



**Universiteit Utrecht**

The causes and consequences of intermittent water supply in  
urban areas: the case of Buenaventura, Colombia

*Exposing the social, institutional, governance and infrastructure problem of  
intermittent water supply*

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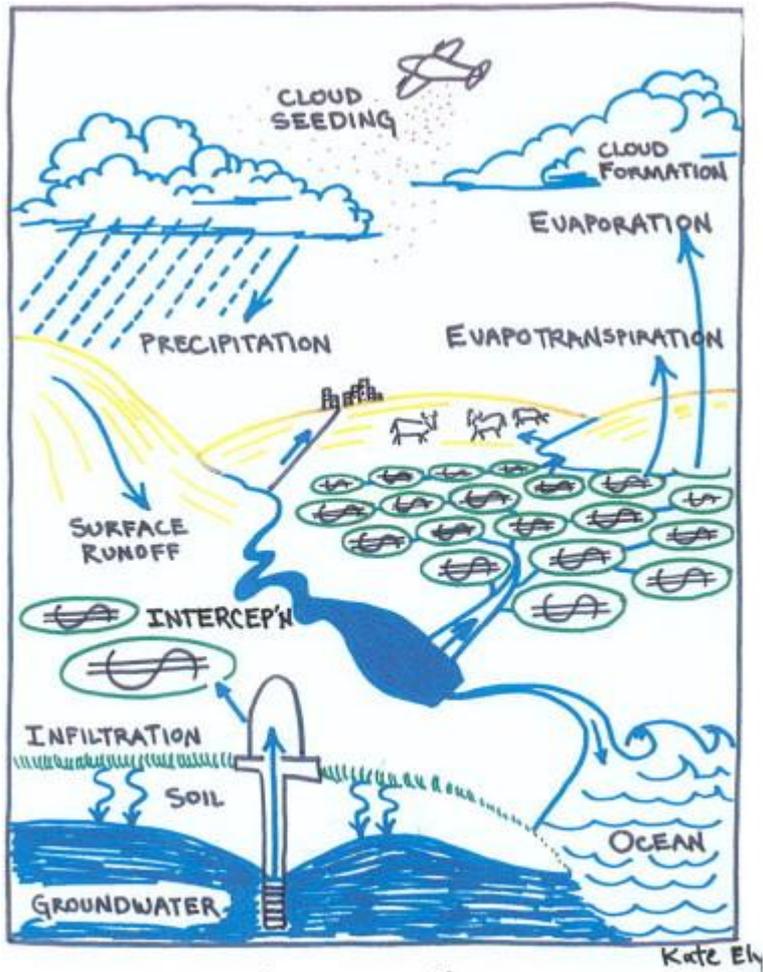
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The hydrologic cycle as it occurs today.  
Water flows to money!

“Water flows to money” (Linton & Budds, 2014, p. 173)

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## Summary (326 words)

Millions of people around the world do not receive a continuous provision of water for drinking and other domestic purposes, which means they have an intermittent water supply (IWS). This has a significant effect on the daily lives of associated residents. In this research, the underlying causes and consequences of water intermittency are studied by placing power relations at the centre of the analysis. These are exposed by the usage of the case study of Buenaventura, a port city in Colombia which experiences water intermittency. This is done by the means of an extensive literature review, six semi-structured expert interviews and the usage of a journal of one of the residents. It focuses not merely on the direct causes and consequences, but on the underlying processes hereof. This presents a new academic perspective on these water systems.

The results indicate that historical developments such as colonization resulting in structural racism and economical neo-liberal processes actively affected the water provision in Buenaventura. This is said to lead to intermittency. It is caused by unequal investments and inadequate and decayed infrastructure. Furthermore, the privatization of the water utility cooperation Hidropacífico created little incentive to invest in the infrastructure because of a focus on cost-recovery and profit. These processes created an environment in which Hidropacífico directs their water provision on the wealthiest individuals, which does not include the residents. The consequences of water intermittency are capture and storage practices by the residents to ensure water in times of discontinuous water provision. This creates health hazards as still-standing water undergoes bio-physical changes which result in an attractive breeding place for animals potentially wearing vector-borne diseases and decreases the quality. Furthermore, it is argued that water intermittency targets the predominately vulnerable such as the Afro-Colombian community and women who found to be further deprived of socially developing due to labour-intensive activities surrounding water provision. Unequal power relations, either based on class, race and ethnicity and/or gender, cause and enforce water intermittency.

## 1. Introduction to the problem statement

One of the biggest contemporary challenges has to do with the resource water. “Like oil in the 20th century, water could well be the essential commodity on which the 21st century will turn.” (Zabarenko, 2011) There are approximately 1.2 billion people worldwide who experience physical water scarcity (Aboelnga, 2019). Very few countries either have sufficient natural sources or financial resources to ensure persistent water availability. It is expected that this will worsen in the future due to persisting climate change (Mokssit et al., 2018). Ensuring water availability and provision of sustainable water management is part of the sixth Sustainable Development Goal (SDG) calling for better usage of the already scarce water source (UNEP, 2018). The SDGs are formulated by the United Nations in 2015 and function as the blueprint to achieve a better and more sustainable future for all (United Nations, 2015).

The entire water sector is an extremely important and intertwined component of the global system. Historically, water-related issues concentrated on the notion of the physical scarcity of the resource (Biswas & Tortajada, 2010). These issues were preferably handled by investing in supply-side solutions such as the creation of new water plants and developing more advanced facilities (Kleines et al., 2009). Nowadays, water management is not merely considered to be a problem of natural availability, but also a distribution one. Water in urban areas is distributed by networks known as water infrastructure. Water infrastructure refers to the entire water flows in a system including water supply, wastewater and drainage (Makropoulos & Butler, 2010).

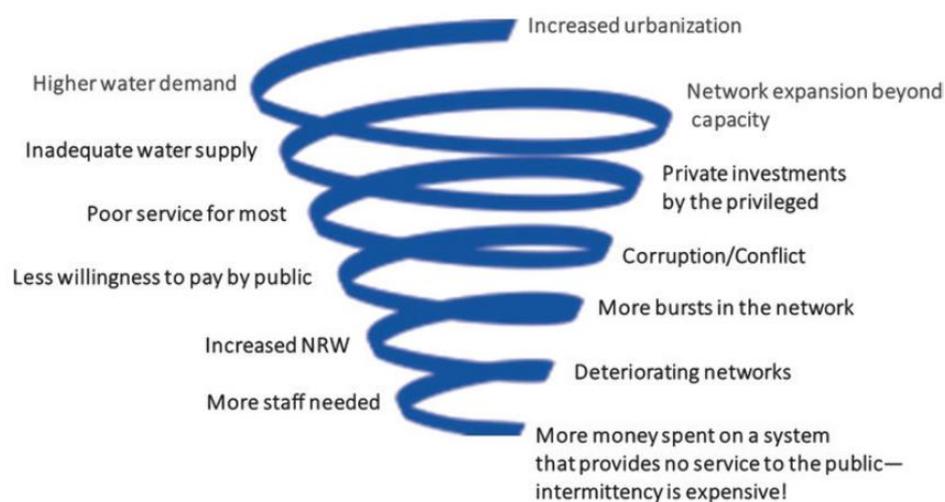
Water is increasingly being studied within a broader context, including “social, economic, institutional, and environmental dimensions” (Aboelnga, 2019, p.6). In this vein, urban waters (including wastewater, ground and surface water, piped water system and flood water) are seen “as the product of socio-natural processes, such as changes in land-use, hydrological processes, social organization, shifts in governance, and technological innovations” (IHE Delft, 2021). Water operation is context-dependent as access to water and water services is dependent on legislation, political organization, geophysical conditions and social norms (Zwarteveen et al., 2017). Therefore, it is argued that water-related problems are also problems of governance. Water governance will be referred to as “the practices of coordination and decision making between different actors around contested water distributions” (Zwarteveen et al., 2017, p. 2).

