



Norwegian University
of Life Sciences

Master's Thesis 2019 30 ECTS

Faculty of Landscape and Society

Department of International Environment and Development Studies

Urban Wastewater Governance in Huila, Colombia: Policies, Practices and the Path Towards Fulfilling the Sustainable Development Goals by Recovering the Magdalena River

Víctor Andrés Renza Avellaneda

MSc International Development Studies

Urban Wastewater Governance in Huila, Colombia: Policies, Practices and the Path Towards Fulfilling the Sustainable Development Goals by Recovering the Magdalena River



Wastewater flows under Puente Santander in Neiva

Photo: Víctor Renza

**MSc Thesis by Víctor Renza
Faculty of Landscape and Society
Department of International Environment and Development Studies
NMBU
2019**

The Department of International Environment and Development Studies, Noragric, is the international gateway for the Norwegian University of Life Sciences (NMBU). Established in 1986, Noragric's contribution to international development lies in the interface between research, education (Bachelor, Master and PhD programmes) and assignments.

The Noragric Master's theses are the final theses submitted by students in order to fulfil the requirements under the Noragric Master's programmes 'International Environmental Studies', 'International Development Studies' and 'International Relations'.

The findings in this thesis do not necessarily reflect the views of Noragric. Extracts from this publication may only be reproduced after prior consultation with the author and on condition that the source is indicated. For rights of reproduction or translation contact Noragric.

© Víctor Andrés Renza Avellaneda, August 2019
victor.renza@nmbu.no

Noragric
Department of International Environment and Development Studies
The Faculty of Landscape and Society
P.O. Box 5003
N-1432 Ås
Norway
Tel.: +47 67 23 00 00
Internet: <https://www.nmbu.no/fakultet/landsam/institutt/noragric>

DECLARATION

I, Víctor Andrés Renza Avellaneda, declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

Signature.....

Date.....

“For achieving good governance political will is necessary. Good governance is a political process. Though role of civil society is critical, without political will and political process, sustainable good governance cannot be achieved”.

Narendra Modi, Prime Minister of India.

ACKNOWLEDGEMENTS

During these months of research and writing, several people have given me a hand in the most difficult moments and have shown me their affection to which I am forever grateful. First, I want to thank you Andrea. During these years of adventures in Norway you have been my support, my inspiration and my motivation to continue. I have no words to thank you for everything you have done for me. This is our achievement, without you none of this would have been possible. Thanks to my beloved family. Thank you for your constant words of support, your prayers, your messages, your help during my fieldwork and all what you have given to me. I love you very much, and this achievement belongs to all of us.

Kristine, my supervisor, thank you so much for all your support during this process, despite the difficulties we have encountered along the way, we have managed to finish the job, and your advice and support were very valuable to me. I must also thank my alma mater, the Norwegian University of Life Sciences. I am proud to belong to an institution where I always felt happy and where I was able to expand my knowledge and grow as person. A special thanks to Ruth, who with her patience always helped to clarify my tangled ideas around good breakfasts. Also, a big thanks to Anette for her availability, efficiency and assistance at several critical moments; I am very grateful with you.

To Sindre and Pavel from Niva, my most sincere admiration and big thanks. Your time spent on my project has been very valuable, and I hope to continue learning from you in the future. I would also like to thank Gloria Lucia, who has been my mentor in Colombia. I am grateful for your contributions, ideas and the time spent during my field work; I feel very honoured to have had your support. I would also like to thank my informants during my field work. Thank you very much for wanting to participate and donate your time to this work. This thesis goes to those who want a recovered river and more environmentally sustainable cities. The fight for a better Huila must continue, and I look forward to joining you for a better future. Finally, to my friends, Astrid and Benedicte, thanks for our hours in cafes and libraries supporting each other to finish our work. I am sure you will make great professionals in your future careers. Filippo and Fernanda, your words of support during my most difficult moments were so important, thanks dear friends.

ABSTRACT

Colombia and Huila have a great wealth of water which is fundamental for the economic progress of the country and the region. However, wastewater management has not been the best at local level with cities that do not have a wastewater treatment plant yet (WWTP). The purpose of this study is to explore the policies on wastewater management, through the analysis of programs, norms and plans on wastewater treatment and reuse and their implementation to later evaluate the governance of wastewater in three municipalities of the department of Huila. Subsequently, this study explores the impact of the Sustainable Development Goals (SDGs), and especially the SDG 6 on clean water and sanitation, in the processes of elaboration and implementation of the regulatory framework and presents some challenges common to the three cities related to governance in general and wastewater governance. This is a qualitative study where primary data has been collected through semi-structured interviews with four types of informants comprising: policymakers/decision makers, public officers, experts and academics and representatives from NGOs/community members. This study also uses secondary data sources such as governmental reports, journal articles, newspaper articles and private publications to guarantee triangulation and validity of the information. The theories of good, effective and equitable governance are used to frame this study and help to conclude that the governance of wastewater in the three municipalities of this study cannot be described as good nor effective and that challenges such as the overproduction of norms, policies and plans as well as the passivity of those taking decisions and the lack of economic and technical capacities represent central barriers for the improvement of wastewater management in the region. Finally, this study calls for a more effective participation of all actors and the use of circular economy modelling to achieve more sustainable projects that could allow them not only to reach the SDGs within the 2030 agenda, to which Colombia is committed, but also generate benefits for all, leaving no one behind.

TABLE OF CONTENTS

DECLARATION	iii
ACKNOWLEDGEMENTS	v
ABSTRACT.....	vi
LIST OF FIGURES	ix
LIST OF TABLES.....	x
LIST OF ABBREVIATIONS.....	x
1. INTRODUCTION.....	1
1.1. Problem statement.....	1
1.2. Background: Treatment and reuse of wastewater in Colombia and Huila	2
1.2.1. Wastewater and water quality index of the Magdalena River	2
1.2.2. Pollutants, improved sanitation systems, wastewater treatment systems and wastewater treatment plants at national, regional and local levels	3
1.2.3. Water scarcity and reuse of water in Colombia and Huila.....	6
1.3. Objective of the study and research questions	8
1.4. Theoretical framework.....	10
1.4.1. Governance: Good, effective and equitable governance.....	10
1.4.2. Environmental, water and wastewater governance	13
1.4.3. Sustainable Development Goals as a global governance strategy	15
1.4.4. Capacity building for sustainable development	18
2. RESEARCH METHODS	18
2.1. Area of study.....	18
2.2. Research design	20
2.2.1. Qualitative research.....	20
2.2.2. Data collection, qualitative sampling and data analysis.....	21
2.2.3. Semi-structured interviews.....	22
2.3. Limitations and ethical considerations.....	24
2.3.1. Information letter and consent form.....	24
2.3.2. Personal data and requests of anonymisation.....	24

3. RESULTS FROM FIELDWORK	25
3.1. Regulatory framework on wastewater treatment and reuse at the national and sub-national levels: Policies, plans, norms and their relationship with the SDGs	25
3.2. Current situation and stakeholders' perceptions in the three cities of study.....	38
3.2.1. The context of Neiva	38
3.2.2. The context of Garzón.....	49
3.2.3. The context of Pitalito.....	54
3.3. Synopsis of field observations	59
4. DISCUSSION.....	63
4.1. Good governance and wastewater governance to meet the SDG 6	64
4.1.1. Accountability and transparency in wastewater management, the rule of law and fight against corruption.....	65
4.1.2. Recognition of problems at national and sub-national levels and effective participation of all actors for locally grown environmental policies	68
4.2. Effective governance: building capacities for problem solving, implementing and executing plans and policies	70
4.3. Equitable governance to leave no one behind and the need for a more environmentally conscious society	72
5. A CIRCULAR ECONOMY MODEL FOR WASTEWATER GOVERNANCE AS DRIVER OF SUSTAINABLE DEVELOPMENT IN NEIVA	73
6. CONCLUSIONS	75
REFERENCES	78
APPENDICES	89

LIST OF FIGURES

Figure 1. Water Quality Index for the 25 monitoring points in Magdalena's river.

Figure 2. Location of the department of Huila in Colombia and the three municipalities of study in Huila with their respective maps and pictures from the discharging points.

Figure 3. Satellite image of the urban area of Neiva.

Figure 4. Image of Puente Santander North discharging point.

Figure 5. Image of Puente Santander South discharging Point.

Figure 6. Satellite image of the area where the WWTP will be built in Neiva.

Figure 7. Design of the WWTP by Hidrosan S.A.S (Las Ceibas, 2018d).

Figure 8. Satellite image of the urban area of Garzón and the Quebrada Garzón signalled in blue.

Figure 9. A discharging point on Quebrada Garzón.

Figure 10. Wastewater flowing on the street of a slum in Garzón.

Figure 11. Discharging point Quebrada Cálamo.

Figure 12. Satellite image of the urban area of Pitalito with the Guarapas River and Quebrada Cálamo highlighted and the location of the old WWTP with the main discharging point.

LIST OF TABLES

Table 1. Types, quantity and characteristics of informants.

Table 2. National regulatory framework on wastewater treatment and reuse of wastewater.

Table 3. Regional regulatory framework on wastewater treatment and reuse of wastewater.

Table 4. Local regulatory framework on wastewater treatment and reuse of wastewater of the three municipalities.

Table 5. Synopsis of main findings.

LIST OF ABBREVIATIONS

BOD	Biochemical Oxigen Demand
CARs	Corporaciones Autónomas Regionales [Autonomous Regional Corporations]
CAM	Corporación Autónoma Regional del Alto Magdalena
COD	Chemical Oxigen Demand
DAMA	Departamento Administrativo de Medio Ambiente de Garzón [Environmental Administrative Department of Garzón]
DNP	Departamento Nacional de Planeación [National Planning Department]

DDP	Departmental Development Plan
DO	Dissolved Oxygen
EMPUGAR	Empresas Públicas de Garzón [Garzón Public Services Company]
HLPF	High-Level Political Forum on Sustainable Development
IDEAM	Instituto de Hidrología, Meteorología y Estudios Ambientales [Institute of Hydrology, Meteorology and Environmental Studies]
MCM	Million Cubic Meters
MDP	Municipal Development Plan
NDP	National Development Plan
OECD	Organisation for Economic Co-operation and Development
PDA	Plan Departamental para el Manejo Empresarial de los Servicios de Agua y Saneamiento [Departmental Water Plan]
PGIRS	Plan de Gestión Integral de Residuos Sólidos [Integrated Solid Waste Management Plans]
PMAR	Plan Nacional de Manejo de Aguas Residuales Municipales [National Plan for the Management of Municipal Wastewater in Colombia]
PNIGRH	Política Nacional para la Gestión Integral del Recurso Hídrico [National Policy for the Integral Management of Water Resources]

POT	Plan de Ordenamiento Territorial [Territorial Arranging Plan]
PSMV	Plan de Saneamiento y Manejo de Vertimientos [Sanitation and Wastewater Discharges Management Plan]
PUEAA	Plan de Uso Eficiente y Ahorro del Agua [Efficient Use and Water Saving Programme]
SDGs	Sustainable Development Goals
TSS	Total Suspended Solids
UNDP	United Nations Development Programme
WGI	Worldwide Governance Indicators
WWTR	Wastewater Treatment and Reuse
WWTP	Wastewater Treatment Plant
WQI	Water Quality Index

1. INTRODUCTION

1.1. Problem statement

Colombia is a country rich in water resources, bordered by two oceans and crossed by several large river systems that irrigate fertile lands and supply the water needs of the communities. According to the 2014 national water study by the Colombian Institute of Hydrology, Meteorology and Environmental Studies (IDEAM), Colombia has a water yield well above the world average, however the distribution of water is unequal because 80% of the population have access to just 21% of the water supply (IDEAM, 2015). Unfortunately, many of the waterbodies are polluted due to direct dumping of untreated wastewater. As Lopera, Campos & Olarte (2012) indicate, although there is a high percentage of water and sewerage coverage in most of the Colombian municipalities in the Andes region, the usual practice is to discharge sewage directly into the waterbodies without any previous treatment because of the lack of functional wastewater treatment plants (WWTPs). The Department of Huila, which is part of the Andes region, is where the source of the Magdalena River, the most important river in Colombia, is located. The Magdalena River crosses the entire department from South to North and continues its way through the centre of the country until it flows in the Caribbean Sea near Barranquilla. During its journey through the department of Huila, the Magdalena River receives wastewater without any previous treatment from Neiva, the capital city of Huila, facing the first major pollutant before leaving its native region. Likewise, the Magdalena River receives polluted water from Pitalito and Garzón before arriving to Neiva, being an urgent problem that until now has not been addressed.

The rights to have access to water and sanitation are fundamental for the development of our society. Access to water is essential not only for the survival of humans but for their productive development and reduction of poverty (Díaz-Pulido et al., 2009). Therefore, it is necessary for any state to promote practices such as treatment and reuse of wastewater to preserve that vital resource and achieve the Sustainable Development Goals (SDGs) established in the 2030 agenda. According to the Food and Agriculture Organization from the United Nations (FAO), in 2012 Colombia produced 2.34 km³ of wastewater and only 0.73 km³ was treated (FAO, 2017). Thus, it is possible that large amounts of untreated wastewater are arriving to the waterbodies generating

an indirect use of untreated wastewater, which could be a risk for human health and environment. It is required to evaluate the policies and practices for wastewater treatment and reuse in some regions of environmental importance in Colombia, like Huila, to ensure that water-use efficiency and reduction of pollution are carried out. In this way, when comparing policies with practices at regional and local levels and considering the perspectives of stakeholders, we can understand why it has not been possible to provide a solution to the problem of pollution by wastewater to the most important river in Colombia. Furthermore, it would be possible to propose alternatives that make feasible a more environmentally sustainable region that is able to reach the SDGs, especially the SDG 6 by 2030.

1.2. Background: Treatment and reuse of wastewater in Colombia and Huila

1.2.1. Wastewater and water quality index of the Magdalena River

The treatment and reuse of wastewater have an extended normative framework at national level. The definition of wastewater in Colombia is found in the decree 1076/2015 which establishes that wastewater is liquid waste from domestic, commercial and industrial use (Ministerio de Ambiente y Desarrollo Sostenible, 2015). Wastewater has affected the waterbodies' quality in Colombia because they are used as disposal sites for wastewater discharges from different activities, including domestic uses. In general, the water quality index (WQI) of the Magdalena River is not good. According to the last national water study published in 2019, the WQI of the Magdalena River was mostly regular, with acceptable quality in the upper part of the Magdalena River in Huila and very bad quality in the town of Girardot where the Bogotá river flows into the Magdalena River (IDEAM, 2019). This decrease in the river's quality is due to the contributions of pollutant loads from the Bogotá River which is contaminated with domestic-urban and industrial wastewater from the metropolitan area of Bogotá. There are 25 water quality monitoring stations along the Magdalena River to measure different variables to establish its WQI. Figure 1. shows the WQI for each station starting in Gigante, Huila and ending in Barranquilla, where the river flows into the Caribbean Sea.

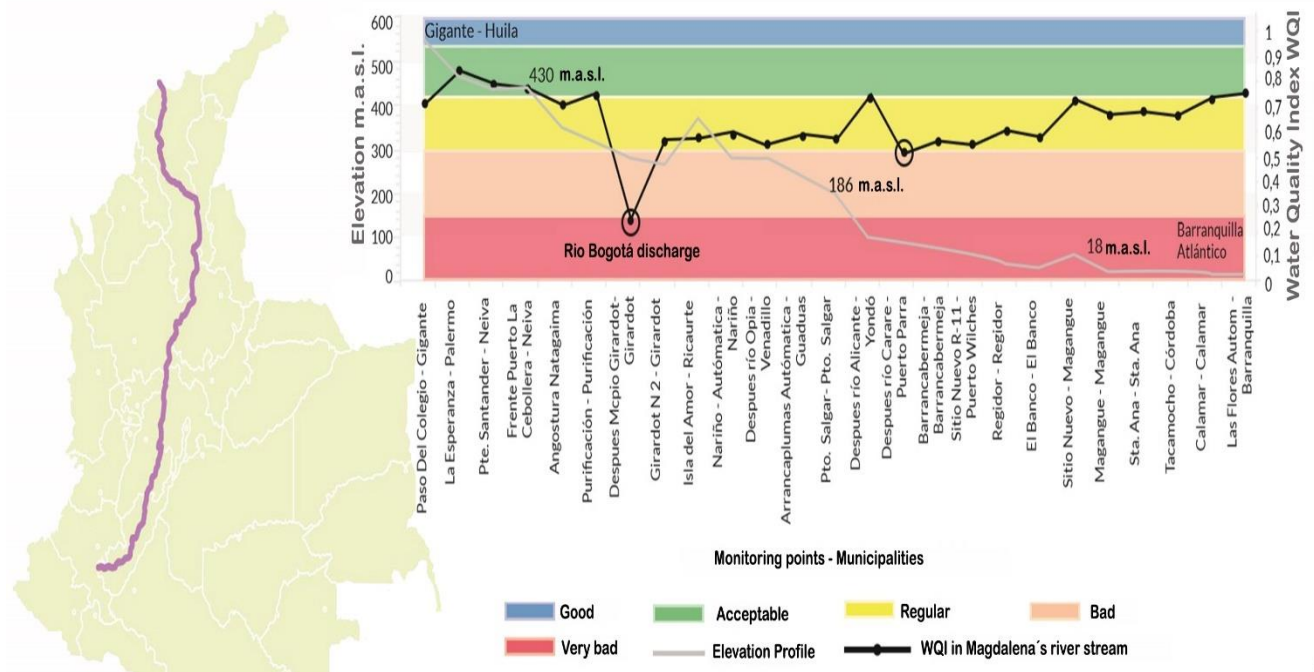


Figure 1. Water Quality Index for the 25 monitoring points in Magdalena’s River (Adapted from IDEAM, 2019:244).

The WQI considers variables such as dissolved oxygen (DO), chemical oxygen demand (COD), biochemical oxygen demand (BOD) and total suspended solids (TSS) among others to establish the quality categories between good, acceptable, regular, bad and very bad. The WQI is categorized from 0 to 1 being 0 very bad and 1 good. There are 4 monitoring points in Huila, starting in the municipality of Gigante and ending in the last monitoring point in Huila called Puerto La Cebollera which is downstream the Santander bridge in Neiva. At this point the WQI experiences a small decrease but remains acceptable as it is shown in Figure 1.

1.2.2. Pollutants, improved sanitation systems, wastewater treatment systems and wastewater treatment plants at national, regional and local levels

The three major sectors responsible for the largest contributors of pollutant loads to the waterbodies in Colombia are the domestic, industrial and agriculture such as coffee plantations. The coffee sector is an important economic driver in Huila; therefore, it is necessary to carry out

more in-depth studies at regional and local levels to clarify the impacts of this activity in the WQI of the Magdalena River. At national level, the industrial sector is the main contributor of pollutant loads measured as DO and COD that are discharged in the waterbodies while the domestic sector is the biggest contributor of TSS as the 2019 National Water Study indicates (IDEAM, 2019). Wastewater treatment is required to purify, disinfect and protect water against recontamination (WWAP, 2019b). To treat the wastewater, a combination of different physical, chemical, and biological processes is applied in wastewater treatment plants (WWTPs). The process stages in the WWTPs are usually classified in primary, secondary and tertiary treatment to indicate the degree of the treatment. In the primary treatment water is pre-treated to remove floating material, coarse solids and part of organic matter. The secondary treatment further removes suspended solids and organic matter, whereas tertiary treatment is employed to remove specific compounds (e.g., nitrogen, phosphorous, heavy metals, suspended solids, refractory organics, contaminants of emerging concern) not removed in previous stages or to provide disinfection.

