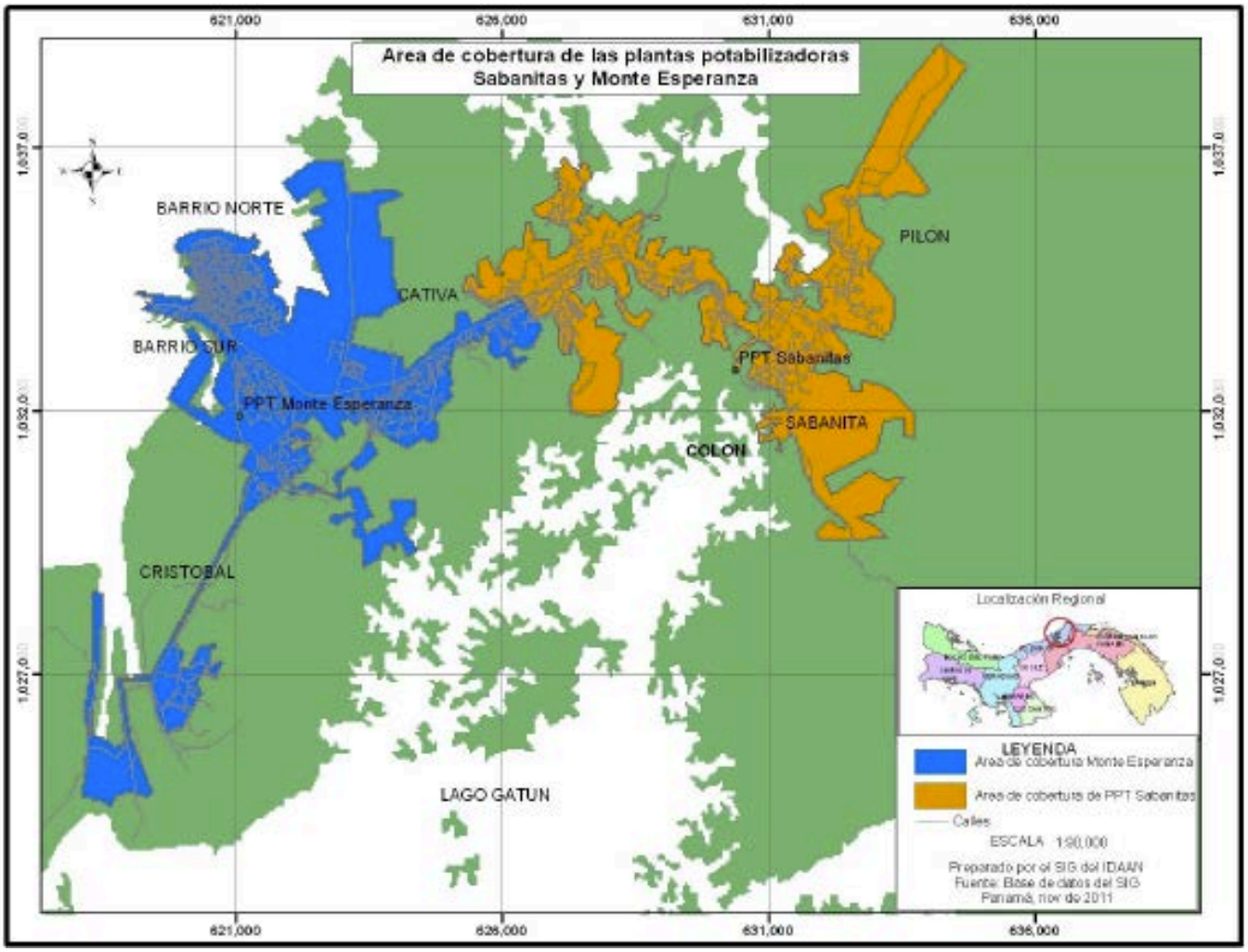
List of interviewees (in order of date on interview):

- José Fierro, Former director of IDAAN
  - February 15th 2012
- Francicsco Arturo Bradley, Plant operator and laboratory assistant at the Sabanitas plant
  - February 16th 2012
- Ricardo Ponce, Engineer for IDAAN-Colon
  - March 1st 2012
- David Michaud, Director of the World Bank project in Panama
  - March 7th 2012
- Roberto Galan, Director of Integrated Water Resources Management at ANAM
  - March 9th 2012
- Oscar Marin, Member of the Planning Department of IDAAN and Collaborator for the World Bank Project in Panama
  - March 13th 2012
- Arnaldo Bramwell, Supervisor of operations at the Mount Hope plant
  - March 23rd 2012
- Carlos Hamilton, Director of IDAAN-Colon
  - March 23rd 2012
- Felipe Cabeza, Union leader for the Frente Amplio Colonense
  - March 27th 2012
- Olga Gutierrez, member of the Frente Amplio Colonense
  - March 27th 2012
  - April 17th 2012
- Plant operator at the Rio Gatun plant
  - April 17th 2012
- Cirilio Gonzalez, inhabitant of Quebrada Bonita
  - April 17th 2012