## 1.2 Water intermittence

Millions of people around the world do not receive a continuous provision of water for drinking and other domestic purposes, which means they have an intermittent water supply (IWS) (Kumpel & Nelson, 2016). Intermittent water supply systems remain especially prevalent in developing countries (Fan et al., 2014). In this research, intermittent water supply is defined as: “(...) a piped water distribution service that provides water to users for less than 24 h a day” (Mokssit et al., 2018, p. 5).

Water intermittency is a complex problem and the causes and consequences hereof have not been systematically studied (Kumpel & Nelson, 2016). Nonetheless, researchers agree that there are considerable disadvantages connected to an intermittent water supply (Totsuka et al., 2014; Kumpel & Nelson, 2014; Simukonda et al., 2018). In a broader context, an intermittent water supply is often understood as a result of a malfunctioning relationship between water management and the water source (Mokssit et al., 2018). There are three categories of anomalies that either relate to issues of investment and infrastructure; to the management of water; or to the resource itself (Totsuka et al., 2004).

There are severe problems relating to inconsistent water provision, including economic, social, technical and political problems as well as severe health risks (see Annexe 1) (Mokssit et al., 2018). It is argued that having an inadequate water infrastructure is a self-fulfilling prophecy that will keep itself in place (Simukonda et al., 2018). This so-called ‘downward spiral of water intermittency’ has been predominant in research concerning intermittent water supply systems and indicates common causes and consequences in these systems (Charalambous et al., 2017, Mokssit et al., 2018).



**Figure 1:** The downward spiral of intermittent water supply systems (Charalambous et al., 2017)

It is argued that water intermittency is not merely dictated by external developments such as increased urbanization as is indicated in the downward spiral presented by Charalambous et al. (2017). Moreover, inherent inequalities ensure a more structural problem of intermittency. Water provision and related

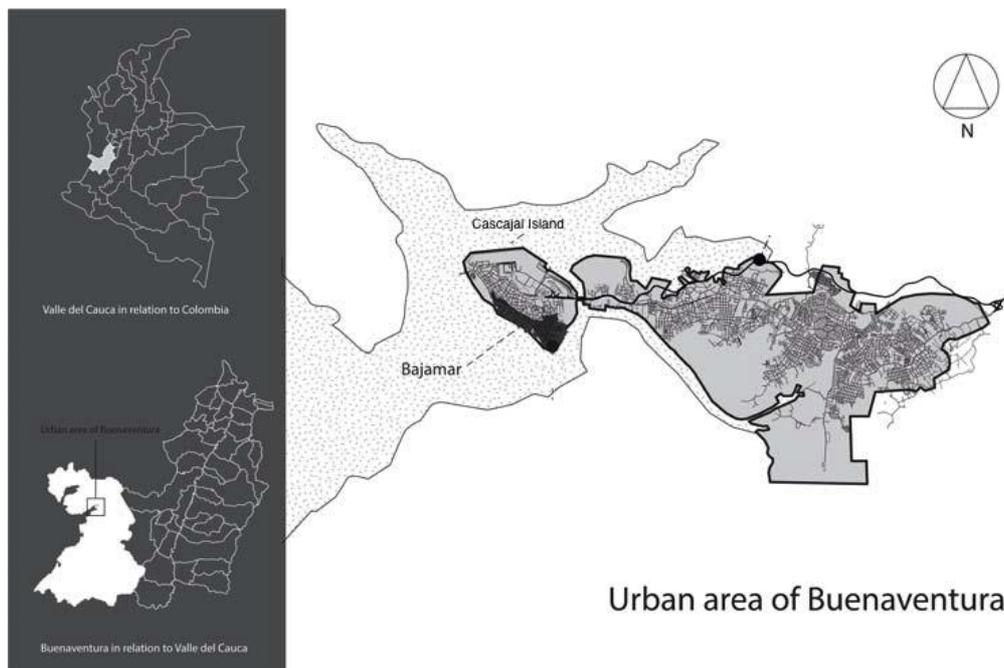
costs and risks are dependent on existing institutions and power relations based on social-economic status, historical constructions around race, gender and ethnicity (Zwarteveen et al. 2017). This thesis puts power relations at the centre of the analysis, taking considering their consequences on the water infrastructure and water governance as these relations are argued to be important. It will embark on the case study of the city Buenaventura, a city in Colombia with an intermittent water supply system. To guide this study, the following research question is asked:

What are the causes and consequences of water intermittency in Buenaventura, Colombia?

This research aims to enhance knowledge about these systems. This is highly important because water availability is to be considered a right (UN General Assembly, 2010) which is not the case for people living in areas with intermittent water supplies.

## 2. Introduction to the case study: Buenaventura

Colombia is one of the world's richest countries in terms of biodiversity, minerals and freshwater (Lavaux, 2006). It is envisioned that Colombia will experience rapid economic growth and increased trade in the nearby future. This requires an enhanced logistic organisation and better infrastructure, especially in the coastal areas (Netherlands Enterprise Agency, 2018). Because of this reason, this research focuses on the biggest port cities of Colombia, namely Buenaventura.



**Figure 2:** Location of the urban area of Buenaventura with the notation of the poor residential area Bajamar retrieved from Lombard et al. (2021) and edited by the author (accessed 27 June, 2021).

Buenaventura is a city located on the West coast of Colombia, in the area Valle del Cauca. The municipality of Buenaventura has a population of over 400,000 inhabitants of which over 90% is Afro-descendant (Lombard et al., 2021, p. 6). The city houses the biggest port adjacent to the Pacific Ocean. The port of Buenaventura handles the majority of the trading of the country, including over 30% of all Colombia's imports (Alcaldía de Buenaventura, 2020). The city of Buenaventura is divided into two zones; Cascajal Island, where most of the port infrastructures are located and which is relatively well-organized, and the continental area where most of the inhabitants of the city live. Residential neighbourhoods bordering the port such as Bajamar are increasingly threatened by encroaching infrastructural developments of the port (Lombard et al., 2021). Whilst the port is rapidly expanding, the city remains heavily neglected by the national government and the social situation of Buenaventura's residents is deteriorating. Violence within the city is increasing simultaneously (Jenss, 2020). The average life expectancy is 51 years old, being 11 years below the national average. At the

beginning of 2020, 34% of the total population was unemployed (Acevedo-Guerrero, 2021) and of those who do, the majority works in the informal sector (DANE, 2020). The residential neighbourhood's poverty level of 66% was way above the national average of 49% (Lombard et al., 2021).

The city lacks basic infrastructures and the public services are generally very poorly managed. One of the biggest problems that Buenaventura encounters is a lack of a continuous water supply. Approximately 80% of the population that does have a connection to the water grid, do not receive more than five hours of continuous water flow a day (Acevedo-Guerrero, 2021). Furthermore, 26.3% of the total population did not have any access to improved water sources in 2018 (DANE, 2020).

The dissatisfaction of the residents about their socio-economic status resulted in the biggest strike in the port's history in May 2017 lasting in a restrained of the port for 22-days straight (Acevedo-Guerrero, 2021). Afro-Colombian and indigenous civil society organizations such as Proceso de Comunidades Negras (PCN) started the strike in call for better sanitation, health care centres and electricity supplies (Janss, 2021). It is argued by Rodríguez-Garavito et al. (2008) that the predominately Afro-descendants living in the coastal areas of Colombia fall victim to continuous marginalization whilst the national government denies the fact. This, whilst Afro-Colombians fall victim to internal displacement over 80% more than the *mestizo* population and with their infant mortality being almost twice as high (Rodríguez Garavito et al., 2008). In reaction to the strike, the government promised to invest and improve the situation. However, three years later in 2020, the residents of Buenaventura did not receive water for over 12-days in a row (Buenaventura Benlinea, 2020).