Some cities in Colombia are using a combination of secondary systems in their plants such as chemical treatments, trickling filters or activated sludges because of their technical and financial advantages. On the other hand, tertiary systems require more complex technology such as ultraviolet or reverse osmosis and imply higher costs and specialized personnel (Superservicios & DNP, 2017) therefore very few municipalities can afford them. Although there are technologies that can efficiently treat up to 80% of the wastewater pollutants with lower costs, many Colombian municipalities, including some important cities like Neiva do not have WWTPs yet.

There are 1122 municipalities in Colombia and 85% of the urban population is covered with improved sanitation systems (FAO, 2017:11). This means that a large part of Colombian population has access to facilities that hygienically separate human excreta from direct contact as the World Health Organization explains (WHO, n.d.). At the same time, 92% of the urban population is connected to a sewerage network (FAO, 2017: 12), i.e. connections to sewer networks that collect wastewater through pipes from its point of origin to prior treatment before finally discharging into the environment (Read, 1997: 1). According to some statistics provided by the National Planning Department (DNP) Colombia went from treating 8% of urban wastewater in 2002 to 43% in 2017 (DNP, 2019). Furthermore, a report on wastewater treatment facilities in

Colombia shows that there are 682 WWTPs in the country of which 23 are in the department of Huila (Superservicios & DNP, 2018). Of those 682 WWTPs reported in the study, 18 use pre-treatment systems, 51 primary treatment, 465 secondary treatment technologies and only 13 used tertiary treatments. The other 149 did not report what kind of technology they were using. These numbers indicate that a great majority of the WWTPs use secondary treatment systems. Other reports such as the technical report on WWTPs in Colombia issued by the Superintendencia de Servicios Públicos in 2014 (Superservicios, 2014) establishes that 492 Colombian municipalities had WWTPs in 2014 while the 2018 national water study by IDEAM reports that only 352 municipalities had WWTPs in Colombia by 2017. Therefore, it is not clear how many municipalities currently have WWTPs functioning correctly and the reporting systems show some weaknesses making it difficult to monitor the wastewater management at national level.

Water and sanitation sector is unstable in Colombia and stakeholders are not reporting on time; hence, there are inconsistencies in the information found and are not completely reliable. The information on sewerage and wastewater is very fragmented and is produced by different entities at both national and subnational levels however this study considers different sources from national and subnational levels trying to have an overview of the matter. Regarding the discharges of wastewater treated at national level, a recent report indicates that the flows of treated wastewater decreased from 28.019 l/s in 2014 to 27.734 l/s in 2017 (Superservicios & DNP, 2018: 64). At regional level, Huila has a sewerage coverage over 95% and 21 of the 37 municipalities in Huila have WWTPs (Asamblea Departamental del Huila, 2016: 99). However, only 21% of the wastewater produced in Huila is treated since the three most populated cities: Neiva, Pitalito and Garzón do not have WWTPs. Moreover, these three cities produce more than 70% of the pollutant loads that arrive to the Magdalena River or its tributaries (CAM, 2018). Just Neiva supplies more than 50% of the pollutant loads in respect to BOD and TSS in the department (CAM, 2018), therefore, it is urgent to find ways to reduce the discharges in the river and reuse the wastewater that could be useful to avoid water scarcity during dry seasons.

1.2.3. Water scarcity and reuse of water in Colombia and Huila

Colombia's water resources are large but are not evenly distributed among the population because of their locations and weather seasons (IDEAM, 2019). Most Colombians live in the centre of the country along the Magdalena-Cauca rivers. Though, the Magdalena-Cauca basins provide approximately 273,000 million cubic meters (MCM) of water per year, this is lower compared to less populated areas such as Amazonas and Orinoco, which have over 500,000 MCM of water according to IDEAM (2019). In general, Colombia does not suffer from physical water scarcity; however, it begins to suffer an economic scarcity due to the high costs of extraction and treatment because of its high pollution levels (Revista Dinero, 2017). According to a study from the Corporación Autónoma Regional del Alto Magdalena (CAM, 2018), in an average hydrological year the department of Huila can produce water to supply a population of 236 million inhabitants (CAM, 2018), nearly 5 times Colombia's total population. The importance of Huila as a water supplier for the whole country is invaluable. The department is in the Andes zone and it is part of the Colombian Massif (Macizo Colombiano), where the source of Cauca and Magdalena rivers is located. This water wealth starts in the south of the department and provides water along the Magdalena Valley to irrigate fertile lands. In the urban and rural area of Neiva, the capital city of Huila, the annual water demand is between 4 and 23 MCM per year depending on the dry and rainy seasons and the annual water supply in average weather conditions exceeds 78 MCM (Gobernación del Huila, 2014). The reuse of wastewater has not been considered by the authorities of the cities, even though it is a valid option to generate economic development and alleviate eventual episodes of water scarcity in the region.

Water scarcity in developing countries is driven by different factors such as rapid population growth, increased demand for food production and water pollution from urban, industrial and agricultural wastewater (Makoni et al., 2016). Treated wastewater could be used to supply other needs that do not require drinking water, increasing the available resources of water in a more economical way, as Melgarejo (2009) explains. The reuse of treated wastewater becomes a valid option to avoid economic and physical water scarcity in different regions of Colombia. The reuse of wastewater has been regulated in Colombia in the last years. The resolution 1207/2014 of the Ministry of Environment and Sustainable Development of Colombia regulates the reuse of

wastewater at the national level, however, these norms have not had the expected effectiveness as Álvarez Pinzón (2017) explains in her work.

Álvarez Pinzón (2017) indicates the importance of promoting the reuse of wastewater because it means more availability of non-potable water to be used in other activities that do not require drinking water. Additionally, the treatment and reuse of wastewater could help to solve temporary or permanent scarcity especially in dry seasons. Finally, wastewater reuse is key to avoiding the progressive deterioration of waterbodies that are receiving wastewater without treatment. Álvarez Pinzón (2017) claims that the national policy for reuse of wastewater in Colombia is contradictory, has legal loopholes and discourages the reuse of wastewater rather than incentivizing it as she further adds in her work. In general, the requirements for reusing wastewater are more demanding than those for direct discharges into the waterbodies and there are few advantages that would encourage the reuse of wastewater nationwide as Álvarez Pinzón claims in her work.

There are several Colombian authors who have demonstrated the possibility of reusing treated wastewater in agriculture, including crops for direct human consumption (Silva, Torres & Madera, 2008; Madera, C.A. et al., 2009; Lopera et al., 2012; Valencia et al., 2010). The reuse of treated domestic wastewater in crops destined to industrial transformation, was studied by Silva, Torres & Madera (2008) proving its potential benefits without putting human health in risk. Madera et. al (2009) examined the use of partially treated urban wastewater from a WWTP in sugar plantations in Cali-Colombia, showing that the effluents are suitable for crops irrigation with no adverse effects on the quality of the products. However, they conclude that protection techniques for human exposure are required to protect the health of those working in the sugar cane fields. Currently the Colombian national regulation for reuse of wastewater prohibits the use of treated wastewater to irrigate crops for human direct consumption.

The mentioned studies in Colombia demonstrate that a wider use of treated wastewater is possible complying with international standards such as the World Health Organization's guidelines for the safe use of wastewater (WHO, 2006). These guidelines are important tools to promote the reuse of wastewater and minimize public health risks and they should be considered to elaborate further policies for reuse of wastewater in Colombia. Furthermore, the indirect use of diluted wastewater

is widespread in Colombia since wastewater treatment is generally not (sufficiently) treated before being discharged in the rivers and streams (FAO, 2017; Lopera et al. 2012). This low level of wastewater treatment is somehow compensated with the great capacity of the rivers to dilute the polluting pathogens (FAO, 2017), hence, the old rule *dilution is the solution to pollution* is widely applied in Colombia. There is no conclusive data about the extension of crops irrigated with diluted wastewater in Colombia, but many of the crops use water from different rivers that are receiving urban wastewater along their way. In some cities the use of wastewater that has been more or less treated or diluted wastewater to irrigate crops is common, that is the case of Ibagué where farmers are using those waters to cultivate rice, sorghum, and tobacco among other products (FAO, 2017; El Tiempo, 2005). A secondary treatment and eventually other disinfection systems are needed to reuse wastewater in crops and avoid human health risks (Lopera et al., 2012). Consequently, it is required to expand the technical, economic and human capacities together with good wastewater governance to treat, discharge or safely reuse wastewater in different activities.

1.3. Objective of the study and research questions

This study explores the public policy on wastewater management through the examination of different plans, programs and norms on treatment and reuse of wastewater at national and sub-national levels. It then compares them with the current practices and the perspectives of the stakeholders involved in the problematics. The region chosen for the study is the Department of Huila and its three most important cities: the capital Neiva, Garzón and Pitalito. This study focuses more on Neiva because it is the biggest city and the one that discharges more pollutants into the river. Furthermore, Neiva is at a crucial moment because after many years of debates and postponements, the construction of a WWTP for the city is about to begin. Additionally, this study explores the interaction between the policies and plans at all three levels and identifies some interlinkages or gaps among them. Moreover, this study aims to determine some connections between the sub-national and national policies and the Sustainable Development Goals (SDGs) that work as a global governance strategy and addresses wastewater management in the SDG 6. In this sense, this work seeks to study how the SDGs are being implemented and what is their real impact on helping to solve the wastewater pollution at local and regional levels. Furthermore, an

assessment of the implementation of the applicable regulatory framework is done, comparing it with the evidence from fieldwork and the data from interviews. This study points out and discuss some of the main challenges that hinder governance in general and specifically wastewater governance in the region. Finally, this study proposes the use of the circular economy theory for the WWTP project in Neiva, indicating some advantages and benefits that it could bring if it was considered.

This study aims to answer the following main research questions and sub-questions:

1. How is the current wastewater governance in Huila and could it be considered an example of good and effective governance?
 - a. Are there any local or regional policies on treatment and reuse of urban wastewater and how are integrated with the national policies and norms?
 - b. How have these policies been implemented at regional and local levels?
 - c. What are the different perspectives of the stakeholders at regional and local levels regarding wastewater governance in their cities or department?
 - d. Does the current wastewater governance show characteristics to be qualified as good and effective?

2. What is the impact of the SDGs on the wastewater governance at national, regional and local levels and how could they help to feed the process of an effective elaboration and implementation of the current policies?
 - a. Is there any relationship or linkage between the current policies at national and subnational levels with the SDGs and in specific the SDG 6?
 - b. Are the current policies useful to meet the SDG 6?

3. What are the main challenges related to wastewater governance in Huila and the three cities in the study?

1.4. Theoretical framework

This section aims to explain some pillar concepts of this study with a literature review of theories that framed the investigation. This study applies the concept of governance and evaluates three qualities thereof: good, effective and equitable governance. Further, the study uses some topical theories of governance including environmental governance and wastewater governance to discuss the results obtained from fieldwork. Finally, this study uses the theories of capacity building and circular economy to propose some strategies that could improve the current situation in Neiva.

1.4.1. Governance: Good, effective and equitable governance

Governance has gained importance in the development studies during the last years since it has played a significant role in the post-2015 agenda for sustainable development (UNDP, 2014). Governance is a common concept in the sustainable development discourses. Prominent scholars such as James Rosenau (1992), Morten Bøås (1998), Thomas Weiss (2000), and Frank Biermann (2017) have developed the governance theory and stressed its link with sustainable development on different occasions. International organizations such as the United Nations Development Programme (UNDP) and the Organisation for Economic Co-operation and Development (OECD) have also focused their attention on governance for sustainable development during the last decades. Governance in our globalized world is of such importance that a Commission on Global Governance was created in the early 90s to expand further on the topic. As a result, the Commission issued a report called *Our Global Neighbourhood* that introduced one of the most common definitions of governance. In the Commission's report, governance is defined as the "sum of many ways individuals and institutions, public and private, manage their common affairs" (Commission on Global Governance, 1995: 2). Likewise, Biermann et al. (2017: 75) defined governance as "the purposeful and authoritative steering of societal processes by political actors". In this sense, governance includes typical governmental activities such as norms and policies but also activities from non-governmental actors or even public-private partnerships as long as they

have a claim of authority, have public legitimacy and shape actors' behaviours (Biermann et al. 2017a).

Governance includes all the formal and informal ways that have popular legitimacy to address the interests of the majority. In this sense governance is broader than government. As Rosenau (1992) explains, governance not only includes governmental institutions and activities driven by formal-legal authority, but also those non-governmental mechanisms that rule the behaviours and satisfy the needs of the people under its authority. Governance is not only concerned with the formal institutions but also about their relationship with people. Governance aims to provide mechanisms to generate collaboration between all actors in different sectors of the society (UNDP, 2014). At local level, governance could be co-operative agreements between state and non-state actors to satisfy any specific need such as installing and maintaining a water pipe (Commission on Global Governance, 2015) or a city plan for wastewater management for example. Thus, as Bøås explains (1998: 120) governance is concerned about “the set of fundamental rules for the organization of the public realm” and includes all the governmental and non-governmental institutions that operate within it. Bierman et al. (2017) propose three core qualities of governance that were used for the discussion of this study. These three qualities are: good governance, equitable governance and effective governance.

Good governance is considered a pillar for sustainable development. The General Assembly of the United Nations in 2012 acknowledged that good governance, democracy and the rule of law are essential for the economic growth, social development and environmental protection (United Nations, 2012). For many years the issue of good governance was in the spotlight of international aid donors. As Morten Bøås (1998) explains, the world bank began to identify bad government as the personalization of power, disrespect of human rights, absence of democracy and non-accountable governments. Therefore, democratization, accountability and respect for basic individual human rights are necessary for good governance (Bøås, M.,1998). Good governance is characterized by other qualities such as transparency, accountability, democratic participation and the rule of law (Biermann et. al., 2017a). Other characteristics such as political legitimacy, justice, democratic citizenship, protection of Human Rights and efficiency were also mentioned in the last World Water Development report from the United Nations (WWAP, 2019). Finally, good

governance is defined by the capacity of the government to produce and implement sound policies and the respect for them by the stakeholders (Kaufmann, Kraay and Zoido-Lobaton,1999). However, sound policies are not enough to have governance that allows their implementation and produces the expected outcomes. Effective governance that reduces the gap between the policy making and implementation and political will is also necessary.

Effective governance to address environmental challenges such as wastewater management requires the institutional capacities for long-term decision making and the implementation of sustainable development policies (Nilsson & Persson, 2012). Thus, improving the “overall problem-solving capacity of governance” should be the focus of an effective governance as shown by Biermann et al. (2017a, p.76). In their study on governance dimensions, Kaufmann et al. (1999) state some indicators of government effectiveness such as the perception in the quality of the public service, bureaucracy quality, civil servants’ competence and their independence from outer pressures, accountability and the credibility of the government’s commitment to policies, among others. Though, other factors such as the integration of policies within sectors and jurisdictions and the implementation of global strategies such as the SDGs considering the local contexts need to be embraced by governments to improve their effectiveness in implementation. A bottom-up approach which is non-confrontational, country-driven and considers the stakeholders’ perspective are fundamental for the success of sub-national, national and global governance policies (Biermann, Norichika & Kim, 2017b). Governance also plays a vital role in reducing inequalities in order to leave no one behind, which is also the main goal of the 2030 agenda; hence, equitable governance is desired for sustainable development.

Equitable governance is concerned with the process of fair distribution of outcomes from the solutions to common problems considering the interests of the most vulnerable groups (Biermann et al., 2017a). The aspects of governance such as democratic participation in the process of improving water management and redistribution of outcomes are the key to having equitable governance. In that regard, equitable governance will tend to reach more transparent and effective policies producing benefits to all, including the poorest in the society. Reducing high levels of inequalities in access to clean water and sanitation including safe wastewater treatment systems should be the goal of equitable governance of the water sector. The three qualities of governance

above mentioned together with other dimensions of governance that are more related to water and environmental resources should be acknowledged by governments to fulfil the Sustainable Development Goals in the next 10 years.

1.4.2. Environmental, water and wastewater governance

New types of governance in specific fields have gained status seeking to address issues of importance to humanity such as the protection of the environment and water. In the agenda 2030 the three qualities of governance mentioned in the previous section play a significant role and are constantly mentioned in different fields within sustainable development. This is the case of environmental governance, water governance and wastewater governance. These governance strategies have been acknowledged in tools such as SDGs where different goals incorporate aspects of good, effective and equitable governance to address specific issues such as wastewater and sanitation. Thus, numerous authors have introduced interesting fields such as water governance and environmental governance that are important for the discussion of this study.

Many scholars that have written about environmental governance tend to think of a global governance system for the management of natural resources influenced by issues such as climate change or global warming. Nonetheless, as Lemos & Agrawal (2006) explain, some of the most important environmental challenges are happening at the local level and require efforts to incorporate state and non-state groups into better processes for environmental governance. Thus, environmental governance is concerned about the interventions from political actors (state and non-state) in form of regulatory procedures, mechanisms and organizations to produce changes in environmental issues (Lemos & Agrawal, 2006).

Other scholars such as Bull & Aguilar-Støen (2015: 5) define environmental governance as a “set of mechanisms, formal and informal institutions and practices by way of which social order is produced through controlling that which is related to the environment and natural resources”. To them, environmental governance is not only concerned about the management of natural resources but also how the conditions of what is possible for the actors are established through the management of the nature (Bull & Aguilar- Støen, 2015). In this sense, state and non-state actors

play different roles in the authoritative allocation, control and coordination of resources (Bulkeley, 2005) and are interrelated with each other. These relationships within the management of natural resources not only occur in the global sphere but also at sub-national scenarios as this study pretends to demonstrate. Hence, environmental governance is concerned with the environmental decision making that emerges from the political and economic powers as well as the interaction between the state actors and society as Bull & Aguilar- Støen (2015) claim. Other relevant environmental issues are developing new fields for governance, that is the case of water and wastewater governance which are growing in popularity among scholars during the last decade.

Water governance is vital for humanity as water demand increases to sustain all human activities, especially in developing countries. A good water management should be a moral duty to us because of its importance to sustain life on earth and support ecosystem services. Around 2 billion people live in countries experiencing high water stress (WWAP, 2019) and the effects of water scarcity are felt in various ways such as droughts and migrations. According to the Global Water Partnership Technical Committee, water governance “refers to the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society” (Rogers, P., & Hall, A. W., 2003: 7). Pahl-Wolst (2015: 26) sees water governance as “the social function that regulates development and management of water resources and provisions of water services at different levels of society and guiding the resource towards a desirable state and away from an undesirable state”. The management of water resources, that is, the activities to analyse, monitor, develop and implement measures to keep the state of the resource in desirable limits (Pahl-Wolst, 2015) is critical for water governance. The OECD has provided evidence that water crisis is usually related to governance crisis and in 2015 established 12 principles on water governance aiming to produce stronger public policies based on effectiveness, efficiency, trust and engagement. In their working papers the OECD identified different gaps that hinder water policymaking and implementation such as lack of funding, technical capacities, overlapping of policies and lack of accountability (Akhmouch, 2012; OECD, 2015). Furthermore, Zamudio Rodríguez (2012) has studied water governance in Colombia and concluded that there is a governability crisis around water with an inability of the state to satisfy the society’s needs characterized by constant institutional reforms of the policies and norms concerning water management. In her work, Zamudio Rodríguez (2012)

concludes that the crisis of governability produces different forms of governance that are often characterized by lack of coordination and dispersion of policies and actors, ignorance of international experience, ignorance of local forms of government and a general disinterest in water management. Therefore, water governance needs to set the frame under which all actors will manage those water resources, including wastewater treatment and reuse.