List of visits (in order of date of visit):

- Water plant Sabanitas
  - February 16th 2012
- Water plant Mount Hope
  - March 23rd 2012
- Casos Sociales en Cativa
  - March 1st 2012
- Water plant Rio Gatun
  - April 17th
- Visit of the communities of Nueva Providencia, Quebrada Ancha, Quebrada Bonita, Nueva Esperanza
  - April 17th

7.3. Appendix 3 Map of areas covered by water treatment plants

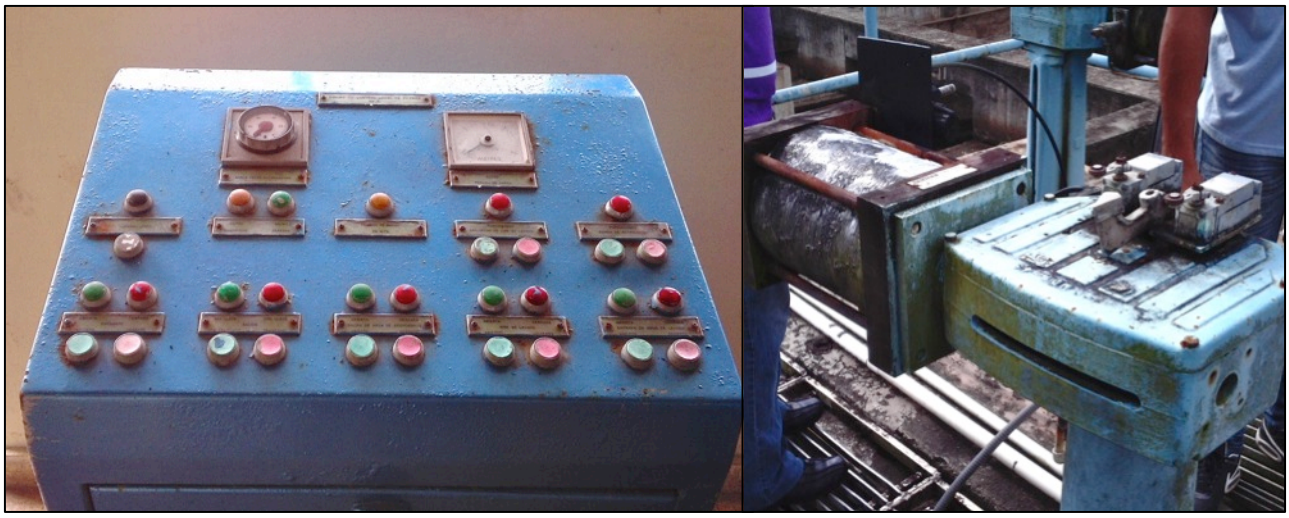


Map of the coverage area of the water treatment plants of Sabanitas and Mount-Hope (Source: IDAAN, 2012b)

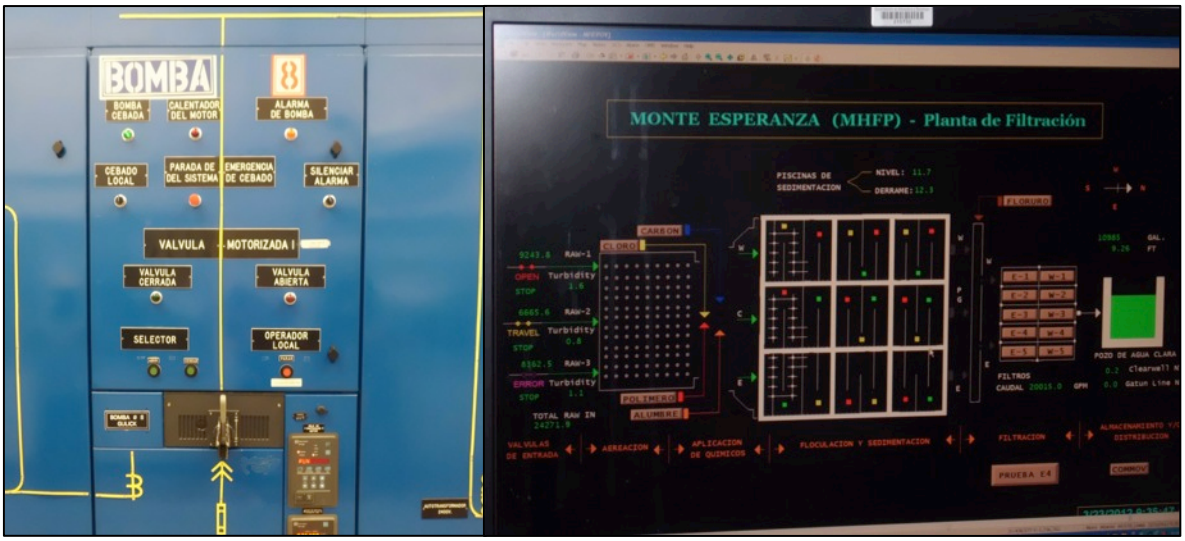
7.4. Appendix 4 Photos of water treatment plants