## 3. Theory and Concepts

### 3.1 Concepts

#### 3.1.1 (Water) Governance

Water is a complex resource. It holds physio-chemical characteristics and it is also incredibly important in the social dimension. Governance refers to the implementation of regulations and policies. The concept is inclusive as “it embraces the relationship between a society and its government” (Rogers & Hall, 2003, p.4). Water governance is understood as the range of political, social, economic, and administrative systems which are founded for the organization and management of the water resource and the corresponding services at various geographical scales (Rogers & Hall, 2003; Barros, 2013). Traditionally, water was governed and distributed by the state as a sole actor. Today, water is managed by a wide variety of actors such as NGOs, local communities and private actors. The term governance leaves room for other actors outside of the state (Lemos & Agrawal, 2006). This is partly due to the processes unleashed by the doctrine of neo-liberalism.

##### *3.1.1.1 Neo-liberalism*

Neo-liberalism is the development of a changing state-society relationship in governance, as it has moved to a “governance-beyond-the-state” (Swyngedouw, 2005, p.1991). It entails a diverse set of policy reforms to include private sector participation. The objective was to increase the efficiency and operationalization of public utilities through market forces (Swygedouw, 2005). The process started in the 1970s in the context of financial crises but escalated in the 1990s in the development world. Ever since, water management all over the world underwent institutional and organisational changes (Furlong, 2010). This is because a market enforced neo-liberal solution was deemed to be a good solution for complex water-related issues. However, deregulation has been proven to have severe negative consequences if not coordinated correctly. This led to problems concerning institutional capacity (Furlong, 2010) and contributed to deepening existing social problems in Latin America (Castro, 2008). Castro (2008) states that private sector participation is not useful in developing countries as it contributes to social inequalities.

#### 3.1.2 Water infrastructure

Water infrastructure refers to all water flows in a system including water supply, wastewater and drainage (Makropoulos & Butler, 2010). Water is being distributed via an infrastructure, consisting of pipes, sewers, dams and irrigation canals. Water undergoes physio-chemical changes as a reaction to its surroundings. With water being a flow resource, it is difficult to capture the complexity of the interaction between water and its infrastructure due to its interconnection with it (Acevedo-Guerrero, 2018). The water infrastructure of an urban area gives insight into the historical development of a city (Star, 1999). Access to water can be traced along with racial and ethnic categories, as a result of context-

dependent historical developments (Alfonso Sierra, 2020). Water infrastructures have a critical role in the management of urban populations (Anand, 2012). Having an insufficient or inadequate water infrastructure also has effects on the way that governments, utilities, and consumers deal with water as a resource. Insufficient financial means could for example result in exudence of formal water infrastructure, which leads to an increase in informal water extraction (Ahlers et al., 2014). Therefore, water distribution is also dependent on the financial capacities of households in an urban area. Financial means ensure the technological capacities that consumers and providers need to organize the water distribution. Informal, or illegal, water connections are prevalent. This creates intensive water usage in a part of the city results in the withholding of water in others, which are most likely poorer areas (Zwarteveen et al., 2017). This deteriorates the infrastructure even more. Water utilities often camp with receiving insufficient investments to foresee this. This, in turn, is dependent on the decision-making process of governments as well as private investors. Therefore: governance and infrastructure are interrelated.

### 3.1.3 Power relations

Urban waterways cannot be understood outside their social and ecological dimensions due to the undeniable links between them (Truelove, 2011). However, only recently have researchers considered the value of a territorial analysis to study the underlying power relations in urban settings (Lombard et al., 2021). By the means of organizing territory with boundaries, also known as territorializing, the existing set of power relationships in that area is defined and enforced (Blomey, 2019). The distribution of water as a resource, therefore, can expose existing power relations. Research by Swyngedouw (2004) following policies concerning the organization of piped water infrastructures concludes that socially privileged classes are often connected to better infrastructures than the poorer citizens. These infrastructures are often due to their historical context. The research of Bayona-Valderrama et al. (2021) states that the location of wealthier areas in Maputo, Mozambique, is dependent on the process of urbanization caused by the Portuguese colonization in the 19<sup>th</sup> and 20<sup>th</sup> centuries. Up to this day, this determines the water infrastructure and distribution in the city.

Socially constructed categories as race, ethnicity and gender used to classify and differentiate people (Alfonso Sierra, 2020) and are therefore important for understanding water infrastructure and water governance.

#### 3.1.3.1 Race and Ethnicity

The concept of race is a social construct that refers to the externally-imposed categorization based on certain physical features as skin colour. Individuals are classified based on their physical and superficial features. Race and racial classification date back to the first histories of colonization by European countries (Alfonso Sierra, 2020).

Ethnicity is a social construct that refers to a group identity based on notions of shared history, culture and kinship (Nagel, 1994). Whilst race is externally defined, ethnicity is a self-cribed group identity (Alfonso Sierra, 2020). Although both concepts are context-dependent, they often overlap. For example, research on Afro-Colombian populations concludes that colour and corresponding racial allusion is a consequence of historical interactions among populations and cannot be confounded on individuals (Acevedo-Guerrero, 2018). This means that the distribution of people over an urban area is often a result of historical developments and that social status and racial status are interrelated.

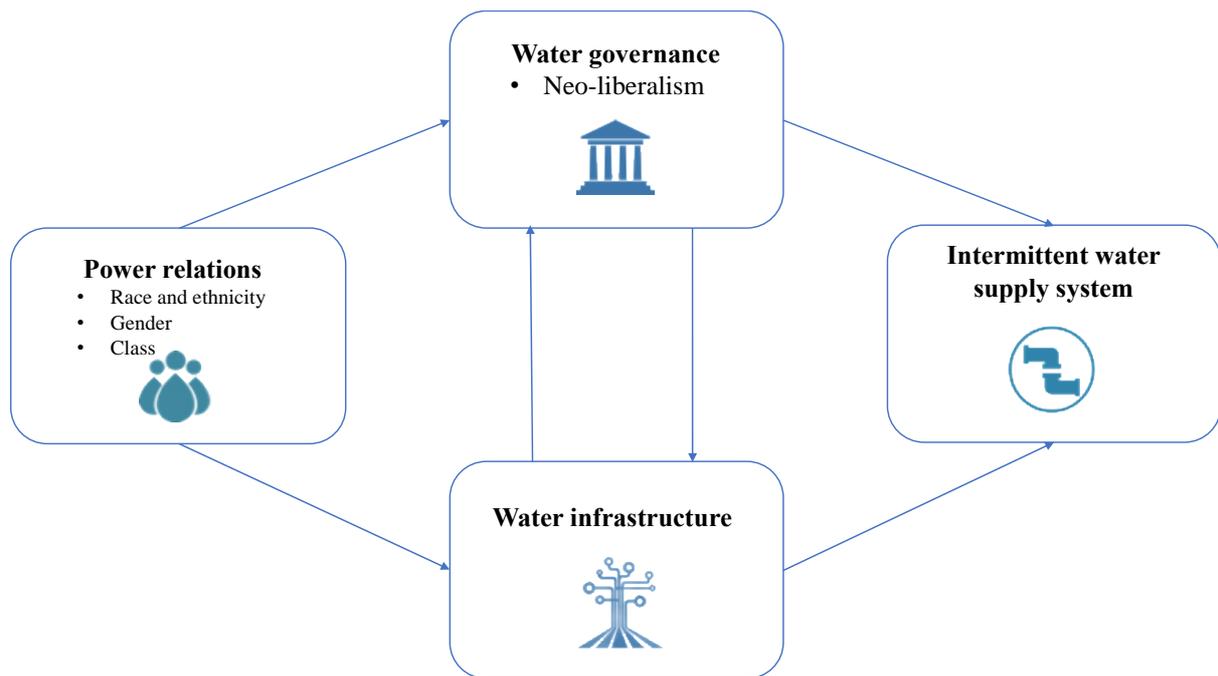
### *3.1.3.2 Gender*

Gender refers to the socially constructed roles ascribed to men and women, that is, the social meaning given to biological sex differences. It also encompasses the relations of power between the sexes which are revealed in a range of ideas and representations which make reference to labour and resources division as well as to their abilities, preferences and desires (Agarwal, 2000). Furthermore, “gender relations are both constituted by and help constitute (...) practices and ideologies, in interaction with other structures of social hierarchy such as class, caste, and race” (Agarwal, 2000, p.1).