Wastewater is an interesting component of water management that is still seen as problem rather than a source of wealth in almost all countries. However, this pattern is changing with the growing water demand around the world. Globally over 80% of all wastewater is discharged without receiving any treatment (WWAP, 2017). In best cases, wastewater is treated and later discharged, however more countries are starting to reuse, recycle and recover different resources from wastewater. Wastewater governance implies mechanisms that involves all citizens in the decisions on sanitation, considering the most vulnerable, and mechanisms to involve all actors in the management of what could be a valuable resource. Therefore, the concern of wastewater governance is to reduce the lack of coordinated policies, the precarious know-how and lack of technical staff and address the scarcity of financial resources to plan and implement wastewater treatment systems (SIWI, 2017). The economic benefits from sanitation are proven to be considerable, since every US\$1 invested gives a return of US\$5.5 (WWAP, 2017). Then, as Kjellén (2018) argues, the long-term benefits of a green economy that reuses, recycles and recovers resources are clear but it needs political alliances to produce the expected actions from the state and to redistribute the benefits among all actors.

1.4.3. Sustainable Development Goals as a global governance strategy

In 2012 the United Nations established the Sustainable Development Goals, seeking a transition to a more sustainable world. The resolution 66/288 “The future we want” adopted by the General Assembly of the United Nations recognized that access to water and basic sanitation is a fundamental right and vital for achieving sustainable development. The resolution highlights the importance of adopting measures to reduce water pollution and water loss. It also urges the nations to maintain the balance between supply and demand by supporting the use of non-conventional water resources (UN, 2012) such as treated wastewater.

Subsequently, the UN General Assembly approved the 2030 agenda for sustainable development through the resolution 70/1 of 2015. The 2030 agenda is an action plan to reach sustainable development through 17 goals and 169 targets to guide the nations to act towards a more just and sustainable world. The SDGs are a clear example of setting goals as a global governance strategy. They were built on the Millennium Development Goals and established “the most ambitious effort yet to place goal setting as the center of global governance and policy” (Kanie et al., 2017: 1). By setting goals, governments and other actors are trying to identify development issues and establish collective ambitions and commit publicly to fulfil those objectives as Kanie et al. (2017) explain. However, the SDGs as a global governance strategy are contested by different scholars because of its effectiveness, the dependence on how the different actors respond in their own domains and the soft mechanisms to demand their implementation (Underdal & Kim, 2017). In some way, it could be argued that the SDGs provide an escape route for governments not to engage in multilateral binding agreements since they were designed as an inspirational guidance to solve development issues at national level. In 2015 *The Economist* called the SDGs “stupid development goals” and a distraction because of their huge cost, broader scope and limited possibility of being reached making them look just like a list of good intentions (The Economist, 2015). Nevertheless, governance strategies using goal setting are becoming the main trend in today’s global governance, that is the case of the Paris Agreement for example, which set the goal of holding the increase of global temperature in less than 2 °C (Yamada, 2017). Thus, the goal setting aims to guide the different actors in establishing priorities to use scarce resources, harmonize efforts towards meeting the goals, track their progress and avoid the tendency for short term results (Young, 2017). As Young (2017) indicates, goal setting embodies the states aspirations and is concerned about generating enthusiasm and maximise the efforts to reach somehow defined targets.

In this sense, goals such as the SDGs can be powerful governance tools that could impact governments and other actors’ behaviours (Biermann et al.,2017b) in managing different issues at national level. Different aspects of governance have been distributed throughout the 17 SDGs, including the effectiveness of governance in the SDG 16 and the participation of the community and implementation of integrated water resources management at all levels in the SDG 6. The SDG 6 is of relevant importance regarding this study because it aims to “*ensure availability and*

sustainable management of water” (emphasis added) by reducing the wastewater dumping and promoting the reuse of wastewater. The SDG 6 is key to ensuring environmental sustainability, economic prosperity and health to everyone through an efficient management of the water resource. This study considered 5 targets from the SDG 6 to evaluate wastewater management in Huila. The targets were also used to interview the informants, these targets are: 6.1, 6.3, 6.4, 6.6 and 6.b. The purpose of target 6.1 is to guarantee universal and equitable access to safe and affordable drinking water by 2030. The reuse of wastewater becomes an important strategy in guaranteeing access to drinking water to the society and should be considered a pillar to accomplish the target 6.1.

Target 6.3 is the most important for this study. This target urges the states to halve the proportion of untreated wastewater, increase recycling and safe reuse of wastewater and reduce pollution. This target also calls on the parties to eliminate dumping of contaminating materials into the waterbodies. This study considers what actions have been taken by the regional and local authorities to meet this target in their territory. Furthermore, the target 6.4 related to water-use efficiency seeks to address water scarcity and reduction of water stress through sustainable withdrawals of freshwater. This target is linked to target 6.6 aiming to protect water ecosystems such as rivers, aquifers and lakes. These goals should be embodied in the current policies in the protection of the environment and waterbodies in Huila as an inspiration to improve water and sanitation management in the region.

The community participation in improving water and sanitation management is mentioned in the target 6b. Target 6b is concerned with how the community is involved in the development and implementation of the policies for wastewater management. This study tries to find whether the community has been involved in the design and execution of such policies or if the policy makers did not consider their needs nor the reality of the region. Community participation in the process of improving water management could produce more inclusive, reasonable and useful policies to reach the SDGs. Guaranteeing participation to the citizens is decisive to ensure good governance and clean management of public resources such as water.

1.4.4. Capacity building for sustainable development

Sustainable development aims for the reconciliation of the economic growth and environment protection to produce social progress and benefits to everyone. In this scenario, enhancing capabilities for policy implementation play an important role to have more socially inclusive, economically prosperous and hence, politically well governed countries (Andrews et al., 2017) that are able to reach sustainable development. UNEP describes capacity building as a changing process to build relationships, values and abilities to improve the performance of the actors involved in development such as states, civil society or private sector and to enhance cooperation between them (UNEP, 2006). The strengthening of capacities for long-term planning is a key factor for effective governance as Biermann et al. (2017a) claim. However, policies, projects and programmes (The three Ps) might not be the main determinant factors for development as many tend to believe. The real determinant for development is thus the capability for implementation, as many states have proved their excellent abilities to produce the three Ps but failed in their implementation (Andrews et al., 2017). Capacity building for sustainable development includes developing human capacities since achieving the SDGs will depend at the most fundamental level on individuals and organizations that require the knowledge, know-how and experience (Gupta & Nilsson, 2017). An analysis of the decision makers' capacities is required to elaborate solutions for wastewater treatment and reuse in the long term that are realistic, known and respected by everyone involved in the development of the region.

2. RESEARCH METHODS

2.1. Area of study

The chosen areas for this study were the municipalities of Neiva, Garzón and Pitalito in the department of Huila in Colombia. The department of Huila is in south-central Colombia and is divided in 37 municipalities (Figure 2). Neiva is the capital and most important city of Huila, Garzón is the most important municipality of central Huila and Pitalito leads the south of the department and is the second biggest city in the department. The economic development of the region has traditionally driven by the extraction of oil, gas and minerals, however sectors such as

agriculture, especially coffee cultivation and fish farming are also important drivers of Huila's economy.

Huila has large water reserves, including paramos such as “paramo de las papas” where the Magdalena River starts. There are two dams along the Magdalena River in Huila to produce energy and it is also used for fish farming. The water is mainly used for human consumption and irrigation of crops. The high-Magdalena basin is fed by other rivers such as Suaza, La Plata and Páez increasing its flow before leaving the department. However, the northern part of the department may suffer from water shortages especially during dry seasons (Gobernación del Huila, 2014).

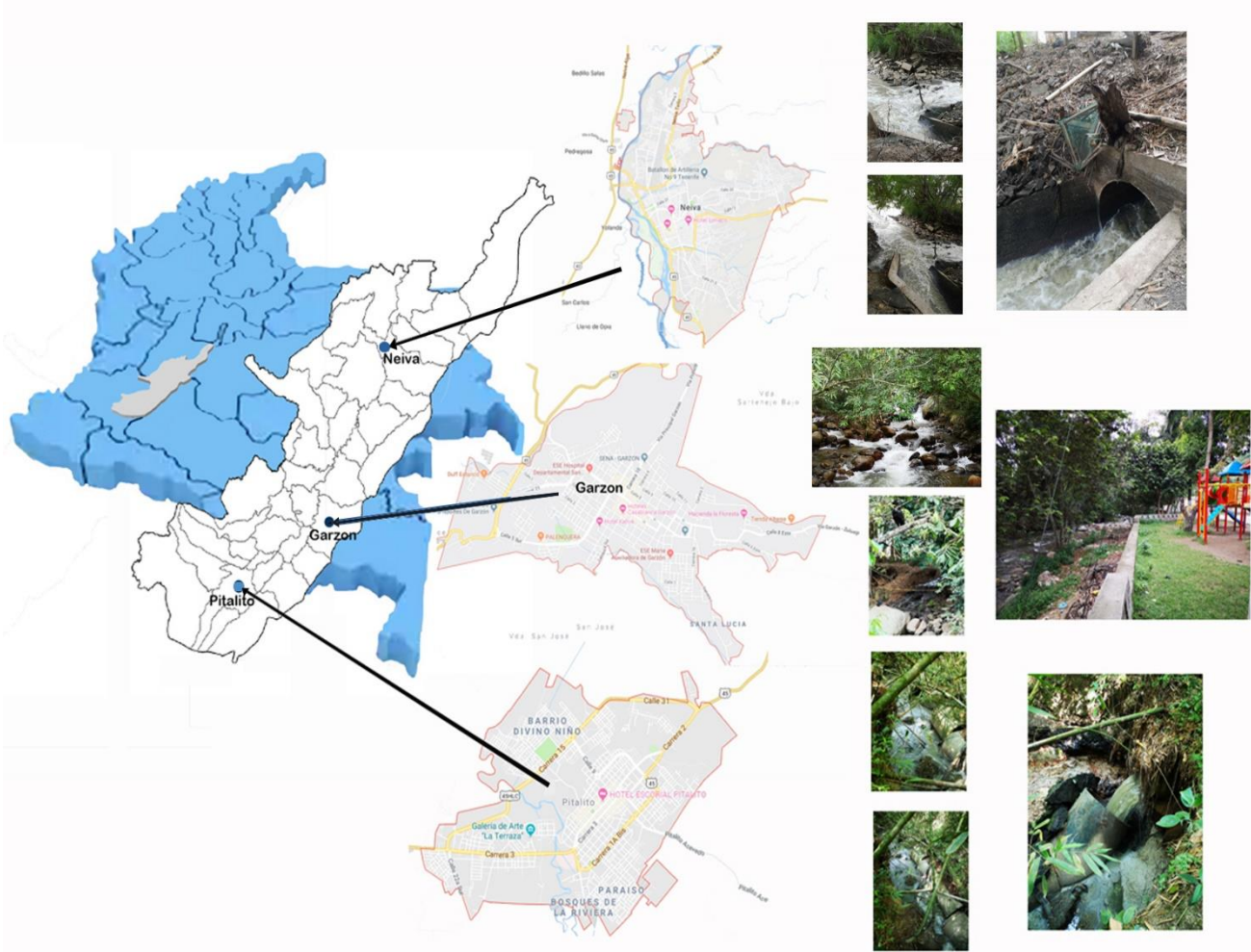


Figure 2. Location of the department of Huila in Colombia and the three municipalities of study in Huila with their respective maps and pictures from the discharging points.

The department of Huila has a total area of 19,890 km² and a projected population of around 1,225,000 (Gobernación del Huila, 2014) by 2020. This work considered the three biggest cities that do not have WWTPs and are discharging their wastewater directly into the Magdalena River or its affluents. Around 50% of the department's population lives in these three cities and around 68% of the pollutant loads are produced by Neiva, Garzón and Pitalito (Aguas del Huila, 2014a). Water and sewerage coverage in the urban areas of the department is above 95%, above the national average (Agua del Huila, 2014), however wastewater treatment is still precarious in the main cities of the department.

The criteria for choosing these three cities were the amount of population, the amount of pollutants discharged in the waterbodies and the fact that they do not have a wastewater treatment plant. This study has a special interest in the city of Neiva where a debate has been going on during the last years about how to solve the problem of wastewater discharges into the Magdalena River and it is the city that pollutes the Magdalena River the most with its wastewater discharges. An evaluation of the situation in the three cities is necessary to understand the causes that prevent progress in finding solutions to wastewater contamination of the waterbodies and the possibilities to reuse the wastewater to reach the SDG No. 6 while improving governance and water and resources management.

2.2. Research design

2.2.1. Qualitative research

This is a qualitative study with an inductive approach. The data was collected from different sources to guarantee a cross-checking using different methods such as qualitative interviews and secondary data. The qualitative method is useful to understand a social phenomenon through the examination and interpretation of the facts and participants of a social phenomenon as Bryman (2012) explains. This is an empirical study and does not pretend to test a theory nor to elaborate statistical models to predict a result. This study attempts to understand a specific socio-

environmental issue such as the pollution of wastewater in a delimited area of Colombia. In qualitative research, the researcher aims to answer his questions by examining diverse social settings and the individuals that interact with it (Berg & Lune, 2017). This technique helps to examine how people understand the reasons behind the incipient progress in solving the wastewater management in Huila and what their perspectives for the near future are.

In this qualitative study the analysis of documents, secondary sources and quantitative data was combined with visits to the field where semi-structured interviews were conducted with different stakeholders. In this way, I tried to ensure triangulation and to guarantee credibility in the study. When interviewing the informants, a process of respondent validation was done to corroborate my findings during the literature review and preparation for fieldwork. During the interviews, the informants were provided with data and findings from the preparative works or previous interviews to ensure that there was correspondence between the informants' perspectives and the information gathered previously as Bryman (2012) suggests.

2.2.2. Data collection, qualitative sampling and data analysis

This study used a mix of non-probability forms of sampling consisting of purposive sampling and snowball sampling. To analyse the data some tools of grounded theory were used such as theoretical sampling and theoretical saturation. The purposive sampling allowed me to choose the resources in a more strategic way, selecting interviewees or documents that were relevant to answer the research questions (Bryman, 2012). The purposive sampling was selected because of the knowledge that I have about the region. It was possible to select certain types of informants that had specific characteristics as Berg & Lune (2017) suggest. The second non-probability sampling technique used in this study was the snowball sampling. Using this technique allowed me to ask my respondents for referrals that could be useful and had the same characteristics as those chosen in the purposive sample. Snowballing was a good technique to find participants that I did not know previously but could be important to this study.

In this study I used a theoretical sampling approach to frame the analysis of the data collected. With a theoretical sampling approach, the process of collecting data is controlled and depend on

the theory that emerges from the data collected (Bryman, 2012). According to Glaser and Strauss (1967: 45) cited in Bryman (2012: 419), theoretical sampling is “the process of data collection for generating theory whereby the analyst jointly collects, codes, and analyzes his data and decides what data to collect next and where to find them, in order to develop his theory as it emerges”. The objective of the theoretical sampling approach is to reach a point of theoretical saturation when nothing else can be added to each category of concepts as Bryman (2012) argues. Therefore, theoretical saturation was the criteria to decide when I needed to stop the data collection to fill each concept and answer the research questions. The data collected was organized and grouped into different categories depending on the geographical origin and topics to facilitate the analysis. Likewise, the literature, secondary sources and documents were grouped in the same categories. These categories are within the theoretical framework to facilitate their analysis. There was not a defined sample size for this study because as Bryman (2012) indicates, there is no point to define a sample size when the theoretical sample approach is used.

The main sources of data for this study were documentary and qualitative interviews. I gathered historical and grey literature produced by public institutions such as the Colombian Ministry of Environment and the regional and local governments as well as press articles, academic articles and other documents that were provided by the informants. Other sources such as norms, regulations and plans were collected to understand the policy making and implementation processes.

2.2.3. Semi-structured interviews

The technique chosen for this study was the semi-structured interview or semi-standardized interview because it allowed me to be more flexible with the informant but keep order using a previously structured questionnaire. Bryman (2012) explains that semi-structured questionnaires allow the researcher to adapt the questions, change the sequence or ask further questions depending on how the interview is developing. Certain advantages of the semi-structured interviews led me to decide on this technique. For example, the fact that I could reorder the sequence of questions, change the language of the questions depending on the informant or being able to expand in certain specific questions as Berg & Lune (2017) indicate, were key to choose semi-structured interviews

as one of my data collection techniques. The semi-structured questionnaires were discussed together with my supervisor and co-supervisors and were useful to obtain precise and detailed information from the informants without limiting their participation. In this way I managed to understand the perspectives from all the stakeholders.

A total of 18 individual and group interviews with a total of 22 people were conducted during the fieldwork between January and February 2019. Four types of informants were interviewed in this study. They were classified as shown in Table 1:

Table 1.

Types, Quantity and Characteristics of Informants

Type of informant	Characteristics
Policymakers – decision makers Total: 5	Informants such as members of the city council, politicians, creators of norms or plans and managers from the public service companies.
Public officers Total: 10	Public officers such as the secretaries of environment from the locations, officers from the environmental authorities such as the Corporación Autónoma Regional del Alto Magdalena.
Experts and academics Total: 2	Academics and experts in wastewater management.
Representatives from non-governmental organizations and community members Total: 5	NGOs concerned about the environment or people affected by the wastewater discharges such as those located in the area of the WWTP project in Neiva.

The interviews took between 60 to 90 minutes. The informants received a document explaining the purpose of the study in Spanish before they were interviewed. The questionnaires were related to their perspectives on the current wastewater treatment and reuse (WWTR) in their city, region or country, the policies on WWTR and their implementation, the challenges of wastewater management and reuse, governance and the SDG 6. The interviews questionnaires are annexed to this study in appendix 1.

2.3. Limitations and ethical considerations

2.3.1. Information letter and consent form

An information and consent letter was designed and given to all the participants in the research project as ethical consideration. The information and consent letter was approved by The Norwegian Centre for Research Data AS. All participants declared their free and consensual participation in the form. Although, the topic of the study is of low sensitivity, confidentiality was guaranteed to all the informants and all data collected has been treated in accordance with the University of Life Sciences and Norwegian requirements.

About limitations, the period of the year in which I conducted my fieldwork was not the most appropriate. During the months of January and February, public officers are returning to their jobs from vacations and many did not have contracts with the public administration during that period. Hence, it was difficult to get some of the informants beforehand and I had to wait until I was in the field to contact them. In Colombia it can sometimes be difficult to arrange everything in advance, therefore it was necessary to plan day by day. However, people were always willing to participate and only one informant required to be anonymous in this study. Anonymisation was carried out with all the informants in any case.