Left: Photograph of the Sabanitas water plant (taken February 16th 2012)
Right: Photograph of the Mount Hope plant and storage tanks (taken March 23rd 2012)

Photograph of the five pumps at Sabanitas plant. Only four out of five of these are functioning due to the broken sluicegate (taken February 16th 2012)



Photographs of the non-functional automated control system in the Sabanitas plant (taken February 16th 2012)



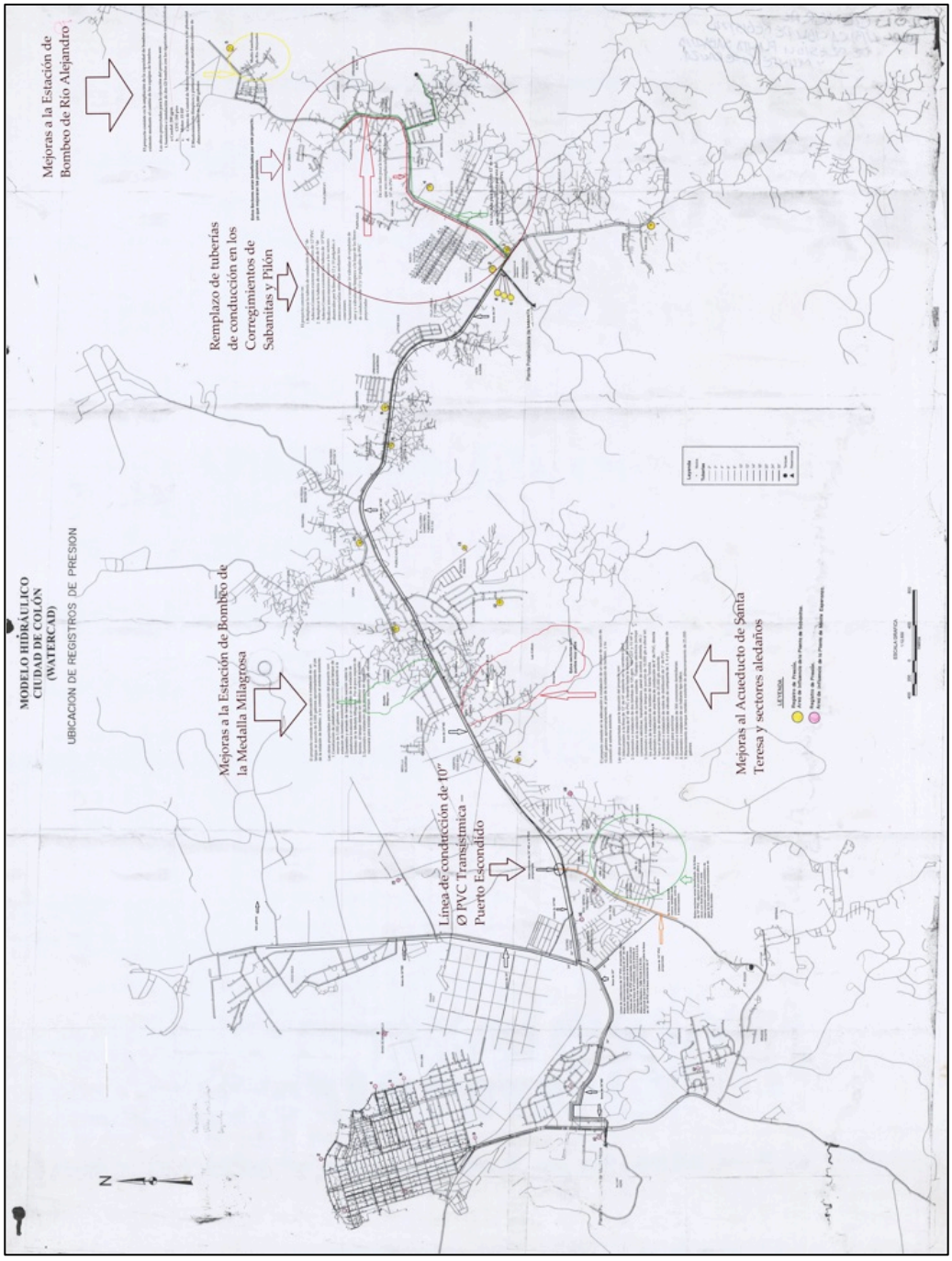
Photographs of the functional control system (left) and computerized control system of the Mount-Hope plant (taken March 23rd 2012)

7.5. Appendix 5 Photos of affected communities

Photograph of the stream a household in Nueva Esperanza uses to wash dishes and clothing. A broken pipe, which is supposed to bring water to the home, is also visible on the picture (April 17th 2012).

Photograph of the IDAAN trucks bringing water to a household in the community of Quebrada Bonita (April 17th 2012).

7.6. Appendix 6 Map of planned projects



Map of the Water Supply Network with future projects and repairs, as prepared by the IDAAN-Colon Engineer R. Ponce (March 2012)