Truelove (2011) argues that existing subjectivities within the water infrastructure reinforce existing gender inequities. “Everyday practices relating to resources and technology contribute to social differentiation and new gender configurations of power” (Truelove, 2011, p.145-146). Where women are in charge of domestic activities (including water-related ones), they are disproportionately affected by water intermittency because they are held responsible for the collecting and treatment of water (Acevedo-Guerrero, n.d.).

## **3.2 Conceptual framework**

This research combines the aforementioned concepts to contribute to the debate on intermittency by putting power relations at the source and centre of the analysis. It is argued that the underlying power relations of an area heavily affect the way water is governed and how the water infrastructure has developed. The concept of class within power relations refers to the financial means of the residents. Water governance and water infrastructure, in turn, affect intermittent water supply. The conceptual framework is visualized below.



**Figure 3:** The schematic representation of the conceptual framework

By building from concepts of power relations, water governance (including neo-liberal water management) and water infrastructure, the underlying causes and implications of water intermittency are studied.

## 4. Research methodology

This section includes the research methodology of the research. The methodology is composed of qualitative data analysis. I have performed a systematic literature review, together with several semi-structured interviews with experts and data of one of the residents is included. Themes resulting from the proposed conceptual framework will be analysed by the usage of a qualitative research methodology to gather information to increase the understanding of the phenomenon of water intermittency. The corresponding qualitative data is “subjective, rich and consists of in-depth information” (Wong, 2008, p.14). The qualitative research follows a thematic analysis of deductive nature as the conceptual framework is constructed based on existing literature. Thematic analysis is a “method for identifying, analyzing, organizing, describing, and reporting themes found within a data set” (Nowell et al., 2017, p.1). Due to the combination of sources, the data is expected to be more reliable and cover more relevant aspects of the topic.

### 4.1 A systemic literature review

Knowledge advancement needs to build on existing information and then identify the knowledge gaps (Xiao & Watson, 2019). For this research, a semi-systemic review is conducted. This type of analysis is useful to achieving themes and theoretical perspectives, to “synthesize the state of knowledge” (Snyder, 2019, p.335). Due to the wide, interdisciplinary scope of this research, studies from different relevant disciplines will be included ranging from biology, environmental science to political science.

#### **Literature identification**

The literature review will include various important keywords and concepts. The mainly used renowned search engine is Google Scholar, as it is used by large quantities of researchers from different disciplines for research purposes (Xiao & Watson, 2019). Various inclusion criteria need to be considered. It is argued that this research will only include papers that meet all the following criteria: 1) the article adds to the understanding of the proposed research topic, 2) the articles need to be peer-reviewed, 3) the articles need to apply to the proposed geographical area. The extensive literature review will also include grey literature such as official documents and reports from the municipality of Buenaventura as well as renowned international organizations such as the United Nations in both English and Spanish.

### 4.2 Semi-structured interviews with experts

To create an overarching conceptualisation of the underlying organization of the water supply system in Buenaventura, six semi-structured interviews are conducted with experts in the area of water supply and water infrastructure (see Annexe 2 for the participation information). The semi-structured interview is used as it is the most frequently used data collection method in qualitative research (Kallio et al., 2016). The method employs a combination of set questions with possible context-dependent follow-up

questions to ensure valuable insights and understandings about the research topics (Adams, 2015). The questions will contain enquiries about general causes and consequences of water intermittency; water intermittency in Buenaventura and the stances of the influence of the underlying power relations. Dependent on the approval of the interviewee, the interview will be recorded. The transcripts of the interviews will be included in Annexe 4. To answer the proposed research question, it is of importance to construct an analysis of the collected data. The transcripts of the interviews are coded and analysed with the programme NVivo. The nodes used are based upon the proposed conceptual framework. Therefore, it is expected that the themes resulting from the analysis are in line with the framework and the existing literature.

### 4.3 Research project

This thesis is written within the framework of the research project: “Managing water, fighting mosquitoes: climate change, gender, & equity in access to water in peri-urban Colombia” (for more information, see IHE Delft (2020)). The project is led by Dr. María Cecilia Roa-García as was made available by the principal researcher Dr. Tatiana Acevedo-Guerrero. Access was granted to data from the research group and I was able to attend a meeting with one of the residents. She is an Afro-Colombian woman in her 30s living in a low-income area in Buenaventura, with a predominant informal sector, which experiences water intermittency. She has written a water journal and describes accurately how she, for three months, deals with the intermittent water supply. The inclusion of this journal in the thesis creates a unique perspective on the dynamics of residents with water and their relations with the intermittent water supply. For this research, she will be referred to as Clara.

### 4.4 Reliability & validity

Reliability and validity are related to the rigour in the described method of research and express the integrity hereof (Robert & Priest, 2006). It is argued that all qualitative research deals with some interpretation. Therefore, the quality of the analysis is dependent on how well the researcher can distance him/herself to the data (Bengtsson, 2016). It is argued that the constructed conceptual framework with a clear description of the used concepts, creates this distance and ensures that the research can easily be conducted again.

### 4.5 Ethics

It is acknowledged that the topic of research and its concurrent findings might contain sensitive information. This research will to carefully act upon this data in line with the codes of conduct presented by Utrecht University in line with the “The Netherlands Code of Conduct for Research Integrity 2018” (KNAW et al., 2018). This guarantees academic integrity during academic research.

## 5. Results and analysis

In the following section, the results are presented. It contains the information gathered through the semi-structured interviews and the water journal of Clara, the Afro-Colombian woman in her 30s living in a low-income area of Buenaventura. It is important to acknowledge that the specific problems relating to water intermittency are always subjective, as “water intermittency will always depend on the context” (A. Bayona-Valderrama, personal communication, May 19, 2021). The associated main themes will be presented below. Primarily, the concept of power relations will be applied to the case study, after which concepts of water governance and infrastructure are analysed.

### 5.1 Power relations

Power relations within an urban area affect the water distribution affectively, but water distribution is also based upon these power relations. Therefore, it is important to study the historical development of an urban area to understand underlying power relations and socio-economic processes. Spatio-temporal relations are interrelated with “asymmetrical classed, racialized, and gendered power relations” (Jenss, 2021, p.68). Historical discursive relations of power enacted by the previous, possibly colonial, governments could implicate certain relationships that are embedded in the contemporary identities of people (Kooy & Bakker, 2008).

In the case of Colombia, we see two main historical developments that affect our understanding of power relations in the region. The first one is colonization. The influence of colonial history on the social dimension in Latin America did not receive academic attention until the second half of the 20th century (Cubillos, 2018). The power relations between the colonizer and the colonized are rather evident as the one held political, social and economic power over the other. The entire colonial system in Hispanic America was namely based on Spanish legislation and political decision-making (Moreno, 1967). This enforced unequal power relations based on people’s racial characteristics.

The other important development, which is highly related to the European colonization, is the historical marginalization of the Afro-descendant Latin-American citizens as a result of the transatlantic slave trade (Herrera, 2012). Slavery resulted in forceful displacement, especially in the coastal area of Colombia. With 90% of the population of Buenaventura being Afro-descendent, it is argued that the majority of the Afro-Colombian community living in the city has endured a long history of prejudice already. Moreover, the Afro-Colombian population continues to be victimized during conflicts in modern Colombian history (Acevedo-Guerrero, 2019). “As the citizens of present-day Afro-Latin-American struggle to escape the economic heritage of poverty and dependency left by plantation agriculture, they do so over the shadow of the social heritage of racial and class inequality left by slavery.” (Andrews, 2004, p.5) This is acknowledged by residents in Buenaventura, as is the notion of the existence of structural racism (Schmidt, 2021). Structural racism is interrelated with the unequal development of water infrastructure (Kooy & Bakker, 2008). Institutionalised social processes such as

racism cause structural insufficient investments in the maintenance and enhancement of the infrastructure in certain areas. “So, the same story for Buenaventura, you can see that patterns of lack of investment do seem to overlay on areas with a more significant Afro-Colombian community.” (M. Lombard, personal communications, 15 June, 2021) According to Lombard, there exists a discourse amongst scholars about the selective intervention of investments in the infrastructure which has to do with racialized discrimination (personal communication, 15 June, 2021). This manifests in unequal power relations.