2.3.2. Personal data and requests of anonymisation

All the informants were notified that their personal data would be treated confidentially and in accordance with the Norwegian data protection legislation (the General Data Protection Regulation and Personal Data Act) and the guidelines and policies of the Norwegian University of Life Sciences as stated in the information and consent letter that is annexed.

Only the research group composed of the student and the supervisor had access to the data. The interviews were recorded on a personal device protected with password, uploaded and encrypted with password. All the files are protected with a password and stored in the area of the Norwegian University of Life Sciences research server. All audio files will be deleted around June 2020.

Anonymization of the transcriptions will be carried out at the end of the project. All the personal data including the list of names and contact details will be stored separately from the rest of the collected data, protected with a password and encrypted. Only one informant required to be anonymized in the study, however, all informants will remain nameless in this study.

3. RESULTS FROM FIELDWORK

The results presented in this section are a mix of primary and secondary data that show the current policies in wastewater management and how they are translated into practice to evaluate the governance status at regional and local levels. Secondary data sources such as white papers, journal articles, newspaper articles and other reports are cross-checked with the interviews and field visits. This section provides regulatory frameworks at the national, regional and local levels for the management and reuse of wastewater. Furthermore, this chapter tries to establish some relationships between the three levels of regulatory frameworks and establish their connection with the SDGs. Subsequently, this section presents the practices and perceptions of the stakeholders in the area. Finally, this section makes a synopsis of the main findings to feed the discussion.

3.1. Regulatory framework on wastewater treatment and reuse at the national and sub-national levels: Policies, plans, norms and their relationship with the SDGs

In Colombia, several norms and plans for wastewater management and reuse exist. There are different categories of norms which make up an extensive legal framework that is somehow dispersed and disorganized. This situation makes it difficult to integrate the norms at different

levels and between all sectors. The national norms and plans are issued by diverse actors of the public administration, including the Congress, the Ministry of Environment and Sustainable Development, the Ministry of Housing and Territory as well as the Regional Autonomous Corporations (CARs) which are the environmental authority at regional level. The normative framework includes different types of norms such as laws, decrees and resolutions depending on the authorities that issued them. Furthermore, there are regional and municipal plans that are more detailed to comply with the national norms and plans. Thus, it is possible to find different norms, plans, projects and programs at sub-national levels, sometimes addressing the same issues.

An overview of the norms, plans, and programs that are part of the policies on wastewater management at national, regional and local levels are presented in tables 2, 3 and 4. The norms, plans or programs that are connected are marked with the same colours in their cells. A further explanation is given below the tables on how these norms, plans and programs interact with each other at the three levels.

Table 2.

National Regulatory Framework on Wastewater Treatment and Reuse of Wastewater

National Level
1) The Constitution of Colombia: Art 49: health and sanitation are public services provided by the State. Art 79: Everyone has the right to enjoy a healthy environment. Participation in decisions that may affect it is guaranteed to the communities. It is the duty of the State to protect the diversity and integrity of the environment, conserve areas of ecological importance and promote education to achieve these goals. Art 95: The protection of the cultural and natural resources of the country and the conservation of a healthy environment are duties of the citizens. Art 366: The solution of the unmet needs in health, education, environmental sanitation and drinking water are fundamental goals of the State.
2) Colombian National Development Plan 2018-2022 (Law 1955/2019) and base documents.
3) National policy for the integral management of water resources (2010-2022)
4) National plan for the management of municipal wastewater in Colombia -PMAR (2004)
5) CONPES document 3383/2005. Development plan of the aqueduct and sewerage sector.
6) Misión Colombia de crecimiento verde [Green Growth mission] from the National Planning Department (DNP)
7) Decree-Law 2811/1974. National code of renewable natural resources and protection of the environment

8) Decree 1541/1978 regulates the decree law 2811/1974 regarding water. It establishes water as a resource of public utility and social interest and creates some prohibitions concerning discharges.
9) Law 9/1979 by which sanitary measures are dictated including liquid waste and discharges from buildings.
10) Decree 1594/1984. Regulates the law 9/1979 regarding water uses and wastewater. Establishes prohibitions and obligations regarding wastewater discharges.
11) Law 99/1993. Creates the Ministry of Environment and organizes the public sector in charge of environmental conservation. It also assigns the competence to the Regional Autonomous Corporations (CARs) the function of evaluation, monitoring and control of water uses and discharges.
12) Law 142/1994 establishes the regime of domiciliary public services and assigns competence and jurisdiction to the municipalities for the provision of the aqueduct and sewage public services.
13) Law 373/1997 About the efficient use and water saving programme (PUEAA)
14) CONPES document 3177/2002 Establishes the guidelines for the formulation of the National Plan for the Management of Municipal Wastewater in Colombia (PMAR)
15) Resolution 1433/2004. Regulates the Sanitation and Wastewater Discharges Management Plan (PSMV) that the providers of the public sewage service must present to the CARs
16) Decree 3930/2010 modified by the Decree 4728/2010. Regulate water uses and discharge permits and the procedures to obtain wastewater discharge permits.

17) Decree 1640/2012. Regulates instruments for the planning and management of watersheds and dictates measures on wastewater discharges.
18) Decree 2246/2012. Regulates the Departmental Water Plans (PDA)
19) Decree 2667/2012. Regulates remuneration rates for the direct use of water as a receiver of wastewater discharges. (Polluter pays principle)
20) Resolution CRA 688/2014 modified by the resolution CRA 735/2015. Regulates the methodology to determine the rates of water and sewage public services applicable to providers with more than 5000 subscribers in the urban area.
21) Resolution 1207/2014. Regulates the use of treated wastewater for different uses.
22) Decree 1076/2015. Single regulatory decree for the environment and sustainable development sector. Compilation of all environmental regulation until 2015 including the decrees 1541/1978, 1594/1984, 3930/2010 and 1640/2012. (García Pachón, 2017)
23) Decree 1077/2015. Single regulatory decree for housing, city and territory sectors. Compilation of all regulation regarding housing, territorial planning (POT), Integrated Solid Waste Management Plans (PGIRS) and sewerage and wastewater management.
24) Resolution 0631/2015. Establishes the parameters and the maximum permissible limit values in the wastewater discharging points to surface waterbodies and public sewage systems.
25) Resolution 0330/2017. Establishes the technical regulation for drinking water and basic sanitation - RAS. Regulates the technical requirements for the construction, operation and maintenance of the infrastructure for aqueduct and sewerage.

26) CONPES document 3918/2018. Establishes the strategy for the implementation of SDGs in Colombia.

Note. Sources: García Pachón (2017), [<http://www.minambiente.gov.co/index.php/gestion-integral-del-recurso-hidrico/administracion-del-recurso-hidrico/calidad/vertimientos-y-reuso-de-aguas-residuales>] and interviews during field work. The norms, plans or programs that are linked are marked with the same colours in their cells in tables 2, 3 and 4.

Table 3.

Regional Regulatory Framework on Wastewater Treatment and Reuse of Wastewater

Regional level - Huila
1) Departmental Water Plan (PDA) “Water program for prosperity” Huila 2014. Contains strategies to meet common goals of most Huila municipalities in water and sanitation.
2) Departmental Development Plan 2016-2019 “El camino es la educación” [The way is education].
3) Public policy for regional environmental management (Ordinance 037/2013): Issued by the assembly of Huila.
4) Regional environmental management plan of Huila 2011-2023: Issued by the Autonomous Regional Corporation of the Alto Magdalena (CAM) which is the environmental authority in Huila.
5) Huila's 2050 climate change plan: preparing for climate change

Note. Sources: interviews during fieldwork.

Table 4.

Local Regulatory Framework on Wastewater Treatment and Reuse of Wastewater

Local level.		
Neiva	Garzón	Pitalito
Municipal Development Plan (MDP) of Neiva 2016-2019 “Neiva, la razón de todos”.	Municipal Development Plan of Garzón 2016-2019. Does not mention the SDGs but the Millenium Development Goals – Not updated.	Municipal Development Plan of Pitalito 2016-2019.
Agreement 026/2009 issued by the City Council of Neiva. Territorial Arranging Plan of Neiva (POT).	Agreement 033/2007 issued by the City Council of Garzón. Basic Territorial Arranging Plan of Garzón (PBOT).	Agreement 018/2007 issued by the City Council of Pitalito. Territorial Arranging Plan of Pitalito (POT).
Sanitation and wastewater discharges management plan (PSMV) of Neiva (2013).	Sanitation and wastewater discharges management plan (PSMV) of Garzón (2016).	Sanitation and wastewater discharges management plan (PSMV) of Pitalito (2019).
Plan Neiva Sostenible 2040.	Master plan for aqueduct and sewerage of Garzón (2009)	Proposal of environmental management strategy of Pitalito (2018).
Efficient use and water saving programme (PUEAA) of Neiva 2013-2018	Efficient use and water saving programme (PUEAA) of Garzón 2013	Efficient use and water saving programme (PUEAA) of Pitalito (2016)
Strategic plan for the public service company of Neiva-Las Ceibas 2016-2019	Quebrada Garzón Basin management plan (2008)	Ruta de Cambio – Pitalito 2030 (2015). Plan to face climate change in the city. One of its axes is the management and efficient use of water, seeking to prevent pollution

		especially from fertilizers and pesticides used in coffee plantations.
Integrated Solid Waste Management Plans (PGIRS) of Neiva 2013	Integrated Solid Waste Management Plans (PGIRS) of Garzón 2017	Integrated Solid Waste Management Plan (PGIRS) of Pitalito (2017)

Note. Sources: interviews during fieldwork. Many of the plans and policies of this table are directly related to some tools from the national regulatory framework. Those tools that are directly related are marked with the same colour in their cells.

As shown in table 2, the regulatory framework is very extensive and dispersed at the national level. The regulatory framework suffers from constant modifications since water and sanitation sector is still developing in the country. In Colombia, sanitation is part of the economic, social and cultural rights and is a public service provided by the State which is obliged to organize and control it according to the article 49 of Colombia's Political Constitution. The article 366 of the Constitution specifies that a fundamental objective of the State is to solve the unmet needs in sanitation and drinking water. Furthermore, the Colombian Constitution in the article 79, guarantees the peoples' right to enjoy a healthy environment and protects their participation in the decisions that could affect it. Likewise, the same article sets as an obligation of the State to preserve the integrity and diversity of the environment. Finally, the article 95 of the Colombian Constitution indicates that the protection of natural resources and conservation of the environment is a duty of all citizens. Noticeably, the most important norm in Colombia recognizes the right to sanitation and urges for the development of specific norms and plans to comply with what is established in it.

About the national plans it is important to mention the National Development Plan (NDP) 2018-2022 that was issued in May 2019. The NDP is the roadmap for the development of the new national government in Colombia and includes some strategies aiming to comply with the SDGs including the SDG 6 and the agenda 2030. Although the NDP has more than 300 articles, only two make direct reference to wastewater treatment for very specific cases. However, the base documents for the NDP, which are an integral part of the NDP law, do address wastewater management in a broader manner. The NDP contains different pacts from the new Colombian Government to reach the SDGs. The bases of the NDP include a pact for the quality and efficiency of public services considering water and energy to promote competitiveness and well-being for all. In this pact, the government recognizes water and sanitation as the basis for increasing the productivity and well-being of everyone and makes direct reference to SDGs No. 4, 6, 7, 10, 11, 12, 16 and 17. This pact emphasizes the importance of the SDG 6 and consequently proposes the development of the circular economy concept through the efficient use of water, wastewater treatment and its reuse in a regional approach seeking the protection of water resources (DNP, 2019. p. 676).

The base document of the NDP indicates that in order to meet the SDG 6, it is required to strengthen governance, planning and efficiency in the provision of public services of water and sanitation. Furthermore, it calls for actions to decontaminate water sources as well as greater

control of wastewater discharges in waterbodies. The base document of the NDP emphasizes that during the governmental period 2018-2022, sustainable use of water sources is a priority and requires to consider innovative measures with new technologies adequate to the local contexts for treatment and reuse of wastewater. The base document also stresses the importance of governance at the regional level and the participation of public and private actors with their resources as well as the introduction of circular economy models to improve efficiency in water management. Regarding the SDGs and their implementation in the national agenda, the National Council of Economic and Social Policy (CONPES) adopted the SDGs through the CONPES document 3918/2018. The CONPES is the highest national planning authority and produces guideline documents for the elaboration of economic and social development policies in Colombia. They work as an advisory council to the national government and design strategies for the implementation of the SDGs, including the prioritization of economic resources from the national government. But, the NDP is not the only important plan to reach the SDG 6 and improve wastewater management. Other tools are concerned with the integral management of water resources, including wastewater at national level such as the National Plan for the Management of Municipal Wastewater in Colombia (PMAR).

The PMAR was issued by the Ministry of Environment and the National Planning Department in 2004. This plan was designed to establish some strategies to address pollution from the municipal (urban) wastewater discharges. The PMAR was developed following the guidelines of the CONPES document 3177 of 2002 that urged the national government to take actions and produce a plan to address wastewater management in less than 6 months. The PMAR seeks to encourage the construction of WWTPs and their optimization in municipalities that generate a high impact on the environment. Likewise, the plan aims for the articulation of all the instruments and the development of norms for wastewater management and the guarantee of financing sources. Some of the most important PMAR strategies are the promotion of new wastewater treatment techniques that allow recovery of resources and other sub-products from wastewater treatment and the reuse of wastewater. However, the PMAR prioritized other smaller and more polluted rivers than the Magdalena River even though some of these rivers flow into the Magdalena River. Unfortunately, the PMAR did not give priority to the construction of the WWTP in Neiva, nor the other 2 cities that are part of this study.

Another important plan issued by the Ministry of Environment in 2010 is the National Policy for the Integral Management of Water Resources (PNIGRH). This policy is planned for 12

years and has 6 objectives with specific strategies that actors involved in the management of water resources must follow. Some objectives of the PNIGRH are the improvement of the water quality by minimizing pollution and the improvement and strengthening of water and wastewater governance.

Furthermore, there is a national plan worth mentioning called the Colombian Green Growth Mission led by the DNP. The Green Growth Mission seeks to ensure economic and social well-being of the population by preserving the nature to reach sustainable development (DNP, 2018). The Green Growth Mission has 3 objectives related to wastewater management and reuse: The promotion of renewable energies including, for example, biomass. Secondly, the efficient use of water with the reduction of pollution and wastewater reuse. Thirdly, the promotion of circular economy through recycling and reduction of raw materials usage.

As the previous paragraphs show, the development of policies and plans that cover the same issues at national level is evident. There are several plans that address the same issues and that could be redesigned into one policy for the efficient management of water resources including wastewater. It is contradictory that there is a plan for the integral management of water resources and another plan for the management of municipal wastewater in Colombia when both could be joined in a single policy that can recognize regional problems and would not leave out environmental issues such as the pollution of the Magdalena River.

On the other hand, there are diverse plans and instruments at regional and local levels such as the departmental water plan (PDA) and the Sanitation and wastewater discharges management plan (PSMV) that have their origin in national norms as shown in tables 2 and 4. The PDA started in 2007 as a national policy and was meant to give the control of water and sanitation services, management of resources, and infrastructure projects to the departments looking for a regionalization and more efficient administration. By law, the municipalities are in charge of the provision of water and sanitation services, however, the PDA pretends to create a regional model to join forces and help the municipalities to fulfil such task. The PDAs have their bases in the decree 2246/2012 and are defined as planned and coordinated activities with the participation of the nation, departments, municipalities, the DNP and CARs to join efforts and resources to provide water and sanitation services in the municipalities (García Pachón, 2017). Through the PDAs, the departments are expected to coordinate the participation of the

municipalities in the department and to create a common fund for water and sanitation projects in the department.

Huila has a PDA and a company that coordinates the PDA called Aguas del Huila S.A. 36 of the 37 municipalities of the department currently participate in the PDA and according to Aguas del Huila, investments have been made in 24 municipalities of the Department (Aguas del Huila, 2014b). However, these investments are mostly focus on water potabilization plants to guarantee drinking water in small municipalities, and in the case of the three municipalities of this study, the effect of the PDA has been minimal concerning WWTPs. It was not possible to interview the manager of Aguas del Huila during my fieldwork to discuss the effects of the PDA in wastewater management in the region. However, informants from CAM confirmed that the PDA have more impact in small municipalities improving the infrastructure for potabilization water plants. Similarly, there are other planning instruments at the regional level such as the Departmental Development Plan (DDP) and the Huila 2050 climate change plan. The current governor of Huila presented his DDP for the period 2016-2022, however, concerning wastewater management, it just describes the current situation emphasizing that Neiva produces more than 50% of the pollutant loads due to its wastewater discharges. It further highlights the need to execute projects to improve the current situation in the region.

The Huila 2050 climate change plan issued by Huila's governorate and CAM with the help of international cooperation is another remarkable tool in the region. The plan aims to analyse the vulnerability and adaptability of Huila to climate change and offers strategies to face this phenomenon. The Huila 2050 climate change plan has the efficient management of water resources to reach sustainable development as axis No. 1. Unfortunately, it does not focus on improving water quality and reduction of wastewater discharges, but on how to satisfy the growing water demands for the urban, agricultural, mining and hydrocarbon sectors through hydrology models generated by software. Finally, it is worth to mention the CAM's 2011-2023 environmental management plan which created a regional fund for water decontamination and financing of WWTPs. Nonetheless, it has not been very useful because the municipalities generally do not present projects to build the plants according to what was stated by the informants from CAM in Garzón.

At the local level the municipal authorities have some planning instruments for the management of wastewater in their jurisdiction. Some of the most relevant plans found in the

municipalities during the field research were the Wastewater Discharges Management Plans (PSMV), the Municipal Development Plans (MDP), the Territorial Arranging Plans (POT), the Efficient Use and Water Savings Plans (PUEAA) and the Integrated Solid Waste Management Plans (PGIRS). As indicated in Table 3, all the three municipalities of this study have these planning tools updated to a certain level. Perhaps the most important plans in the three cities of study are the PSMV. The PSMV were designed for municipalities that do not have a WWTP. The resolution 1433/2012 defines the PSMV as programs, projects and activities with their respective schedules and cost calculations to improve the sanitation and treatment of wastewater including the collection, transport, treatment and final discharge of rainwater runoff and urban sewage. The PSMV must be articulated with the quality goals for discharges set by the CAM which approves the PSMV and controls its compliance in the department of Huila. The PSMV must be planned for at least 10 years with short, medium- and long-term goals aiming to construct the WWTPs. Usually, the municipalities establish public service companies to provide the water and sanitation services and these companies elaborate the PSMV and submit it to the environmental authority to be approved. The PSMV is a tool that was questioned by many actors, some believe that they only help to delay definitive solutions to the problem of wastewater treatment. Others consider that they have been poorly designed and are very flexible in their implementation, About the PSMV, one of the DNP interviewees opined the following:

“The PSMV are too idealistic. The PSMV oblige the municipalities to create plans that normally are not adapted to the local realities. The costs of the treatment of wastewater are too high and the municipalities need to find sources of finance. The public service companies cannot comply with their PSMV and the retributive rates that they must pay for the discharges of wastewater are enormous and do not allow them to invest in infrastructure”.

On the other hand, the director of the CAM in Garzón stated the following about the PSMV:

“The PSMV is a tool designed by the government for the territorial entities to justify their incapacity to generate resources. The national government gives permission to delay the solution with the PSMV for 10 years and at the end of that period a decision on the WWTP construction is made depending on the availability of resources. If at the end of that period the construction of the wastewater treatment plant is not possible, the city

major can justify the need to modify the PSMV and extend the period for another 10 years...I think the PSMV is a justification for the inefficiency of the state..."

In the next section, different plans in the three cities will be discussed in more depth, as well as the local realities and perceptions of the interviewees. Furthermore, the following section explores the influence of the national policies in the local realities and how the SDGs are embraced at the local level, with especial consideration to the SDG 6.

3.2. Current situation and stakeholders' perceptions in the three cities of study

In general, the three municipalities have the same problems but different circumstances. It was interesting to note that all the stakeholders mentioned the same issues concerning wastewater governance in their localities. However, each locality has its own realities that denote the importance of not thinking about "one size fits all" policies and rather promotes understanding their local realities and needs. This approach could be key to improve the current situation regarding management of wastewater and its possible reuse at the local level.

3.2.1. The context of Neiva

Neiva is the capital city of Huila. According to the information provided by the city townhall webpage the actual population is 347.501 inhabitants and it is estimated that it can surpass the 400,000 inhabitants in the next years. The city is located on the eastern side of the Magdalena River in the Magdalena valley between the Central and Eastern Cordillera. The economic development of Neiva is determined by activities such as agriculture, public services, commerce and construction. The agroindustry is incipient and is generally dedicated to producing raw materials, beverages and food supplies to satisfy the regional needs. Neiva does not have a strong industrial sector, so companies emerge in a spontaneous and disorganized way without considering the land-use planning from the POT of the city (Alcaldía de Neiva, 2009). The urban area of Neiva has been developing in a disorganized manner during the last decades. The city is dispersed, disarticulated and does not have a good infrastructure for public transport or alternative means of transport. Most of the commercial activities are located in the city centre and different slums are spread in the urban area usually in risky areas such as slopes close to streams and rivers (Alcaldía de Neiva, 2009).

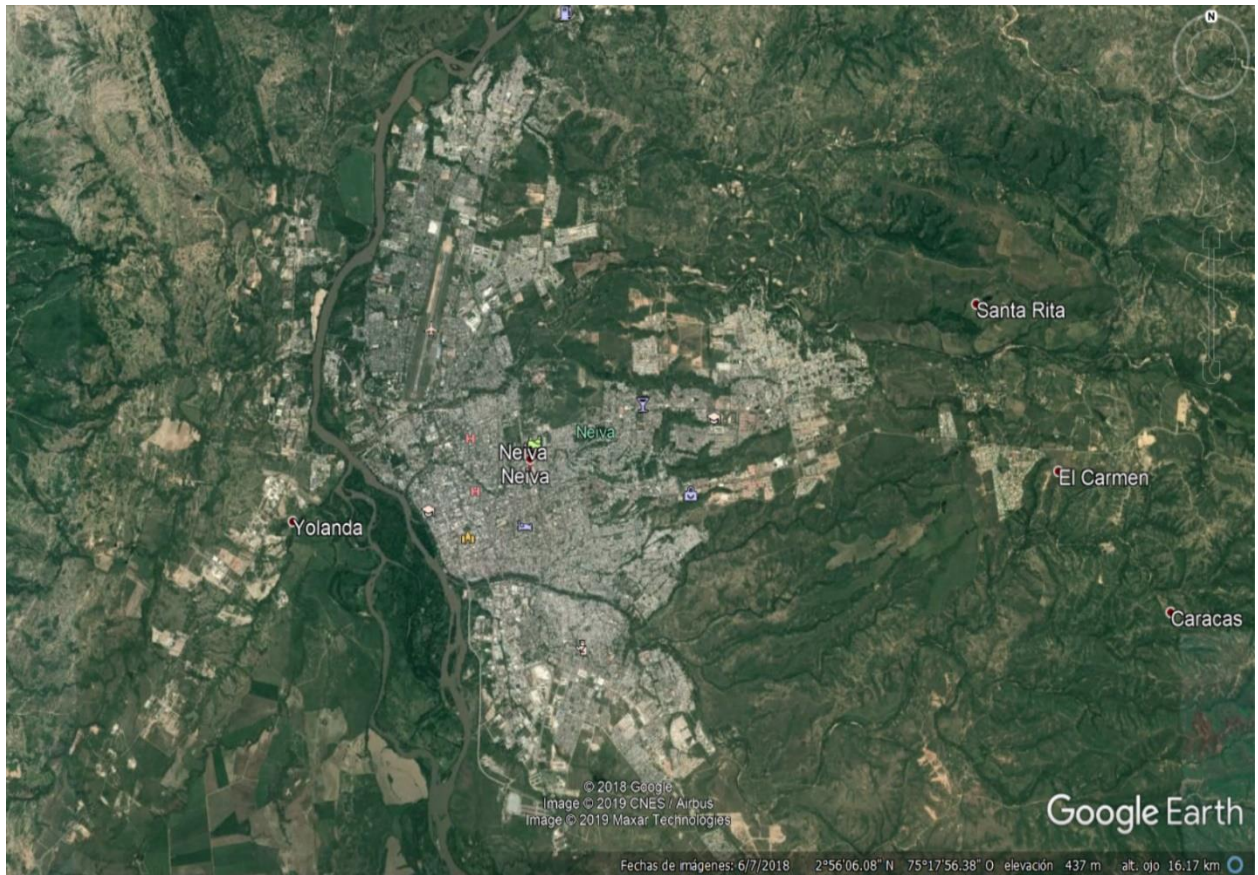


Figure 3. Satellite image of the urban area of Neiva.

Today Neiva does not have a WWTP and the sewerage infrastructure is not the most adequate to face the rainy seasons. Most of the sewerage networks in the urban area of Neiva are combined, i.e. they collect rainwater runoff and domestic wastewater at the same time. All the wastewater is discharged into the Magdalena River without any kind of previous treatment along 13 dumping points contaminating it (Las Ceibas, 2018a: No page). The most recent information offered by Las Ceibas which manages the water and sewerage in the city, shows that the discharging points with the highest flow are in the area where the WWTP is meant to be. According to Las Ceibas (2018b) and (2018c), these two points are Puente Santander North and Puente Santander South (Figures 4 and 5) and approximately 1,554 litres per second (l/s) of sewage are discharged into the Magdalena River.

In total, more than 1.700 l/s of sewage is discharged into the Magdalena River without receiving any previous treatment in Neiva. The sewage gives a pollutant charge of 14.979 kilograms of TSS and 26.467 kilograms of BDO per day (Las Ceibas, 2018b). The data reported in the PDA of 2014, indicates that Neiva produces the 55.37% of BDO and 51,37% of TSS in the department of Huila (Aguas del Huila, 2014a). However, the characteristics of the wastewater vary depending on the rainy and dry seasons, being more heavily polluted during the dry seasons since there is no rainwater to dilute the sewage. According to the deputy manager of operations from Las Ceibas, who coordinates the WWTP project in Neiva, 95% of the wastewater in Neiva is urban wastewater: a mix of domestic and rainwater run-off, since there is no industry and the few existing factories in the city are obliged to have their own WWTPs. In his words the fact that the discharges are mostly urban wastewater “*is an advantage because the river can resist and purify itself the polluting charges*”. The same opinion was shared by other informants from Las Ceibas and CAM in Neiva, although they did not deny the need to have a WWTP as soon as possible. So, the old but controversial rule of “dilution is the solution to pollution” is widely accepted in Neiva.



Figure 4. Puente Santander North point



Figure 5. Puente Santander South point

As shown in table 4, Neiva has different planning tools where wastewater management is addressed including a PSMV as the most relevant plan. The Municipal Development Plan (MDP) for 2016-2019 of Neiva “Neiva, la razón de todos” answers to a constitutional

requirement that obliges the territorial entities to elaborate development plans in accordance with the NDP to ensure the efficient use of the resources. One of the guiding principles of the MDP of Neiva is the environmental sustainability, and one of its objectives within the environmental component is to guarantee the recovery, restoration and decontamination of the waterbodies and the effective management of wastewater to prepare the community for climate change (Concejo de Neiva, 2016: 55). Furthermore, the MDP has a specific component on water and sanitation whose main objective is the implementation of the PSMV and acquiring resources to build the WWTP. The MDP of Neiva is strongly influenced by the SDGs especially the SDG 13 on climate action which is mentioned in the Huila 2050 plan. The base document of the MDP of Neiva uses the SDGs as a guideline for the development of the city and a mechanism to integrate the MDP with the National Development Plan to maintain the coherence between the National and Sub-national levels (Municipio de Neiva, 2016). Moreover, Neiva is part of the Sustainable Emerging Cities (CES) plan sponsored by Findeter, which is a Colombian development bank, and the Inter-American Development Bank (BID). The *Plan Neiva Sostenible 2040* is part of the CES plan and aims for the improvement of aspects related to the sustainable development of emerging cities including issues such as the wastewater management offering strategies and support to reach such task (Findeter, n.d.).

Today, Neiva does not have a WWTP despite the various planning tools that urge the city to have one. Since 1988 the Municipality has had a Master Plan for Aqueduct and Sewerage that has been updated in different times and a PSMV from 2007 that has been modified in its schedule several times, both aiming to build a WWTP. In 2018 a new PSMV was submitted to the CAM aiming to reduce the polluting loads by 2022 with the construction of a WWTP. However, the reality shows a different panorama in the city considering that since 2005 the Municipality of Neiva, the Department of Huila, CAM, Las Ceibas and Cormagdalena (Another CAR just for the Magdalena River) have been forced to build a WWTP as defendants in a litigation. In 2005 a ruling from the Administrative Tribunal of Huila obliged the actors above mentioned to solve the problem of contamination produced by the sewage discharges into the river. The ruling was a response to an *acción popular*¹ initiated in 2004 by the

¹ The *Acción popular* described in the article 88 of the Colombian Constitution and the law 472/1998. It is a legal mechanism that aims to protect the collective rights and interests such as public health and the environment. The *Acción Popular* is used when a collective right is threatened to be violated or when the damage has been produced already. It also aims to restore the things to the prior situation before the damage was committed.

Association of public service users of Huila and one citizen from Neiva. The demandants asked the Tribunal for protection of some collective rights violated by the discharge of wastewater without treatment and ordered the construction of one or several WWTPs in Neiva by the defendants.

The Tribunal found the defendants responsible for the violation of collective rights such as the right to a healthy environment, the rational use and management of natural resources to guarantee sustainable development and the right to public health of the citizens of Neiva. The Tribunal ordered the defendants to build a WWTP and to guarantee its operation by latest 2011, as well as to address the contamination produced by wastewater discharges into the Magdalena River by 2015. Even though more than 10 years have passed since the Administrative Tribunal ruling of 2005 which was confirmed in 2009 by the *Consejo de Estado* as supreme tribunal deciding the appeal from the defendants, the situation is not solved, and numerous events have prevented the city from having a WWTP by 2019. Appendix 2 shows a timeline of the events regarding the construction of the WWTP in Neiva until April 2019. In 2018 a final project with the technical designs for the construction of a WWTP was presented by Las Ceibas but there were not enough resources for its construction and apparently the works will not start before 2020. Moreover, the project does not have popular support because of its location and the selected technologies that will be used in the WWTP. Different groups such as academics, experts, the citizen oversight committee, NGOs and citizens living near the location of the future WWTP are against the project. Some of them have sent letters and written opinion articles in newspapers suggesting the need to find alternatives to the current WWTP project. They propose a plant outside the city that can treat 100% of the city's wastewater with different technologies. However, the project proposed by the municipality and led by Las Ceibas seems to continue despite its unpopularity in a sector of Neiva's society.



Figure 6. Satellite image of the area where the WWTP will be built in Neiva

The WWTP of Neiva will treat around 80% of the total wastewater of the city according to the information provided by the informants from Las Ceibas. The project is localized near the Santander Bridge where Santander north and south discharging points are located (Figure 6). The area of the project is close to a residential area and during the field visits it was possible to evidence the opposition of the neighbouring community to the project. The costs of the project were determined mostly by the selection of the technologies that will be implemented in the WWTP. In 2017 Las Ceibas hired the consulting company Hidrosan S.A.S. to make the studies and designs of the WWTP of Neiva and they presented the following technological alternatives:

- Conventional activated sludge system
- Plastic media trickling filters
- Chemical-assisted primary treatment + conventional activated sludge system
- Chemical-assisted primary treatment + plastic media trickling filters
- Extended aeration activated sludge system.



Figure 7. Design of the WWTP by Hidrosan S.A.S (Las Ceibas, 2018d)

Hidrosan S.A.S. delivered their final designs in 2018 (Figure 7) and recommended the trickling filters with plastic media as the best alternative considering costs, technology lifetime, waste production and the community's acceptance, among others (Las Ceibas, 2018d). The WWTP is a necessity for the city since it is demonstrated that the wastewater discharges affect significantly the quality of the Magdalena river downstream (Las Ceibas, 2018a). However, the main motivation for the construction of the WWTP has not been the environmental protection but the compliance with the ruling from Administrative Tribunal of Huila. The deputy manager of operations from Las Ceibas believes that "With the construction of the WWTP the public services company Las Ceibas seeks to avoid further administrative sanctions against the municipality and the company more than preserving the environment". During my visit to Neiva it was possible to notice a certain lack of interest from the Municipality to solve the problem for the last 15 years. When the informants were asked about the causes and challenges to overcome the current situation and their own perspectives, a common response was the lack of commitment from the previous local governments and the disintegrated work with the new one and between the entities inside the municipal government. Some of the interviewees mentioned that there is no real interest in environmental issues from the government because it is more politically beneficial to deliver other projects in the city that are

more popular among the citizens than a WWTP. The leader of the Citizens Oversight Association believes that:

“There is no political will to solve the problem and analyse the solutions to choose the best one, the current administration is only worried about the court ruling and wants to start the construction as soon as possible to avoid more sanctions”.

This fact is linked to another root cause mentioned by the informants which is the ineffective environmental education in the region. The lack of environmental awareness is most evident in the vulnerable sectors where solid waste usually ends up clogging the sewers obliging the public services company to focus their efforts on solving problems day by day before concentrating on building a WWTP. Precarious urban planning was another recurrent topic among the informants that hinders the implementation of the plans and policies on wastewater management. In general, planning became improvisation in the city, although there are clear guidelines for territorial organization, the city continues to grow without adhering to these plans. This situation makes difficult, for example, the connection to the sewerage network of new residential areas and it caused the unauthorized discharging points. The secretary for environment and rural development of Neiva recognized that *in* “Neiva we have problems in territorial planning. Slums are establishing around the river basins and this kind of issues impede the effective implementation of the policies”. Likewise, he added “We cannot plan much ahead because there are so many problems in the city that force us to solve them on daily basis; it is like improvising because every day we have new issues to fix”. The ex-president of the town council of Neiva during the period 2016-2017 believes that planning and the model of development adopted is one of the main causes for the current situation in Neiva. During the interview he expressed that “There is a pre-modern model of development in Neiva. Our society believes that progress means to build more buildings and infrastructure that sometimes is not needed but are anyway visible things”. He also indicated that:

“Neiva has not met its duty to have a WWTP and shows a lack of awareness. It is not a problem of economic resources as everyone believes but a problem of weak planning, considering that Neiva is still updating the new territorial arranging plan-POT, and a problem of capacities to implement the plans, because some public officers do not have the qualifications and work day by day getting lost in bureaucracy”.

The lack of economic resources is the biggest concern for the public officers. Both the secretary for environment and rural development of Neiva and the representatives from Las Ceibas agreed that lack of resources is the main challenge to have a WWTP soon. The defendants in the ruling from 2005 are committed to contribute some resources but still a big portion of the budget is missing to start the WWTP construction. The townhall of Neiva and Las Ceibas as the coordinator of the project are trying to find resources through different mechanisms such as a public-private partnership where the private partner would complete the budget and do the operation of the plant (Alcaldía de Neiva, 2019). Hence, the start of the construction is expected to be in 2020 if the process goes according to what they expect. Other issues that emerged during the interviews with the stakeholders in Neiva were the need for wastewater reuse, the knowledge and implementation of the SDGs especially the SDG 6, the democratic participation in the policy making and implementation process and corruption and transparency from the public administration.

There are divided opinions about the need to reuse wastewater among the different stakeholders in Neiva. The secretary for environment and rural development of the city believes that the reuse of wastewater would generate environmental and economic benefits so they should consider it in a new policy on water management that they will elaborate. Likewise, the leader of the Citizens Oversight Association believes that “it does not make sense to treat the water, clean it and then discharge it into the river, considering that water is highly wasted in Neiva”. Similarly, the former president of the Municipal Council of Neiva believes that the reuse of wastewater and implementation of a circular economy model is necessary, so the city can think about reusing sub-products and recycle resources from the wastewater treatment process.

On the other hand, the informants from Las Ceibas believe that there is enough water in the region, so the reuse is not a priority and they have not considered it for the WWTP project. Nevertheless, one of the interviewees from Las Ceibas thinks that the company should offer different types of water like raw and drinking water to save resources. The informants from the CAM in Neiva have a similar opinion when they expressed “There is a lot of water during the rainy seasons, but the water is not captured by the soil, therefore there could be scarcity during dry seasons. A better option is to create some reservoirs, but in any case, it is proven that during the whole year enough water is produced to satisfy the city needs”. The data collected shows that the non-revenue water index which is “water that is placed into a water

distribution system but not billed to the customer... water consumed but not paid for by the customer” (World Bank, 2016:1) in Neiva has increased in the last years² reaching 58% in 2017. This reflects that the PUEAA is not efficient and it is necessary to think about reusing wastewater to compensate the economic losses from the water that is not paid. It is important to consider that water demand in an average hydrological year is high in Neiva. (CAM, 2016: 83).

Another topic discussed with the informants was their knowledge about the SDGs and if they have been implemented in their cities. The secretary for environment and rural development of the city claimed that “The SDGs are better known in the academia but not within the public administration sector. The Millennium objectives were perhaps better known before but not the SDGs”. Inside Las Ceibas the SDGs are not well known, since their representatives claimed to not have heard about them nor studied them before. However, it was interesting to find that the company has met some of the targets and indicators of the SDG 6 without even knowing it. As an example during our interviews we discussed some targets such as 6.2 about ending open defecation providing access to sanitation and hygiene and the conclusion was that the city did outstandingly well in this target since the coverage in water and sewerage in the urban area is over 98% (Aguas del Huila, 2014a) and common defecation is rare in Neiva. The same situation occurred with the target 6.6 that aims to protect and restore water-related ecosystems. In this target, Las Ceibas have worked in the protection of Las Ceibas river which supplies drinking water to Neiva, aiming to protect the river through reforestation and recovery from its source until it flows into the Magdalena River. However, other targets still need a lot of effort and willingness from the public administration to be accomplished such as the target 6.3 on eliminating wastewater discharges by 2030. Las Ceibas is interested to learn about the SDGs and considered them as a useful tool to elaborate the company’s environmental strategy soon. It was interesting to see that the leader from the NGO COBIDA which is working in the protection and recovery of the Magdalena River, had a good knowledge of the SDGs. This helps to support the argument that the SDGs can have a positive influence on the civil society and private actors as the main drivers to meet the 2030 agenda.