### 5.1.3 Gender

Due to the water intermittency, residents need complimentary means to ensure sufficient water provision and find manners to capture and store water themselves. The water journal of Clara explains that a very common measure to do so is to capture the rainfall. Clara states that, when the rain comes, the residents can supply themselves with water and can carry out domestic activities, ensure personal hygiene or prepare food. To do so, residents need to capture rain and are required to build water tanks inside their homes to retain the water. “The service water was intermittent a few years ago, so they [residents of Buenaventura] build a tank that is outside and inside the house” (A. Bayona-Valderrama, personal communication, May 19, 2021). The process of water provision is very labour-intense in terms of the cleaning of the tanks and the treatment of water to ensure its quality. This is necessary to prevent organic matter to enter the tank, otherwise, mosquitos will place their larva and develop quickly. Financial capacity is necessary for the purchase of water tanks. If there is no money for the ownership of a water tank, water is stored with other means such as water bottles.



**Figure 4:** The capture of water in plastic bottles due to an intermittent water supply in Buenaventura, Colombia (IHE Delft, 2020).

Women have a significant role in the management of the intermittent water provision in these communities. Women are considered to be the caretakers of domestic households. This oftentimes includes the fetching, collecting and cleaning of the water. “In many occasions, women are the caretaker in the home. (...) [T]aking care of the home implies taking care of the water and taking care of the food. These are specified goals that we learn from early on. And this implies that women are going to be more in touch with water. Ranging from the ones that handle water, to clean or handling water to cook, or making sure that there is enough water in the house, so that means queuing for the water at someplace and bringing it back home” (A. Bayona-Valderrama, personal communication, May 19, 2021).



**Figure 5:** A woman using captured water for domestic purposes in Buenaventura, Colombia (IHE Delft, 2020).

It is expressed by Clara that the mother and grandmother of the household are responsible for the collecting of water and other domestic purposes. Clara admits that her day-to-day activities concerning the collecting of water increase the amount of effort she needs to put into her other duties. This emphasizes the amount of time that the women are busy with the assurance of water. This tends to exclude a lot of women from investing their time elsewhere which subsequently excludes certain opportunities. This is also why intermittent water supply systems reinforce power relations of women: women are considered to take care of the domestic households and therefore have little time to put their time into other activities outside of these traditional activities.

As women generally are more actively engaged with water, they are more likely of being exposed to mosquitos. This creates a higher chance of getting infected with vector-borne diseases like Malaria or Dengue. Outbreaks affect vulnerable communities, and therefore women, disproportionately which makes them even more vulnerable (Bayona-Valderrama, 2020).

#### 5.1.1 Class: financial means

The differences in power relations ensure large differences concerning the income and financial power of the residents. Due to the intermittent water system, financial means are necessary to ensure some constant and safe water provision. However, some residents cannot pay the bills in the first place. The high unemployment rate enforces problems with water intermittency. “If you want to keep and maintain the water supply system, from my point of view, you have to solve the problem of unemployment in

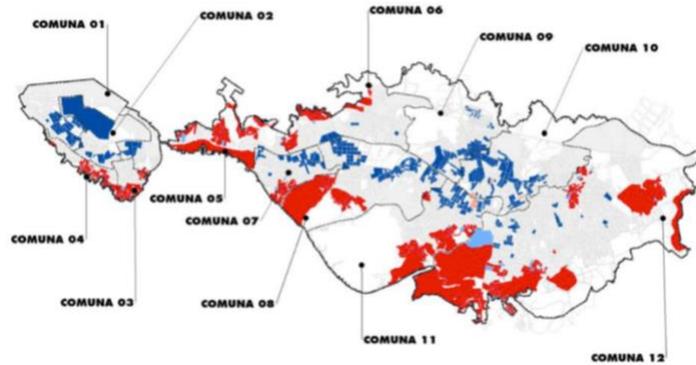
Buenaventura.” (C. Durán, personal communication, June 3, 2021) Before, the majority of the residents of Buenaventura was employed by the port: *Puertos de Colombia* (COLPUERTOS). This way, the residents could enjoy some of the benefits of the investments in the port. “So, there was a better connection between the community and the port in the ports earlier days. Because there used to be a labour relationship.” (M. Lombard, personal communication, 15 June, 2021). Due to the Act 1a of the Colombian Constitution of 1991, COLPUERTOS liquidated because the neo-liberal policy was “giving the private sector greater participation in infrastructural investment by granting concessions for installations and permitting their operation by private agents” (ECOSOC, 1991, p. 100). This resulted in the privatization of the national port authorities, which took from 1991 to 1993 (Gaviria, 1998) and the port expanded. A cheaper workforce was found elsewhere and the majority of the residents lost their jobs in the port. The residents currently are predominantly without a job or working in the informal sector (DANE, 2020). Furthermore, the process of neo-liberal privatization as a result of Act 1a affected the organization of Buenaventura immensely.

## 5.2 Water governance

In Buenaventura, it is evident that the problem of water availability is a problem of governance and not a problem of bio-physical water scarcity (Lavaux, 2006).

“(…) [I]t is a problem of governance, you have the Villa Estela river, that is the main contributor of water for Buenaventura, there are also other rivers if you do not have the capacity for the demand, but the stats show that the Villa Estela river is sufficient for providing water to the people, it is just because of decisions made around the water supply system.” (C. Durán, personal communication, June 3, 2021)

In Buenaventura, the water intermittency is thus a case of decision-making around water supply systems. Financial means are found to be particularly important when it comes to the process of water governance. Durán argues “(…) that understanding intermittency is very good of the perspective of power relations because you can see that it is not that hard to place a sufficient infrastructure, but it is a matter of who decides if they are going to put the money there.” Moreover, he states that “[t]he people with money decide where the water flows” (C. Durán, personal communication, June 3, 2021). Therefore, the problem is the focus of the national government to expand the port, whilst not giving sufficient investments for the residents. “In Buenaventura, all of it is contextualized by port expansion, essentially, and which loans are earmarked for port expansion” (M. Lombard, personal communication, 15 June, 2021). Below, a map is presented of the city with corresponding concentrations of deprivation of water sources. What is observed, is that the port area (*Comuna 02*) and the historic city centre (blue centre at the right) have sufficient water provision and the border areas where the residents live such as Bajamar (*Comuna 04*) are deprived of water.



**Figure 6:** Territorial display of the levels of concentrated deprivation of water sources in Buenaventura, Colombia, the red areas express the high concentration of deprivation and blue a low concentration of deprivation of water sources (DANE, 2020).

The aforementioned is a problem of selective intervention and investment: it is not a case of not having the financial capacity or resources, but there is structurally being decided to not spend these on the residents.