² Comparing different data sources, I found that in 2014 the Non-revenue water index in Neiva was 45% (Aguas del Huila, 2014a) and in 2015 the index increased to 54,82% (Findeter, n.d.) reaching 58.40% in 2017. Therefore, much more water is wasted meaning more economic losses to Las Ceibas.

The last two common issues during the interviews were the participation of the community in the elaboration of plans and decisions and the lack of trust in the public administration because of corruption and zero transparency. During the last years Neiva has seen some corruption scandals in the public sector. Although most of the informants mentioned corruption as a cause for the current situation, they did not expand much on the topic. However, the former president of the Municipal Council argued that: “Corruption in Neiva comes from a clientelist society, which generates relations of patronage among politicians and citizens... The bureaucrats use their public positions to pay back favours and some politicians arrive to their positions with a predatory attitude seeking only their personal interest” and he explained further:

“One of the biggest employers in the city is the public sector since there are not many industries in Neiva, therefore, politicians can manipulate people easily and corruption is common within our society”.

Lastly, concerning the community’s participation it was possible to see two contradictory points of view among the informants. The public officers, including the informants from Las Ceibas, considered they have always guaranteed participation in the WWTP project to the community. They argued that the Citizen Oversight has been given the opportunity to monitor everything from the beginning so there has been transparency during all the process. However, for the Citizen Oversight the WWTP project has always been carried out ignoring their recommendations and without consulting them nor the community affected by the project. They argued that just few meetings were held to inform that the project would be carried out in the area of the discharging points at Puente Santander. The CAM and Las Ceibas argued that the community participation is not active, and people did not show interest until the construction of the plant was about to start. Some leaders from the neighbourhood around the WWTP project area were invited by Las Ceibas to see other WWTPs in different cities in Colombia, however, that has not been enough for them to feel included in the decision-making process as they claimed during my fieldwork. The community has protested a couple of times and the WWTP project seems to not have a high level of support from the people that could be affected by having it in their surrounds.

3.2.2. The context of Garzón

Garzón is in the centre of Huila and is the third most important city of the department. The population of Garzón is around 90.000 inhabitants of which over 43.000 live in the urban area (Alcaldía de Garzón, 2016). The main economic activity in Garzón is agriculture, mostly focused on coffee plantations and other types of crops such as fruits and forage for livestock. Another important economic activity in Garzón is fish farming in El Quimbo dam that uses the Magdalena River to produce energy. Garzón has a drinking water coverage in the urban area of almost 100% (Aguas del Huila, 2014a) and takes the water from the stream called Quebrada Garzón before it enters the urban area. According to Garzón's townhall, the sewerage coverage in the urban area was 92.30% in 2015 (Alcaldía de Garzón, 2016: 56) but the data found in the PDA by Aguas del Huila indicates that the sewerage coverage was around 98% in 2014 (Aguas del Huila, 2014a: n.p.). Most of the sewerage in Garzón is combined as in Neiva and the wastewater is not treated because there is no WWTP in the city. During a visit to the public services company of the city Empresas Públicas de Garzón (EMPUGAR), the operations inspector said that right now they are mostly committed to completing the sewerage network and building connections to lead the discharges to a single discharging point before eventually building a WWTP.

Nowadays, the urban wastewater is discharged directly into the stream Quebrada Garzón along 6 different discharging points and into the creek Quebrada La Cascajosa, which flows into Quebrada Garzón at a subsequent point. It is important to mention that Quebrada Garzón is the stream that provides drinking water to the city; therefore, it is protected upstream the water potabilization plant before entering the urban area. However, after the stream enters the city, it receives lots of polluting charges from sewage discharges and it is also heavily contaminated with solid waste. During my field work it was possible to see at least 4 of the 6 discharging points along the Quebrada Garzón in the city. I also visited the point where La Cascajosa flows into Quebrada Garzón, adding more pollutants to it. The Quebrada Garzón flows into the Magdalena River which at that point is dammed by the El Quimbo hydroelectric plant. Figure 8 shows a satellite image of the urban area of Garzón and the Quebrada Garzón highlighted in blue starting at the water potabilization plant before entering Garzón until it flows into the Magdalena River.

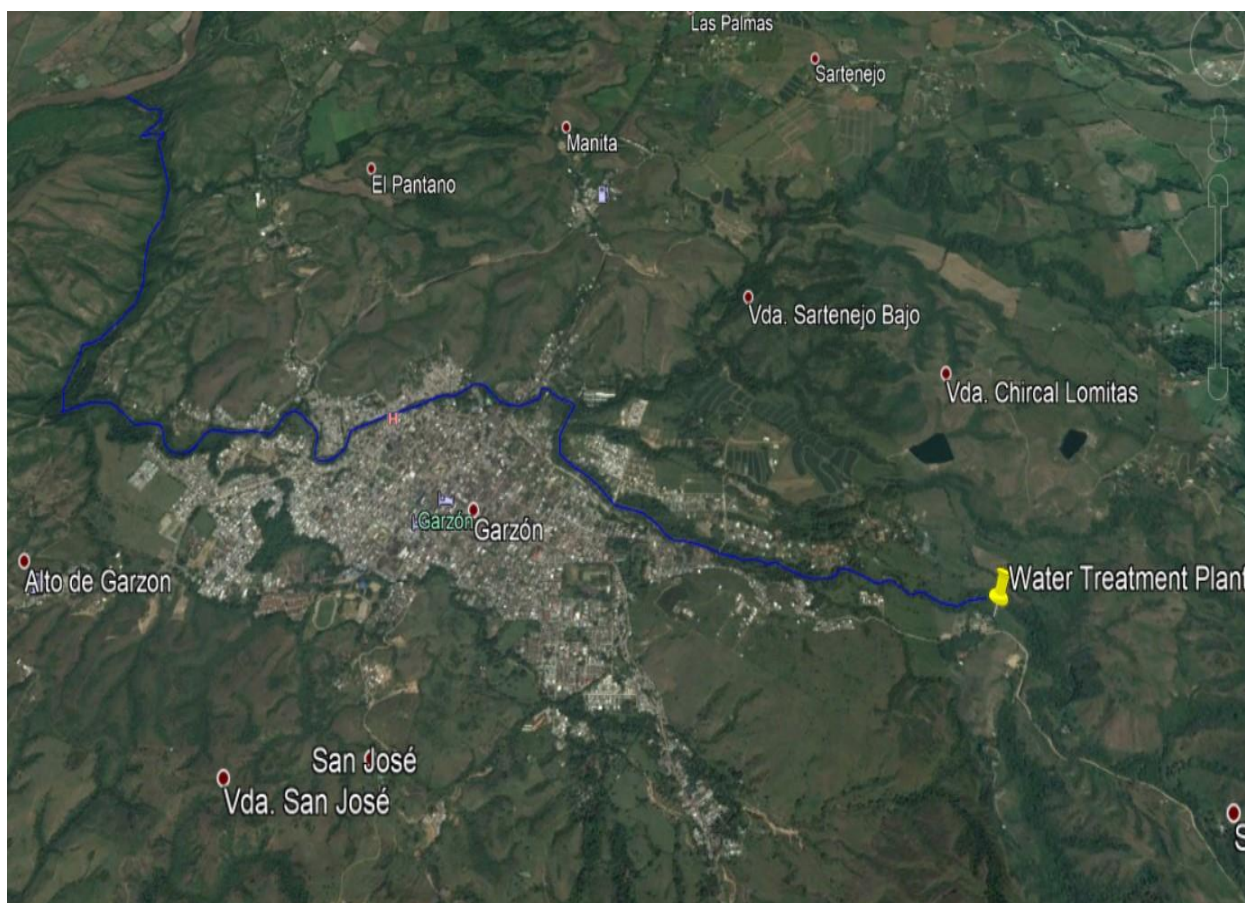


Figure 8. Satellite image of the urban area of Garzón and the Quebrada Garzón highlighted in blue.

The contamination of the streams was evident during the visit to the city. There were bad smells and different kind of solid waste along the discharging points as shown in Figure 9. Garzón is not such a great polluter compared to Neiva, however it produces around 5% of the total BDO and TSS pollutant charges in the department (Aguas del Huila, 2014a). According to the last regional water study from 2016 in Huila, the Water Quality Index of the Magdalena River is almost the same upstream and downstream the Quebrada Garzón flow (CAM, 2016: 108) with a regular index. This fact could influence the attitude of the decision makers on solving the contamination produced by wastewater in the city's waterbodies. There are different plans and policies concerning wastewater management in Garzón. The Municipal Development Plan for 2016-2019 presented by the current mayor of Garzón addresses repeatedly the wastewater issue and the need to build a WWTP in the city. The plan includes projects to improve wastewater management such as the elaboration of a sewer master plan and the construction of sewers as well as the WWTP in the short term. Noticeably, the municipal mayor recognizes the need to

move forward in the construction of a WWTP to reduce and improve the quality of the wastewater discharges of the city.



Figure 9. A discharging point in Quebrada Garzón.

The municipal development plan of Garzón for the period of 2016-2019 is linked to the previous NDP and has tried to integrate the UN Millennium goals even though by 2016 the SDGs have already taken over. However, none of the informants had knowledge about the SDGs nor had even heard about them in Garzón. The MDP aimed at the integration with the national sustainable development policies and focused on sustainability in different aspects, yet, the reality shows that a lot of work still needs to be done to achieve environmental sustainability in the city. Furthermore, the city also has a well-structured PSMV with clear objectives aiming to have a WWTP as its main goal. During my fieldwork the informants from the Environmental Department of Garzón (DAMA) and EMPUGAR indicated that the studies and design of the WWTP were ready. Despite that, the municipality was not able to buy the lands required to build the WWTP and they had to start an expropriation process. In June 2019 the director of the DAMA confirmed that there was going to be a public-private partnership between the municipality of Garzón and Enel, the company owner of El Quimbo dam, in order

to pay for the lands. The municipality will search for more resources to start the project which will take two years to be completed according to their plans.

The director of the DAMA explained that since 2011 the municipality has tried to build the WWTP, but different circumstances have not allowed them to meet the goal. She believes that an appropriate wastewater management has never existed in the city and the public administration has focused more on protecting the watershed upstream from the city to supply drinking water to the population. According to the manager of EMPUGAR, the problem of wastewater could be due to a lack of coordination between the different entities within the local, regional and national government. She believes that “all policies are designed for large cities and need plans with certain requirements that small towns cannot fulfil because they do not have enough capacity”.

Both the informants from EMPUGAR and DAMA believe that the city lacks coordination between the various offices that must watch over wastewater discharges in Garzón. They consider that there are serious problems in urban planning because some slums are growing, and the municipality gives them electric power and connection to water instead of relocating them because they are in risk areas. These slums have no connections to sewerage, so they discharge their sewage directly into the river or onto the ground. During the field work it was possible to visit one of the slums where sewage was dumped directly into the Quebrada Garzón or simply flowing into the streets, as shown in Figure 10, this being a clear risk to human health.



Figure 10. Wastewater flowing on the streets of a slum in Garzón.

In general, the problems in relation to governance are very similar between Garzón and Neiva. The informants mentioned that the problem is not the absence of plans, projects and policies, on the contrary, there are already too many, but that national policies have no impact at local level because they are elaborated by experts in the capital city and do not consider the local contexts. They also believe that there are not enough resources, neither economic nor human, to be able to implement the plans to which they are obliged to. Therefore, as the director of the DAMA said, the public administration in Garzón is limited to living day by day, doing small projects that bring popularity to the mayor. The informants also expressed their concern about the lack of education and environmental awareness of the inhabitants of Garzón. The leader of the NGO Interpretes Ambientales thinks that:

"People in Garzón believe that we have a lot of water and therefore it can be wasted since they are paying for it, they believe to have the right to use as much water as they want".

Likewise, cases of corruption have occurred in Garzón during the last years. The director of the DAMA had to denounce several situations where people were hired to deliver environmental studies and plans, but the results were copies of other studies from other cities in Colombia, which consequently affected the resources and planning of the city. On the reuse of wastewater, one informant from EMPUGAR thinks that “since it is an innovative proposal it would not prosper because people in Garzón are not used to it and they would not accept to use treated wastewater mostly because of ignorance”. The informant further considers that bureaucratic demands also make it very difficult to take advantage of other products from the wastewater treatment such as the sludges because they need permits that would take more time and is just too much effort lost in bureaucracy compared to the possible returns. Regarding citizens participation in the policy and decision making, the NGO leader considers that the participation has not been effective because sometimes they are called to take part in initial consultations, but they are not considered for the decision-making nor monitoring of the projects. On the other hand, EMPUGAR considers that people are not interested in participating and even though they have invited them by radio and other means, people do not show up as they expected. Finally, all the interviewees agreed that there is a very uncoordinated work at the local level, they require better economic and human resources, raising awareness about the importance of rivers and streams, seeing wastewater treatment as a moral duty to future generations and not only to comply with the current norms.

3.2.3. The context of Pitalito

Pitalito is the last city of this study on wastewater management in Huila. Pitalito is the second most important city of Huila. It is in the south of the department in the valley of the Guarapas River and over the valley of the Magdalena River between the central and eastern Cordillera. Pitalito has a total population of around 126,000 people and around 75,000 inhabitants live in the urban area (Concejo Municipal de Pitalito, 2016: 229). The economy of Pitalito is based on agricultural production, being a large producer of first quality coffee, as well as commercial activities and the provision of public services. Pitalito is an important city in southern Colombia and serves as a linking point with other departments such as Putumayo and Cauca. Pitalito is one of the main cities of the Colombian Massif (Macizo Colombiano), a huge mountainous area with unique biosphere and the principal water producer for the centre of Colombia. The municipality has become an important environmental protector through the

creation of regional natural parks under their jurisdiction. The case of Pitalito is interesting because they have tried to give more importance to the environmental issues in recent years and have recognized the SDGs as a guideline in the last Municipal Development Plan. The municipality has also elaborated its own policy to face climate change called "Ruta de cambio - Pitalito 2030" being the first one at the local level in Colombia to elaborate such a plan. Pitalito is proud to call itself a pioneer in the 2030 agenda, addressing issues of environmental importance worldwide and is about to produce a big strategy of environmental management for the municipality soon. However, Pitalito today does not have a WWTP and all its domestic wastewater is being discharged directly into the stream Quebrada Cálamo and the Guarapas River that later flows into the Magdalena River.

Pitalito has a history that shares similar characteristics with Garzón and Neiva. One of the main deficiencies in the management of wastewater in the city has been the precarious urban planning and the lack of coordination among the entities in charge of wastewater management at local level. Pitalito, in contrast to Neiva and Garzón, has a WWTP that was built more than a decade ago. However, the plant was in a risk area below the flood level of the Guarapas River and during a rainy season the river covered the plant and left it unusable. Today it is estimated that about 205 l/s of wastewater are discharged directly into the Quebrada Cálamo that flows into the Guarapas River and later reaches the Magdalena River (Concejo Municipal de Pitalito, 2016: 130). The biggest discharging point in Pitalito is at Quebrada Cálamo (Figure 11).



Figure 11. Discharging point in Quebrada Cálamo.

Figure 12 shows the urban area of Pitalito with the Guarapas River highlighted in red and the stream Quebrada Cálamo in yellow. The old WWTP is marked on the satellite image in figure 12 together with the biggest discharging point of the city.

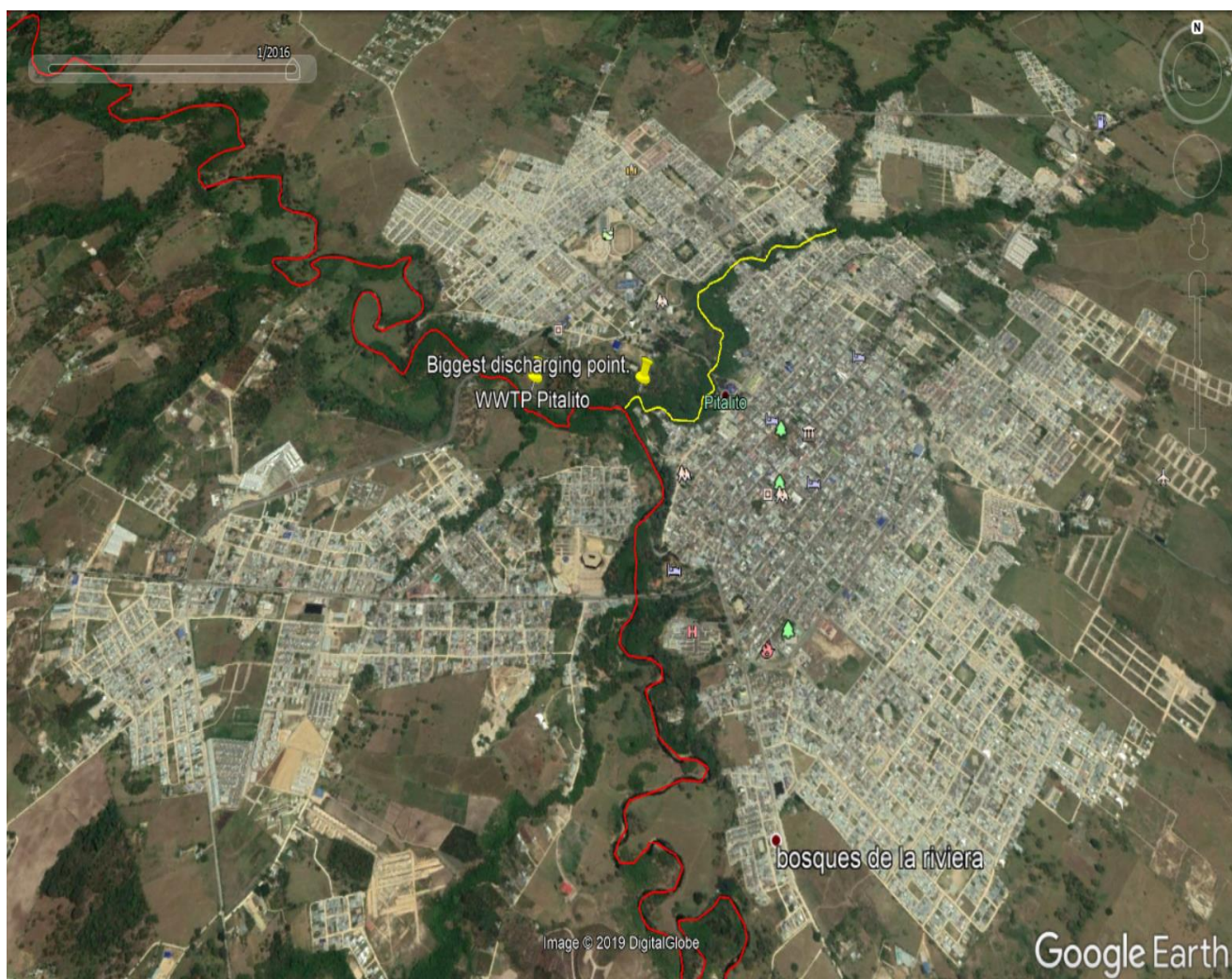


Figure 12. Satellite image of the urban area of Pitalito with the Guarapas River highlighted in red and the Quebrada Cálamo highlighted in yellow and the location of the old WWTP and the main discharging point.