### 5.2.1 Organization of the water management

Another prominent contributor is the mismanagement of the water utilities in Buenaventura (Huffington, 2020). There are now two important actors concerning the management and provision of water in the city of Buenaventura. There is *La Sociedad de Aceuducto y Alcantarillado de Buenavenutra* (SAAB) and there is *Hidropacífico*. SAAB is the contracting entity, which has been operating since May 24, 2001, that was established to administer the transition to private water provision. SAAB is the most important actor concerning the management of the water infrastructure, being according to their website: the entity entirely responsible for managing the public services of the water infrastructures by planning, building and administering it completely for the entire District of Buenaventura (SAAB, 2019). Hidropacífico is in charge of the management of the water utilities (Hidropacífico, n.d.). Hidropacífico was established as the operator, with a contractual agreement with SAAB since 2002 lasting 20 years. The two enterprises are interrelated, as one is responsible for the administration of water management, and the other responsible for the infrastructural management of the water. The water management of the city used to be in the hands of the regional public utility: Acuavalle (Acevedo-Guerrero, 2021). Due to increased urbanization in the region as a result of the expansion of the port, the utility did not provide sufficient water and received criticism. The previously mentioned Colombian Constitution (1991) also created an opportunity for the privatization of water management (Acevedo-Guerrero, 2021). Both Hidropacífico and SAAB are privatized enterprises providing a public service, which means that their organizational structure is centred around making a profit. This affected the governance of the water utilities in Buenaventura substantially. “I think that the privatization in Buenaventura started in the water supply system has started in the 2000s, but the merchandising of the

water, the water understood as an economic good from before that. It is hard to privatize water, but you can privatize the water supply system. That is what is they have done.” (T. Acevedo, personal communication, June 3, 2021)

The narrative behind the policy design of the private sector participation in Colombian municipalities was to enhance the service and to make it more accessible. However, this resulted in increased tariffs which made inaccessible to low- and medium-income households (The World Bank, 2006).

Furthermore, the privatization leads to the disengagement of the residents. “From the end-user perspective, it came with some disengagement from what the service is, I think that the user no longer sees the water service as something to be proud of like this is the service and they are taking care of me, but more like something that, that is an enterprise.” (A. Bayona-Valderrama, personal communication, May 19, 2021)

These two developments created a situation in which the residents of Buenaventura did not only have the financial means to receive water, they did not feel inclined to pay for it. However, if they did not pay the tariffs, they would be cut from the water network and they would not have any water provision left. This is part of the downward spiral of water intermittency.

### 5.2.2 Counter neo-liberal movement

In opposite to the neo-liberal movement, there is now a countermovement of some sort ascending. The contract of the company Hidropacífico with the municipality of Buenaventura ends this year (2021), so it is expected that the governance of the water utilities will most likely change. The people of Buenaventura want to regain power over the water and wish to re-organize the system so that the management of water will fall into the hands of the public ones more (Acevedo-Guerrero, 2021).

“(…) [T]he water supply system and the port has been governed by other actors from Cali and Bogota from outside, but not from the people of Buenaventura, what they try to do now, is to govern themselves.” (C. Durán, personal communication, June 3, 2021)

The new mayor of Buenaventura, Victor Hugo Vidal, seems to be determined in doing so. It is namely not only a problem of non-participation of the residents but there is a problem of structural exudence of the predominantly Afro-Colombian population in the pacific as presented above. Vidal belonged to the social movement Proceso de Comunidades Negras (PCN), and was one of their important spokespersons during the strike of May 2017 (Buenaventura, n.d.). During this major strike, these human rights advocacy groups called out for the rights and the inclusion of the population including the marginalized Afro-Colombian population. The residents felt and still feel excluded, as “all people were in the street, but mostly those that are very vulnerable that don't have a study that they are not

studying. They don't have employment. Here they say from them that they are *nini's. ni empleo, ni educación*. So, they have nothing to lose (...)." (C. Roa, personal communication, June 14, 2021) The inclusion of the population in the management process of water could very well prove valuable. "[I]f you have more participation from discriminated groups in, decision making instances more possibilities to have better policies to respond to those because they care, it's a basic principle because they care because they are from there because they are that people." (T. Alfonso Sierra, personal communication, 3 June, 2021)

### 5.3 Water infrastructure

The problem of water intermittency in Buenaventura is in part very simple. "This is due to a lack of infrastructure. The infrastructure is too old. There are little investments." (C. Durán, personal communication, June 3, 2021) To ensure a safe water intermittent supply system, you need a well-functioning infrastructure that can distribute the water throughout the urban area. The foundation of the water infrastructure of an urban area is in turn also dependent on the location's historical developments. "The centre portions of the city are the ones that the cities' infrastructure was first laid out, and then from there on, it starts extending." (A. Bayona-Valderrama, personal communication, 19 May, 2021) The infrastructure does not always expand together with the neighbourhoods in the city (see figure 6). This has resulted in areas of the city being completely cut off of the water infrastructure. "It has been a problem from the 1970s because of the lack in the water supply system. You can see from the 1970s, just 50% had even infrastructure to connect to the water supply system from their homes. It remains to be like this up to this day." (C. Durán, personal communication, June 3, 2021)

Additionally, water infrastructure requires a lot of maintenance. The privatization of the water utility was supposed to lead to increased maintenance and investments in the water infrastructure. This has not been the case. The water utilities deny water to the residents if they are unable to pay the increased fees. Hidropacífico delivers the water to those who can pay the bills as they are trying to retain full cost-recovery as a privatized company. This creates a focus on the port and not the residents. The additional problem is that Hidropacífico does not use the obtained profit to increase the construction or maintenance of the infrastructure. "(...) [Y]ou can sell water to the port, that is alright, but you can use this money to invest in infrastructure, and this is something that Hidropacífico is not doing." (C. Durán, personal communication, June 3, 2021) This means that the already deteriorated and insufficient infrastructure in place is not maintained sufficiently and provides the already scarce provision to the highest bidder.

This lack of infrastructure causes many problems associated with water intermittency. Clara explains that the sewage system is inadequate and it has not been updated since the years have passed. Because

of this, the water has nowhere to go and still leaks over the walls to the streets. This creates damage to the already vulnerable housings, but it also creates bad odours and attracts disease-transmitting mosquitos and rats. Clara expresses her concern that children as young as three years old experience health issues due to the inadequate water infrastructure. To foresee these issues, “[y]ou need the infrastructure and you need to make sure that the water is safe throughout the distribution network and it is such an expensive endeavour.” (A. Bayona-Valderrama, personal communication, May 19, 2021) In this vein, it is due to a lack of investments in the infrastructure that people are required to ensure some form of water provision for themselves.

Buenaventura’s resident Clara emphasizes that there are large differences within neighbourhoods as well, as not everybody from the same street or neighbourhood have access to the water infrastructure. Some do not have the financial means to pay the bills, in other cases the water infrastructure is not strong enough to cover the high number of houses. Also, the use of water pumps by some residents ensure that there is not sufficient water left to reach other homes in the neighbourhood. The means for ensuring water provision by one decrease the availability to others from the community.



**Figure 7:** Resident’s extension of the water infrastructure in a low-income neighbourhood in Buenaventura, Colombia (IHE Delft, 2020).

Some residents do so by ensuring a water provision by illegally connecting to the infrastructure. “You see a problem with illegal connections, because some neighbourhoods like Bajamar, they have not been

recognized as legal neighbours so the people keep making illegal connections, and that damages the infrastructure and the water supply system.” (C. Durán, personal communication, June 3, 2021) The illegal connections deteriorate the infrastructure. An insufficient water infrastructure makes it therefore difficult to exclude the bacteria in the system. “(...) pathogens like E.coli, or let us say all the pathogens that are signalled by E.coli, and Cryptosporidium, the ones that transmit fever, cholera: all of those are living in water and we create barriers so these organisms do not reach us at the tap.” (A. Bayona-Valderrama, personal communication, May 19, 2021) With a system deterioration, a lot of health hazards are connected due to a decrease in the water quality running through the system. This deteriorates already scarce and intermittent provision.

## 6. Discussion

In this research, the underlying causes and consequences of the intermittent water supply system in Buenaventura are studied. This is done so by placing power relations, specifically those surrounding race, gender and class, at the centre of the analysis. Important historical developments as colonization and slavery and economical processes such as neo-liberalism are emphasized. Because of this, the obtained data contribute to the understanding of water intermittency and places it in a broader, social-economical context.

### 6.1 Causes

One of the main causes for the water intermittency has to do with a lack of investments in the structure of the piped water distribution, not only in the development hereof but also in the maintenance. This is interrelated with multiple facets of power relations. There is consensus in the literature that the national government has not invested much in the predominantly Afro-Colombian city of Buenaventura due to structural racism. This is a product of decades of marginalization of the Afro-Colombian community as a result of colonization and the slave trade. It prioritizes investments in the port over the residents, which can be inferred as the port is explaining whilst the social situation of the population deteriorates.

Another cause is the management of the water utility by actors Hidropacífico and SAAB. Here, it is important to highlight the role of neo-liberalism in the governance of the resource which pushed the city to privatize its water utility in 2002. Some authors argue that because of this, the utility is not incentivised to do investments in maintenance because of the 20-year contract. Also, privatized companies are interested in full cost-recovery and profit which resulted in disengagement by the residents and an increase in the water bills. This intensified the focus on the clients that have sufficient financial means to afford this which often port-related entities. This is caused by the power relations of class because it enforces financial power structures.

### 6.2 Consequences

The consequences of water intermittency reinforce power relations. One of the most prominent consequences of water intermittency is the need for water capture and storage practices due to the uncountability of the water provision. Considering that there often is not even a formal connection to the water infrastructure in the first place. This also creates practices by residents with water pumps. These are only accessible for the ones with sufficient financial means as they are expensive. These enforce class differences as the wealthier residents intercept water provision from others. Power relations are involved because water intermittency occurs more frequently in low-income, Afro-descendant families working in the informal sector. These communities have a higher probability of being targeted by the negative consequences related to intermittency. Water intermittency creates a higher probability of sources being contaminated due to its complex physio-chemical characteristics.

This is because the water is captured. Still-standing water creates suitable breeding places for animals as mosquitos and rats which can carry vector-borne diseases.

Moreover, this thesis argues that intermittency has an important gender aspect as women are expected to take care of the domestic aspects and therefore have more to do with water. The collecting and cleaning of the water are labour-intensive denying women to invest their time into other activities as making them more vulnerable to illnesses as they are more exposed to these still standing water sources. This deepens the power relations between genders. An unforeseen consequence of intermittency in Buenaventura is the public participation resulting as a reaction to the years of mismanagement of the water utility. This is referred to in the thesis as the counter neo-liberal movement which could be considered a positive consequence. It is presented that the inclusion of the residential community, such as the PCN, could prove valuable in the future management hereof.

In line with the conceptual framework, which serves as a hypothesis, it is argued that water intermittency is not a problem of physical scarcity but a problem of governance. This research recognizes the theory of the downward spiral of intermittency by Charalambous et al. (2017) as this is considered to be true for the residents of Buenaventura as well (see figure 1). Increased urbanization did result in higher demand and the management of Acuavalle went to Hidropacífico.

It is argued that the neo-liberal doctrine is not useful for the management of the water sector as it did contribute to increased social injustice as stated by Castor (2008). In agreement with Rodríguez-Garavito et al. (2008), the results do point out that the deprivation of the residents has to do with the existence of structural racism in Colombia.

The results build on the existing notion of Mokssit et al. (2018) that an intermittent water supply is understood as a result of a malfunctioning relationship between water management and the water source. However, it goes further than that. This research argues that this malfunctioning relationship is caused by the inequity of racial, ethnic and gender relations which cause and enforces it eventually resulting in water intermittency. The marginalization of the residents in terms of the intermittent water supply finds her source within the social dimension concerning power relations, which in turn deteriorates their social status. It is argued that this unique perspective is not well enough explored in academic research. Also, the results indicate the significant role of women in these communities which is an often-overlooked consequence of water intermittency. Up until now, academic research tends to focus at the direct causes and consequences of intermittency, such as an inadequate infrastructure in place which indeed is to be considered important. However, looking at the source of these inadequacies is argued to be a more sustainable strategy.

### 6.3 Limitations

There are limitations associated with the conducted research. The generalization of the results is limited by the context-dependency of water intermittency as it is difficult to study without the usage of a case

study. However, the presented conceptual framework could be used for the analysis of other cases of water intermittency. Another limitation was a strict time constraint.

It is recommended that in upcoming research, an interdisciplinary perspective is advised to be used because water intermittency is interrelated within multiple dimensions and encompasses different disciplines. More attention should be given to the topic of water quality which was briefly touched upon in this research. Inclusion of water quality measurement could enhance the understanding of the deteriorating infrastructures and result in recommendations for investments herein. Also, it has to be taken into account that the management of the water utility in Buenaventura is on the verge of changing strategies as it is expected that the contract of Hidropacífico will not be extended. The mayorship of Vidal provides hope for the necessary institutional changes. Following these developments would present a good opportunity for increasing the understanding of private/public management of (public) utilities and water intermittency in developing countries.

## 7. Conclusion

Not being able to receive a continuous water provision significantly affects the quality of peoples' lives. Whilst the importance of water supply is widely accepted, urban areas in countries all over the world still camp with problems herein. Water intermittency is a relatively new academic focus whilst arguably being one of the most complex problem areas of water management mainly due to its context-dependency. To understand the underlying causes and consequences of water intermittency in urban areas, the case study of Buenaventura, Colombia is used. The data is derived from a systemic literature review, six expert interviews and documentation of one of the residents.

Due to the focus on power relations, it is argued that historical developments concerning colonization and slavery caused the current environment of water intermittency. The causes are insufficient investments, an inadequate and decayed infrastructure. Moreover, the privatization of the port results in a focus of the water utility on the port instead of the residents of the city. The aforementioned neo-liberalism process has caused the water bills to even further increase, which created a disengagement with the water from the residents. The intermittent water supply system results in additional costs for both the provider as the consumer and increases capture and storage practices which are labour-intensive activities. This creates health hazards due to diminished water quality and increased exposure to disease-carrying animals. This disproportionally goes for the Afro-descendent community and women.

Unequal power relations, either based on class, race and ethnicity and/or gender, cause and enforce water intermittency. The new dawn of water governance in Buenaventura, with the inclusion of public participation of the marginalized communities in the policy design, could present effectively in the creation of a more equal and just water supply.

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## Annexe 1: Associated problems with an intermittent water supply

In addition to the previously explained causes and consequences concerning the case study of Buenaventura, there are some universal trends associated with water intermittency.

Water intermittency creates an environment for contamination of the water. Inadequate access to safe drinking water and basic sanitation is still a major cause of disease outbreaks worldwide (Boakye-Ansah et al., 2016). With water being a flow resource, it will be easily contaminated when kept stored as it will undergo physio-chemical changes. Another possible unforeseen consequence of this is, is that stored water transforms into a suitable mosquito habitat which consequently leads to the spread of deadly diseases (Bayona-Valderrama et al., 2021).

Economically, water provision is important for private incomes as most professions are dependent on a consistent water supply. Insufficient water availability results in residents being required to collect, transport and store water. Income is considered to be a strong indicator of the ability of households to receive a consistent water flow. Poorer neighbourhoods are oftentimes coupled to worse connections to the water infrastructure or do not have the financial means to safely store water (Boakye-Ansah et al., 2016; Acevedo-Guerrero, T., 2018). Ultimately, it is stated that insufficient access to sanitation is a cause for economic loss of approximately US\$260 billion annually (Katko & Hukka, 2015).

Intermittent water flows cause pressure differences in the pipes which deteriorate the quality of the pipes. This also could lead to health hazards, leakages and higher maintenance costs (Totsuka et al., 2004). Boakye-Ansah et al. (2016) document how communities with a majority of low-income households, generally experience not only inadequate water infrastructure but also insufficient maintenance activities. This, in part, is what Charalambous et al. (2017) mean with the ‘downward spiral of decline’.