According to the information found in the PDA, Pitalito produces in total 8.36% of BDO and 11.03% of TSS (Aguas del Huila, 2014a: n.p.) of the department of Huila, being the second biggest polluter in the region after Neiva. The MDP of Pitalito aims to build a WWTP with a primary treatment and a second stage with oxidation ponds, furthermore, the place for the construction of the WWTP is already defined and the municipality ceded the land to the public services company of Pitalito - Empitalito ESP to build the plant as soon as possible. However, according to some informants from Empitalito ESP and the Municipal Secretary of Agriculture, Environment and Rural Development, the land where the WWTP should be built is currently illegally occupied by people and they will need to proceed with legal actions to recover the land from the invaders.

In Pitalito it was possible to interview 4 informants from different entities and all agree that the municipality does not have the necessary resources and has not given priority to solving the wastewater contamination. The director of the CAM office in Pitalito for the south of Huila thinks that “Although, Huila and Pitalito have been leaders in developing environmental policies, the priority when using the resources is not the environment but other projects such as building rural roads. The resources are not invested in the environmental sector”. He further considers that “there is need of more scientific and technical investigation resources to reduce costs of the WWTPs in the region and priority should be given to granting the necessary resources to build plants as as much as it is given to building tertiary roads”. One informant from Empitalito believes that together with the lack of awareness there are also serious problems with urban planning because there are many slums along the river which makes it difficult to install pipes for sewerage and thus, these slums discharge the wastewater directly into the river or other streams. The informant of Empitalito considers that the discharges could be treated with smaller WWTPs in different areas of the city to make the process less expensive and to help to solve the problems of connecting sewerage pipes. Finally, she also considers that even though there are specific policies and plans such as the PSMV to address the wastewater issue, there is lack of commitment from the municipality because environmental issues simply do not grant votes or popularity to the current mayor.

Furthermore, an informant from the Environment Secretary of Pitalito and one informant who is an ex-manager of Empitalito consider that a lot of political will is missing in order to be able to solve the problem of wastewater contamination in the waterbodies. The former manager of Empitalito says that public service companies are politicized, and each city mayor changes the staff and puts those he wishes in the positions he can choose. That situation damages interesting processes that could give results in the medium and long term. Finally, although the administration tried to incorporate the SDGs into their policies, none of the 4 informants except the informant from the environment secretary knew about them. He considered the SDGs as an appropriate guideline to elaborate the new Pitalito's environmental management policy that should be finished soon. There was no clear information about when the WWTP construction could start and there is still an ongoing interesting debate around the possible solutions to the wastewater discharges in Pitalito.

3.3. Synopsis of field observations

This section provides a synopsis of the main findings from the three cities of study. Table 5 shows the main finding with a description and some relevant examples gathered during field work.

Table 5. Synopsis of main findings.

Finding and research question	Description
<p>1) Overproduction of policies, plans and norms at national and local levels.</p> <p>Research question 1a. Are there any local or regional policies on treatment and reuse of urban wastewater and how are integrated with the national policies and norms?</p>	<p>There are many policies, plans, projects and norms at national, regional and local levels. They are somehow integrated, especially those at local level with the national policies.</p> <p>Many of the plans and policies at regional and local level follow obligations from national norms. However, the framework is too extensive, dispersed, disorganized and suffers of constant modifications. There is not a single norm concerning water and wastewater management. Therefore, different norms, plans and projects can apply at the same time and this makes difficult their implementation.</p>
<p>2) Bad wastewater management in the 3 cities. Polluter pays principle and the rule of “dilution is the solution to pollution” as an excuse to not act further.</p> <p>Research question 1b. How have these policies been implemented at regional and local levels?</p>	<p>There is no wastewater treatment in the 3 cities. The polluter pays principle works as a kind of excuse to not put real action into solving the problem. The municipalities just pay the rates for discharging polluting water into the rivers to the CAM but the contamination problem is not solved because the CAM is not in charge of building the WWTPs. Then, the municipalities must pay lots of money for the discharging rates and there will never be enough budget to build the WWTPs. Similarly, public officers and</p>

	<p>decision makers believe that the river can dilute the pollutants, and even though they could be right, and some studies could back up that statement since the quality of the river maintains the same regular standards, the pollution problem should be addressed as a moral duty according to some informants. Contradictorily, the protection of the sources of drinking water is great in the 3 cities and demonstrates that the efforts are concentrated in first providing water to the citizens but not in treating the wastewater.</p>
<p>3) Wide recognition of the SDGs at national level and recognized at local level. Not mentioned at regional level.</p> <p>Research question 2. What is the impact of the SDGs on the wastewater governance at national, regional and local levels and how could they help to feed the process of an effective elaboration and implementation of the current policies?</p> <p>Research question 2a. Is there any relationship or linkage between the current policies at national and subnational levels with the SDGs and in specific the SDG 6?</p>	<p>The Sustainable Development Goals have been recognized widely at the national level. They are mentioned in the current National Development Plan and in the previous too. A CONPES document also introduces them in the national political agenda. At the regional level they are not mentioned, however at the local level in two of the cities they are mentioned and used as guidelines for their Municipal Development plans. The SDGs are well known by the public officers at the national level, but at the local level there is little or no knowledge about them among the public officers. Some informants from the civil society were aware about them, which is hopeful.</p>

<p>4) Passivity or lack of interest from the decision makers – Public Administration.</p> <p>Research question 3. What are the main challenges related to wastewater governance in Huila and the three cities in the study?</p>	<p>The wastewater contamination seems to not be a priority for the public administration according to the opinion of some interviewees. Those in charge of taking decisions are not acting fast towards solving the problem and prefer to invest in other projects that could give them more popularity or votes as some informants claimed. The main motivation to act towards environmental issues is to avoid sanctions from the CAM or tribunals.</p>
<p>5) Not enough environmental awareness plus a deficient environmental education.</p> <p>Research question 3. What are the main challenges related to wastewater governance in Huila and the three cities in the study?</p>	<p>Even though there have been projects to introduce environmental education in schools, still one of the biggest barriers is the lack of environmental conscious or awareness linked to poor educational projects to understand the value of water in the region. This was mentioned different times by the informants.</p>
<p>6) Precarious coordination between the entities at different levels. Not good planning for midterm and long-term objectives.</p> <p>Research question 1d. Does the current wastewater governance show characteristics to be qualified as good and effective?</p>	<p>Many informants believed that there is not a good teamwork between the different entities inside the local administrations to join forces and find solutions to the wastewater problematic. Sometimes the urban planning offices, the environmental offices, the public service companies and others involved just work on their own and can even disturb each other's work. Informants also think that there is no long-</p>

	<p>term nor midterm planning because they just need to go day by day, being more an improvised administration than a planned one.</p>
<p>7) Not enough economic and human resources.</p> <p>Research question 3. What are the main challenges related to wastewater governance in Huila and the three cities in the study?</p>	<p>This was the main concern expressed by the decision makers. The first thing when they were asked about the challenges was the lack of economic resources and sometimes human resources. Lack of capacities was a constant root cause for almost all the participants in this study.</p>
<p>8) Reuse of wastewater has divided opinions. Not a generalized support.</p> <p>Research question 1b. How have these policies been implemented at regional and local levels?</p>	<p>Among the public officers-decision makers, the idea to reuse wastewater and sub products is not seen as something needed. Other actors such as the ex-president of the city council of Neiva, the citizen oversight of Neiva and NGOs on the contrary believe that it is required and even talked about switching to a circular economy model.</p>
<p>Lack of transparency and some corruption cases.</p> <p>Research question 1. How is the current wastewater governance in Huila and could it be considered an example of good and effective governance?</p> <p>Research question 1d. Does the current wastewater governance show characteristics to be qualified as good and effective?</p>	<p>In general corruption was always mentioned even by the public officers. There have been some cases of corruption in the region and the trust in the public administration is not the best. There are some doubts about the process of buying the lands and selection of technologies for the WWTP of Neiva for example. The civil society and NGOs do not understand for example why the municipality decided to buy the lands before having final studies and designs and therefore forcing Hidrosan to make their</p>

	studies subject to the lands that were already bought.
<p>9) Not effective democratic participation – apparent participation.</p> <p>Research question 1d. Does the current wastewater governance show characteristics to be qualified as good and effective?</p>	<p>Decision makers always argued that they have offered enough chances for participation however the community expressed otherwise stating that they are called just in the initial phases or to be communicated that a project was decided and how it could affect them, but never to decide together the best options and discuss it openly before taking decisions.</p>

4. DISCUSSION

This section aims to discuss some of the main findings based on the research questions and the theoretical framework. This section is divided into four parts as follows: First, good governance and wastewater governance are discussed using some of the findings from my field work to answer the first research question about whether the current wastewater governance in Huila can be considered good and effective. In this part, emphasis is placed on the need to strengthen institutions' capacity to enforce rules and provide public services taking the privatization phenomena that is happening in Latin America into consideration. Second, some characteristics of good governance such as accountability, transparency, rule of law and fight against corruption are examined. Further, the impact of SDGs on the wastewater governance in Huila is discussed with the aim of answering the second research question. Third, the debate focuses on the need to recognize common problems at local and regional levels to produce more "regionalized" policies that allow for more effective governance. Fourth, the need to build capacities to solve problems related to environment and to execute plans is discussed in the section concerning effective governance. Through the discussion I try to identify different challenges related to wastewater governance to answer the third research question on the main challenges in the region and the three cities of the study. Finally, the need to have a more equitable governance to distribute the benefits produced by good wastewater management is discussed in the last part of this section.

4.1. Good governance and wastewater governance to meet the SDG 6

To answer the first question of this study, it is important to understand the relationship between development, good governance and wastewater governance. The relationship between economic growth and good governance has been questioned by authors such as Sundaram & Chowdhury (2012: 10). In their work they explain that “although good governance is unobjectionable, if not desirable, reforms inspired by this approach have not been and cannot be successful for accelerating growth” and they conclude that “empirical evidence show that countries have only improved governance with development and good governance is not a necessary precondition for development” (Sundaram & Chowdhury, 2012: 9). However, when it comes to the provision of public services in developing countries, governments alone are not able to provide water and sewerage services, which has led to a decentralization and privatization leaving governments only as market regulators and policy makers (WWAP 2019a). This fact reinforces the importance of good governance and good wastewater governance, which aims to strengthen the institutions that must enforce and monitor the policies for an effective implementation from those in charge of providing services such as water and sewerage in pursuit of public interest (OECD, 2015).

The definition of Governance proposed by Biermann et al (2017a:75) that is an “authoritative steering of societal processes by political actors” and Fukuyama (2013: 3) who simplifies governance as “the ability of the Government to make and enforce rules and deliver services whether if it is democratic or not” give us some components for this discussion. Considering these two concepts it is possible to argue that governance in Huila is not completely matching the concepts proposed by Biermann and Fukuyama. In Huila, the ability to propose the three Ps is evident, however the enforcement and thus the provision of services seems to be failing. Good governance relates to governance systems that have qualities such as accountability, public participation and efficiency (WWAP, 2019a). In this study I tried to evaluate these qualities in wastewater governance in Huila. The evidence from my fieldwork shows that those responsible for guaranteeing the water and sanitation services are not accountable for not meeting the norms, plans and policies, therefore, the situation continues to be the same. The efficiency in the public administration seems to be weak with a slow decision-making process. Many years have passed since the Administrative Tribunal of Huila issued the ruling that

ordered the construction of the WWTP in Neiva. Perhaps, the fact that no other than the public institutions are sanctioned and prosecuted, makes the situation even worse. The results call for further research in locally based policymaking and implementation processes, and calls for actions to improve the governance systems that are ruling in Huila to protect and recover the Magdalena River before it is too late.

4.1.1. Accountability and transparency in wastewater management, the rule of law and fight against corruption

Accountability is one of the governance dimensions proposed in the Worldwide Governance Indicators (WGI) project. Voice and Accountability as it is explained by Kaufmann et. al (2008), refers to the measure of the perceptions to which a citizen can participate in elections as well as the guarantee of freedoms such as freedom of expression and association. In water governance, the lack of accountability denotes a “lack of transparency, institutional quality and integrity in water policy making” (Akhmouch, 2012: 18). Accountability is also related to relationships between actors such as citizens and decision makers, meaning that in a democratic country, citizens choose their decision-makers and these must justify their actions to their electors (Bäckstrand, 2006). With effective accountability mechanisms, officers and institutions are answerable for their actions and sanctions can be applied because of their illegal acts, poor performance or abuses of power. Hence, accountability is key to force actors to fulfil their responsibilities (WWAP, 2019a). However, accountability is not only concerned with decision-makers but also about citizens and their awareness and concern about the policy making and implementation processes which is key for good governance. Low participation and therefore absence of exhaustive monitoring and evaluation of plans and policies implementation are a major obstacle in water governance (Akhmouch, 2012). This was mentioned by the decision-makers on different occasions during my field work. It was difficult to find NGOs or other citizens involved in wastewater management other than those directly affected by the WWTP project in Neiva. The problem seems to be ignored by the rest of the citizens who apparently still do not have enough sense of belonging. Nevertheless, it is important to remember that the ruling from the Administrative Tribunal in the Case of Neiva’s WWTP was a result of the active participation from the Public Service User’s Association. This could indicate that although the participation is not very large, those who have been active are able to exert pressure through democratic methods and should encourage more active

participation in the protection of the Magdalena River which also means the protection of their own rights as citizens.

The privatisation of public services in Latin America for more than two decades reduced government's participation in water and sewerage sectors and therefore the traditional accountability has changed to one that answers mostly to the market regulation and contracting process (Akhmouch, 2012). Colombia and Huila are not an exception to this phenomenon. There is an extended network of public and private actors involved in water and wastewater management that could hinder the accountability in the provision of water and sewerage public services. The participation of different actors (policymakers, decision-makers, public service companies and citizens) creates vast networks that make it difficult to find who is accountable for failed governance in such diffusive networks (Pahl-Wolst, 2015: 94). Appealing constantly to private actors to provide public services could generate issues such as inequality in access to public services and lack of accountability (Lemos & Agrawal, 2006) and one clear example are the slums in the three cities of the study, where people do not have access to sewerage networks, and no one has been responsible for their living conditions and relocation until now. It would be interesting to follow Neiva's case where a public-private partnership is being sought for the construction and management of the WWTP. A future research could investigate what are the impacts for wastewater governance of such kind of public-private partnerships. Moreover, it would be worth to investigate how those kinds of partnerships could contribute to the citizens' wellbeing, especially to those most in need, and their contribution to sustainable development in the region.

Considering the second research question on the impact of the SDGs on the wastewater governance at national and subnational levels, accountability and transparency are also included in the SDGs that have been embraced in the country at national and local levels. Goal 16 calls for the development of accountable and transparent institutions at all levels (target 16.6). Likewise, target 16.3 relates to the promotion of the rule of law and equal access to justice for all. The rule of law can have different meanings such as "law and order or strict observance to western norms of Human Rights" as Fukuyama (2013: 3) indicates. Others define the rule of law as a durable system of laws, institutions and community commitment where government and private actors are equally accountable before the law (World Justice Project, n.d.). The rule of law is characterized by having just, clear and stable laws with transparent governments and open processes for policy making and prompt and effective

justice (World Justice Project, n.d.). The lack of clarity and observance to the rules and lack of accountability was one of the most interesting findings during my fieldwork. In practice, nobody has been found responsible for the delay in the construction of WWTPs in the three cities of this study. Likewise, the norms are neither clear nor stable and some lack mechanisms to be enforced. The vast normative framework hampers good governance because it is just too difficult to understand and it is overwhelming. It is a big challenge to learn, comprehend and implement all the existing tools for water and wastewater governance and it is necessary to simplify the normative framework, considering the local realities of small towns with low budgets not only in Huila but in the whole country as well.

Colombia has recognized the SDGs as an important guideline not only for the development of its policies but also for their effective implementation. Additionally, the SDGs have been included in some municipal development plans as guiding principles for their administration periods. However, the impacts of the SDGs in wastewater governance at local level are minimal since evidence from fieldwork shows that some small municipalities are far from reaching some targets of the SDG 6. Fight against corruption is another issue addressed in the SDGs. Target 16.5 seeks to reduce corruption and bribery in all forms to reach peace, justice and strong institutions. Absence of corruption is one of the factors considered in the World Justice Project rule of law index, and it considers forms of corruption such as bribery, misappropriation of public funds and improper influence by public or private interests (World Justice Project, n.d.). Various cases of corruption were mentioned during the interviews and it seems to have hinder citizens' trust in institutions and decision-makers. A recent report on social, economic and environmental aspects of the Magdalena River issued by the Office of the General Attorney for environmental and agricultural affairs indicates that from 2007 until 2013 there were 404 disciplinary sanctions to public officials from municipalities along the Magdalena River basin in Huila. A total of 7635 public officers have been sanctioned in Colombia (Procuraduría General de La Nación, 2013: 91). Many of the sanctions were for contractual and administrative irregularities, therefore risk of corruption cases must be faced to improve the current situation. A better use of the already scarce economic resources of the region, establishing priorities and investing in projects according to the needs and capacities of the municipalities is necessary to change the current situation.

To answer the third research question concerning the biggest challenges on wastewater governance in the region, the results from fieldwork offer important elements to consider in

this discussion. It is interesting to note that several of the challenges coincide with the gaps mentioned by the OECD in its publications (2012, 2015) on water governance, however, in wastewater governance some of the challenges may have different motivations. Policies and norms tend to remain on paper and are not completely enforced because of the lack of technical and economic resources as many informants argued. Furthermore, effective justice has not been achieved considering the ruling from the Administrative Tribunal of Huila, showing that governance and rule of law in Huila and Colombia may be weak. Moreover, it seems to be difficult for those who are not part of the public administration to participate in the policy-making processes affecting its transparency. It can be very difficult to have access to public documents that should be open to everyone in Colombia. During my field work I experienced the same situation, where I had to formally request public documents that should be in the official portals and then I had to wait for several weeks to receive them. Still, at this point, some of the documents have never arrived to me, which is a great limitation to this study.

4.1.2. Recognition of problems at national and sub-national levels and effective participation of all actors for locally grown environmental policies

Considering the policies and their integration, to answer the first research question, it is important to emphasize that the Colombian framework on wastewater treatment and reuse is characterized by its hypertrophy, frequent modifications and dispersion that hinders its harmonization and impedes the collaboration between different actors (García Pachón, 2017). It is worrisome that there are so many instruments and not a single consolidated normative tool on water and wastewater management that would make easier wastewater governance at regional and local levels easier. Moreover, as García Pachón (2017) explains, the diversity of plans can produce a duplication of tasks with repetitive efforts from the actors involved in wastewater governance that are working to meet the same goals. The effort of the state to compile several decrees related to wastewater management in a single decree (decree 1076/2015) is redeemable. However, the Colombian State should aim to have more simplified tools for the management of water resources including the management and reuse of wastewater to avoid overlaps and contradictions between them and meet the policies they aim to implement. On the integration of policies and the development of norms, most instruments at local level are based on norms and plans issued at the national level as shown in the findings.