## Annexe 2: Information about the respondents

<b>Participate number</b>	<b>Date of interview</b>	<b>Name of expert</b>	<b>Profession and expertise</b>	<b>Consent</b>
<i>Participant 1</i>	May 19, 2021	Angela Maria Paula Bayona-Valderrama	Biologist and researcher in water intermittency in urban areas	Written consent (see annexe 3)
<i>Participant 2</i>	May 26, 2021	Has requested to remain anonymous	Expert in water science and water intermittency	Verbal consent for the usage of information and not name
<i>Participant 3</i>	June 3, 2021	Camilo Andrés Durán Acevedo	Lawyer and Graduate Assistant of Honorific Teaching at Universidad de Los Andes in Colombia	Written consent (see annexe 3)
<i>Participant 4</i>	June 3, 2021	Dr. Tatiana Andrea Alfonso Sierra	Full-time professor in ITAM's law department, psychologist and lawyer from the Universidad de Los Andes, Colombia. Additional expertise in the sociology of law, studies of race, ethnicity, and development.	Verbal consent
<i>Participant 5</i>	June 14, 2021	Dr. Clara Eugenia Roa García	Chemical Engineer and Magister in Sanitary and Environmental Engineering from the Universidad del Valle. Senior researcher at the project “Managing water, fighting mosquitoes: climate change, gender, & equity in access to water in peri-urban Colombia”.	Verbal consent

<i>Participant</i> 6	June 15, 2021	Dr. Melanie Lombard	Lecturer in Global Urbanism at the Global Urban Research Centre in the School of Education, Environment and Development at the University of Sheffield	Verbal consent
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**Table 1:** Participation information of the expert interviews

### Annexe 3: Consent Forms

It is emphasized that the interviewees were informed that they could withdraw at any given time throughout the interview and that the information required from the interviews will be not be used for any other purposes. Before the start of the interview, an e-mail was sent to the interviewees with information about the research and the consent form.

The consent forms of Angela Maria Paula Bayona Valderrama and Camilo Andrés Durán Acevedo are added as the other consents were given verbally during the interview. All of the participants have received both the Participant Information Sheet and the Participant Consent Form to ensure that they were aware of their participation throughout the interview.

## 3.1 Participant Information Sheet



Universiteit Utrecht

### RESEARCH PARTICIPANT INFORMATION SHEET

#### **The causes and implications of intermittent water systems in urban areas: a case study of Buenaventura, Colombia**

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Supervisor: dr. Tatiana Acevedo-Guerrero  
Professor at the Copernicus Institute for  
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[t.acevedoguerrero@uu.nl](mailto:t.acevedoguerrero@uu.nl)  
+31 302530000

Version date: 2<sup>nd</sup> of July, 2021

#### **What is the purpose of this study?**

The purpose of this study is to research the underlying processes of intermittent water supply systems and exposing the social, institutional, governance and infrastructure hereof. This is done so by presenting a conceptual framework stating that power relations, such as race, ethnicity and gender, historically have affected and still affect the organization of water governance as well as water infrastructure. Power relations therefore have an important, but arguably underrated, effect on the water intermittent water supply. This research aims to create a more inclusive understanding of the implications of discontinuous water provision in urban area. This is done so by focusing on the case study of Buenaventura, Colombia.

#### **What will I do if I choose to be in this study?**

Participating in this study means agreeing to an online semi-structured interview centering water intermittency. The methodology of this research includes expert interviews as a means to derive qualitative data. The research includes the expert opinion of researchers specializing in water management to identify prominent factors and indicators for water intermittency. Also, the research will include an analysis of the role of power relations in Buenaventura, Colombia by interviewing experts in the region. There are no identified risks associated with participating in this research.

#### **How long will I be in the study?**

The interview will take up to an hour at most.

#### **Will information about me and my participation be kept confidential?**

Your responses will be kept strictly confidential, and digital data will be stored in secure computer files. Any publications based on this research will only include your name or any other individual information by which you could be identified if it is agreed upon. The project's research records may be reviewed by departments at Utrecht University responsible for regulatory and research oversight. Confidentiality protection is ensured. This consent applies for the duration of this study, up to August 2021 at the latest.

**What are my rights if I take part in this study?**

Your participation in this study is voluntary. You will not be paid for your participation. You may choose not to participate or, if you agree to participate, you can withdraw your participation at any time without being penalized.

**Who can I contact if I have questions about the study?**

If you have questions, comments or concerns about this research project, you can talk to one of the researchers. Please contact Femke van der Zaag, student performing this research or the supervising professor dr. Tatiana Acevedo-Guerrero.

## 3.2 Participant Consent Form



### RESEARCH PARTICIPANT CONSENT FORM

#### **The causes and implications of intermittent water supply in urban areas: a case study of Buenaventura, Colombia**

Femke van der Zaag  
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Supervisor: dr. Tatiana Acevedo-Guerrero  
Professor at the Copernicus Institute for  
Sustainable Development University Utrecht  
t.acevedoguerrero@uu.nl  
+31 302530000

Version date: 2<sup>nd</sup> of July, 2021

- I voluntarily agree to participate in this research study.
- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted.
- I have had the purpose and nature of the study explained to me in writing and I have had the opportunity to ask questions about the study.
- I understand that participation involves an interview for a duration of a maximum of an hour in which the interviewer will ask me questions concerning my expert opinion.
- I understand that I will not benefit directly from participating in this research.
- I agree to my interview being recorded.
- I understand that all information I provide for this study will be treated confidentially.
- I understand that disguised extracts from my interview may be quoted in this bachelor thesis only.

- I understand that signed consent forms and original audio recordings will be retained in the personal archive of the researcher until the publication of the thesis,
- I understand that a transcript of my interview in which all identifying information has been removed will be retained for the period of two years depending on the specific requirements of the exam board of the university in question,
- I understand that under freedom of information legislation I am entitled to access the information I have provided at any time while it is in storage as specified above.
- I understand that I am free to contact any of the people involved in the research to seek further clarification and information.

I give my consent to the interview being audio-visually recorded

I give my consent to the publication of my name and job title in the research

Yes	No

*Signature of research participant*

-----

Signature of participant

-----

Date

Femke van der Zaag

I believe the participant is giving informed consent to participate in this study



Signature of researcher

2<sup>nd</sup> of July, 2021

Date

### 3.3 Consent form of Angela Maria Paula Bayona-Valderrama



Universiteit Utrecht

**RESEARCH PARTICIPANT CONSENT FORM**

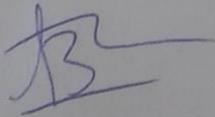
**The causes and implications of intermittent water supply in urban areas: a case study of Buenaventura, Colombia**

Bachelor thesis Global Sustainability Science (GSS)

Femke van der Zaag Student Liberal Arts and Sciences University Utrecht <a href="mailto:f.m.vanderzaag@students.uu.nl">f.m.vanderzaag@students.uu.nl</a> +31627037030	Supervisor: dr. Tatiana Acevedo-Guerrero Professor at the Copernicus Institute for Sustainable Development University Utrecht <a href="mailto:t.acevedoguerrero@uu.nl">t.acevedoguerrero@uu.nl</a> +31 302530000
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Version date: May 19, 2021

- I voluntarily agree to participate in this research study.
- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted.
- I have had the purpose and nature of the study explained to me in writing and I have had the opportunity to ask questions about the study.
- I understand that participation involves an interview for a duration of a maximum of an hour in which the interviewer will ask me questions concerning my expert opinion.
- I understand that I will not benefit directly from participating in this research.
- I agree to my interview being recorded.
- I understand that all information I provide for this study will be treated confidentially.
- I understand that disguised extracts from my interview may be quoted in this bachelor thesis only.



1

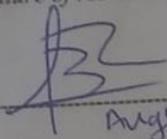
- I understand that signed consent forms and original audio recordings will be retained in the personal archive of the researcher until the publication of the thesis,
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- I understand that under freedom of information legislation I am entitled to access the information I have provided at any time while it is in storage as specified above.
- I understand that I am free to contact any of the people involved in the research to seek further clarification and information.

I give my consent to the interview being audio-visually recorded

I give my consent to the publication of my name and job title in the research

Yes	No
X	
X	

*Signature of research participant*

  
 \_\_\_\_\_  
 Angela Bayona  
 Signature of participant

19.05.2021

Date

Femke van der Zaag

I believe the participant is giving informed consent to participate in this study



Signature of researcher

19-05-2021

Date