There is a certain level of congruence between what is legally required to do from the national level and what is done at the local level in terms of production of plans and policies. However, such plans and policies usually require huge efforts from the small municipalities, and they do not really recognize the local realities, including the fact that those municipalities do not have big budgets to execute all the plans. Those plans, projects and programs at local level follow the ones produced by officers in the capital of the country, who sometimes seem not to understand the local needs, and this was mentioned by the participants in this study repeatedly. The informants said that those plans, policies and norms were thought for big cities such as Bogotá or Medellín and not for small towns in the middle of Huila with not enough economic and technical resources.

What is also evident is the participation of different actors of the public administration in the elaboration of the regulatory framework that led to an overproduction of tools that could delay an effective wastewater management. Both the Congress of the Republic and the Ministries of Environment and Housing as well as other actors at national level, and the Governorates, Departmental assemblies, townhalls and municipal councils at sub-national level participate in the elaboration of the policies, plans and norms applicable to wastewater management. This situation is not bad *per se* but when there is not a synergic work between the different actors at all levels, as it appears to happen, it is very difficult to meet common goals such as addressing wastewater contamination. Many of the informants, especially the decision-makers and policymakers at local level felt unsettled due to the fact that they have never been called to participate in the elaboration of the national policies. Some of the CAM officials believed that the problem is that they generally receive new guidelines to be applied at local level but without enough tools to implement them, so they end up being useless. In the same way, one of the academic experts believes that "it is necessary to recognize common problems at local and regional levels to later be able to recognize problems at national level. Then, we could have regionalized policies that are more effective and other policies that aim to solve common problems at national level". This confirms that "there is no one-size-fits-all answer, magic blueprint or panacea to respond to governance challenges in the water sector, but rather a plea for home-grown and place-based policies integrating territorial specificities and concerns" as Akhmouch (2012: 16) claims.

The results of the fieldwork show that in all three cities, although they have the same problem, influenced by the same challenges, each one also has different needs and characteristics, thus,

local-grown policies could be more effective to solve the problem considering that it is the citizens themselves who know their priorities and realities the most. Currently, Neiva and Pitalito are working towards having local-grown environmental policies. Likewise, policymakers from Garzón have been talking about regionalizing services such as solid waste management with the creation of regional policies that address common problems for some municipalities of the centre of Huila. Let's hope this could be possible regarding wastewater management in the future, and in this way the local processes of policy making could feed the national ones changing the current top-down approach to a bottom-up one. With this approach, local and regional realities are recognized to elaborate policies that could address more effectively issues such as wastewater management more effectively. Additionally, it is important to call upon all actors to actively participate in the processes of elaboration, implementation and monitoring of the future policies establishing common goals where everyone feels part of the same team in order to see results.

4.2. Effective governance: building capacities for problem solving, implementing and executing plans and policies

An effective governance relates to “the capacity of governance systems to address today’s complex sustainability challenges... and strengthening the basis for long-term decision making and integrated implementation of sustainable development policies” (Biermann et. al, 2017a: 85). As one of the main findings, the field work results show the inefficiency of the decision-makers in taking actions to solve the pollution as one of the main findings. This discovery not only demonstrates lack of prioritization but also the fact that there could be challenges with problem solving capacity and execution of the plans, projects and programs that exist at local and regional level. Effectiveness is being included as one of the WGI and is defined as the “measuring of the perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies” (Kaufmann et al. 2008). Therefore, effectiveness comprises not only of the formulation of sound policies but also the capacities of governments to implement them and how much the citizens trust in the government’s commitment to the policies they elaborate. With an effective implementation of the plans, programmes and projects in Huila, the population could be assured of good quality services in water and sewerage. However, the current lack of

effectiveness from the public service providers who seems to be driven by rent-seeking motivations in a competitive market, together with the lack of authority and control over the implementation have led to the current situation. It appears that public service companies are more engaged in profiting and keeping the business going on than really solving the issues regarding wastewater. Improvisation is normal within the administration and this leaves people without adequate water and sewerage services. Investing in infrastructure for sewerage and wastewater treatment is not prioritized and vulnerable zones such as slums lack sewerage to conduct wastewater to adequate places, deteriorating the quality of life of people who are already at disadvantage. Moreover, public officers involved in issues such as wastewater management are not well trained, and this could lead to situations where resources are wasted as it was the case of Pitalito. The lack of technical capacities was mentioned by different informants including those from CAM and the ex-manager of Empitalito. They recognized that sometimes the municipalities can build the WWTPs but there is not enough trained staff for the management and maintenance of the plants or even if such personnel exist, a new mayor could arrive and change it for the one he wishes, sometimes with no qualifications. This has a serious impact on the achievement of mid and long-term objectives and requires an effort to improve individual and organizational capacities at the local level.

There is no doubt that the public sector and other actors need to have the capacities to implement the policies. Target 6.5 of the SDG 6 calls for the implementation of integrated water resources management at all levels, and target 6b aims for the participation of local communities in improving water and sanitation management. The policy implementation requires not only economic capacities, where the most urgent needs of the municipalities must be prioritized, but also technical and organizational capacities of individuals and institutions. As Andrews et. al (2017: 85) explain, the most common response to low capacities is to propose more technical training thinking that the organizational capacity is limited to the individual capacities. However, in many cases the capacities of the individuals are not the greatest challenge since they know what they should do but they simply do not act accordingly (Andrews et al, 2017). Therefore, it is necessary to strengthen the organizational capacities where the efforts of all individuals combined productively would sum up to a greater extent. In any case, during my field work it was evident that there was lack of coordinated work among the establishments and within themselves, as well as lack of technical capacities on wastewater management in the region. This situation leads to hiring external consulting firms and further extending the network of actors involved in the policymaking and implementation processes,

which affect the accountability. That is the case of Neiva, where a new consulting company was hired to review previous studies that had failures and eventually delayed the execution of the WWTP project that has not yet begun by July 2019. These challenges answer the third research question of this study and require deeper investigation in order to understand what is required to improve the actors' capacities at the local and regional level.

4.3. Equitable governance to leave no one behind and the need for a more environmentally conscious society

Equitable governance relates to the “distribution of outcomes for fair solutions to public policy problems” as Bierman et al. (2017a) explain. Despite the Colombian economic growth, the unequal distribution of income has increased, positioning the country as the second-most unequal in Latin America (UN periódico digital, 2018). Colombia has committed to the 2030 agenda for sustainable development. This agenda has recognized that the eradication of poverty in all its dimensions is the biggest challenge for sustainable development, pledging to leave no one behind. Colombia as a country committed to the 2030 agenda must strive to fight inequalities within its country, promote gender equality and empower its citizens especially women and girls. These efforts must be entrusted to those who govern at regional and local levels. The municipalities have also committed to the SDGs in their own development plans and these commitments must be translated into policies, plans and programs that seek through projects such as WWTPs to generate social, economic and environmental benefits for the whole community, especially the most vulnerable.

WWTPs can not only solve pollution problems generated by wastewater but also create economic and social benefits. An improved treatment of wastewater represents means of new resources, alternative energy and clean water (SIWI, 2017). Well-designed WWTP projects that recognize circular economy and sustainable development as guiding principles can reduce costs and generate access to public services for the poorest. Moreover, the participation of all actors in the design and implementation of policies and projects could create social awareness of the need to preserve the rivers and other water bodies. Environmental preservation should not only be a task for the public administration but for all citizens. If everyone is invited to participate in finding solutions to the environmental problems in their own cities, people could have more environmental consciousness and such participation combined with the education

programs that have already begun in the three cities of study, could create societies where citizens are the first controllers of public management.

5. A CIRCULAR ECONOMY MODEL FOR WASTEWATER GOVERNANCE AS DRIVER OF SUSTAINABLE DEVELOPMENT IN NEIVA

The circular economy concept has gained importance during the last decades because of the need to use our resources more efficiently. Different scholars have focused their attention on researching the topic and propose a paradigm of circular economy that "closes the loop" by reusing resources in exchange to a linear model that ends in waste. One of the most common definitions of circular economy is proposed by the Ellen MacArthur Foundation (2013:07) indicating that it is "an industrial system that is restorative or regenerative by intention and design". Geissdoerfer et al. (2017: 759) define the circular economy as a "regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops, through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling".

The SDG 6 calls for the reuse of wastewater as an important practice to reach sustainable development. Sustainable wastewater management is an important part of the current circular economy paradigm and represents a way of "closing the loop" by recovering and reusing resources that represent inputs to other productive processes (Andersson, K. et al., 2016). Wastewater is an important source of assets such as nutrients for agriculture and methane for energy as well as an alternative source of water for other uses than drinking and even drinking when safely treated. In fact, wastewater has been reused around the world for many years although rather as unplanned/unintentional approaches (*de facto* reuse) than planned direct or indirect water reuse schemes. Therefore, it is required to shift the paradigm of wastewater management from treatment and disposal to reuse and recovery (WWAP, 2017) to reach the SDGs by 2030. The High-Level Political Forum (HLPF) on Sustainable Development reviewed in 2018 the implementation of the SDG 6 worldwide, finding that it is not on track to be met by 2030. The report produced by the HLPF indicates that wastewater is still seen as "an undervalued source of water, energy, nutrients and other recoverable by-products" (High-Level Political Forum on Sustainable Development, 2018: 2). The HLPF explains that safe and innovative practices in treatment, recycling and reuse and political will are crucial to ensure availability and sustainable management of water and sanitation, especially in

developing countries. Hence, Colombia has developed different plans that mention the introduction of the circular economy in the country's public agenda as a strategy to increase the country's economic growth.

Colombia has answered to the international call and included a commitment for the quality and efficiency of public services in its national development plan. The plan recognizes water and sanitation as a basis for increasing the country's productivity and the well-being of all citizens. The NDP aims for an introduction of the circular economy model in water consumption and treatment of solid waste and wastewater. Furthermore, the promotion of new technologies for wastewater treatment is an important strategy to improve wastewater governance that is mentioned in the NDP base documents. In June 2019, the Colombian national government launched its national circular economy strategy, which is headed by the Ministry of Environment and Sustainable Development. This strategy aims to achieve efficient management of raw materials, water and energy, increasing the recycling rate and closing the loop in the water cycle. The Colombian circular economy strategy also aims to be applied to the water and sanitation sector, seeking to recover, reuse and make a better use of water resources, considering that there is already a norm for wastewater reuse. However, this norm must be redesigned as Álvarez Pinzón (2018) proposes, to allow an effective implementation of the circular economy in water and sanitation.

The numerous social, environmental and economic advantages of the circular economy in water and sanitation well documented. According to Andersson et al. (2016) sustainable wastewater management have positive economic, social and environmental impacts such as the improvements in public health and reduction of costs linked to health impact for the public administration. Likewise, ensuring water security, production of clean energy such as biogas as an alternative fuel and reduction of greenhouse gases helping to climate change mitigation are other advantages from applying the circular economy in wastewater management (Andersson et al. 2016). Moreover, the prevention of environmental damages means budget savings for the public administration with the reduction of the fees paid for direct wastewater discharges in the Magdalena River. Furthermore, potential new jobs and green business options would be possible if the circular economy was applied to the WWTP project. Some of the informants believe that it would be possible to think about the distribution of water of different qualities for diverse uses instead of using drinking water for all kind of activities, generating new business opportunities for the public service companies and savings in water

potabilization, reducing the non-revenue water index as an outcome. Likewise, industries such as the oil sector, which is important in Huila, should be encouraged to offer the treated wastewater used in their production processes to be reinserted in other sectors such as agriculture for indirect human consume as one informant from the Ministry of Environment claims. In any case, the potential to use the circular economy in water in different productive sectors requires more investigation in further studies.

The city of Neiva has a great opportunity to improve its wastewater management and build a WWTP that guarantees sustainability in the middle and long term. A sustainable wastewater management plan must protect and promote human health, minimize environmental degradation, be technically and institutionally appropriate and socially and economically acceptable (Andersson et al. 2016). The WWTP in Neiva will use trickling filters as its main technology. This technology can remove around 70% to 80% of the pollutants and the non-use of aeration systems, which saves energy (Noyola et. al, 2013). However, there could be compounds which will not be removed with the expected WWTP and a revision of technologies could be useful to determine which is the best option before the plant is built. Additionally, the project includes the use of solar power as an alternative source of energy for the plant, this could be an advantage and it is positive that alternative sources of energy have been considered for the project. However, biogas production could also be thought as another alternative energy source for a more self-sustaining WWTP and such option should be considered in the project. Today, Las Ceibas has not considered to give any use to the by-products or the treated wastewater, continuing with the linear paradigm of generating waste at the end of the process. Decision-makers should consider improving the project applying a circular economy approach, since it could be a way to have greater social and economic returns that could benefit everyone in Neiva and achieve sustainable development. Finally, it is advisable to study the possibilities, advantages and challenges of applying the circular economy concepts in the WWTP project in Neiva in a further research, taking into account that the national government has launched its circular economy strategy in June 2019.

6. CONCLUSIONS

The department of Huila is an area of environmental importance for Colombia as it is where the Magdalena River source is located and faces the first adverse impacts from human activities. Although there is an extended framework of norms, programs and plans at the

national level that shows Colombia's efforts to have a clear environmental policy, many municipalities have not yet been able to fully implement such tools. In Huila, cities such as Neiva, Garzón and Pitalito are discharging their wastewater directly into the Magdalena River or others that flow into it. This situation leads to asking about the current wastewater governance in the region considering the development, interaction and implementation of the applicable norms, plans and programs at the national and subnational levels. Based on the theories of good, effective and equity governance, this qualitative study aimed to evaluate the status of the wastewater governance in the region and through the analysis of primary and secondary data, including interviews and fieldwork, identified the main challenges in wastewater governance in the region. Moreover, this study explored the linkages and impacts of the SDGs in the wastewater governance at regional and local levels and how they could be useful to improve the policymaking and implementation process from a local-grown perspective. Finally, this study proposed the introduction of the circular economy paradigm to help the improvement of the WWTP in the city of Neiva.

Different Colombian authors such as Ramirez Zamudio (2012) and García Pachón (2017) have studied the legal regime of the wastewater discharges and the water governance in Colombia. However, this study tried to go further and through empirical work aimed to understand how the wastewater governance is done at the local and regional levels and investigate the root causes that have not allowed a progressive advance for a better wastewater management in Colombia. One of the major contributions of this study is precisely to show an overview of what is happening at the local level, presenting the local needs expressed by the stakeholders and calling to improve the governance that have serious deficiencies. The results from the fieldwork demonstrate that there is an extensive and overdeveloped normative framework for wastewater management at all levels, but the implementation and execution of these tools have not been successful, showing the lack of good and effective governance. The findings confirmed that there are different challenges that must be overcome to stop the direct discharges of sewage into the Magdalena River. Challenges such as bad planning, lack of interest, environmental consciousness and economic and technical capacities among others, could be hindering the good governance of wastewater and the effectiveness of the decision makers at local and regional levels.

This study demonstrates that Colombia could be suffering of what Andrews et al. (2017:12) have called *skewed capabilities* that is “the capability to routinely and repeatedly propose

policies, programs and projects, but not the capability to implement them”. The results indicate that the problem may not be the lack of projects, programs or policies but lack of political will and capacities from the decision-makers. The ineffectiveness in solving environmental problems by the public administration is confirmed in the case of Neiva, where more than 10 years have passed since a ruling was issued and it has not yet been possible to build the WWTP. Moreover, the absence of medium- and long-term planning including urban planning is usual and improvisation is common within the public administration. Furthermore, the belief that the river has the power to regenerate itself could be feeding the lack of environmental consciousness in the region, therefore it is not a priority for the decision makers because other projects could give them more popularity among their voters.

It is possible to argue that the SDGs are widely known at the national level but not really known among the stakeholders in the three cities of study. Although the plans and policies at the local level seek to use the SDGs as guidelines for their implementation, their impact is minimal because they have not been translated into specific goals towards the 2030 agenda. The potential to use the SDGs to feed the local policies is great and this was acknowledged by some of the informants who were part of this study. It would be important to investigate how the SDGs could be effectively implemented in the three cities of my fieldwork, considering that they have recognized the SDGs in their plans, and how they could influence governments attitudes and commitment to sustainable development. Finally, it is needed to introduce the concept of circular economy in the local public agendas, considering the strategy of circular economy presented by the national government in June 2019. Further research could investigate the potential benefits of applying a circular economy model to the WWTP in Neiva, aiming for a more sustainable management of wastewater that can benefit everyone to leave no one behind as the SDGs main goal claims.

REFERENCES

- Aguas del Huila (2014a). *Diagnóstico del sector de agua potable y saneamiento básico 2014. Programa Agua para la prosperidad. Plan Departamental de Aguas.* [online] Available at: <https://aguasdelhuila.gov.co/index.php/pda/diagnostico-del-sector>
- Aguas del Huila (2014b). *Inversiones PDA.* [online] Available at: <http://www.aguasdelhuila.gov.co/index.php/pda/inversiones-pda>
- Akhmouch, A. (2012). Water Governance in Latin America and the Caribbean: A Multi-Level Approach. *OECD Regional Development Working Papers 2012/4.* OECD. [online] Available at: <https://www.oecd-ilibrary.org/docserver/5k9crzqk3ttj-en.pdf?expires=1563810221&id=id&accname=guest&checksum=9DC21E48AE53B7EE03263DF2329DDB78>
- Alcaldía de Garzón (2016). *Plan de Desarrollo Municipio de Garzón 2016-2019 “Garzón, municipio región... oportunidad para todos”*
- Alcaldía de Neiva (2009). *Documento diagnóstico Plan de Ordenamiento Territorial 2009.*
- Alcaldía de Neiva (2019). *Con alianza público-privada se construirá la PTAR de Neiva.* [online] Available at: <http://www.alcaldianeiva.gov.co/NuestraAlcaldía/SalaDePrensa/Paginas/Con-alianza-p%C3%BAblico-privada-se-construir%C3%A1-la-PTAR-de-Neiva.aspx>
- Álvarez Pinzón, G.L. (2018). *El reúso de aguas residuales en Colombia* [The reuse of wastewater in Colombia] In: García Pachón, M.d.P. (ed.) *Derecho de aguas tomo VII*, pp. 187-232. Bogotá, Universidad Externado de Colombia.
- Andersson, K., Rosemarin, A., Lamizana, B., Kvarnström, E., McConville, J., Seidu, R., Dickin, S. & Trimmer, C. (2016). *Sanitation, Wastewater Management and Sustainability: from Waste Disposal to Resource Recovery.* Nairobi and Stockholm: United Nations Environment Programme and Stockholm Environment Institute.

- Andrews, M., L. Pritchett and M. Woolcock (2017). *Building State Capability: Evidence, Analysis, Action*. Oxford, Oxford University Press.
- Asamblea Departamental del Huila (2016) Ordenanza 009/2016 *Por la cual se adopta el plan de desarrollo “El camino es la educación” y se dictan otras disposiciones*. [online] Available at: <https://www.huila.gov.co/documentos/526/plan-de-desarrollo/>
- Bäckstran, K. (2006). Multi-Stakeholder Partnerships for Sustainable Development: Rethinking Legitimacy, Accountability and Effectiveness. *European Environment*. 16: 290-306.
- Berg, B. L. and H. Lune (2017). *Qualitative Research Methods for the Social Sciences*, Pearson.
- Biermann, F., Stevens, C., Bernstein, S., Gupta, A., Kanie, N., Måns, N., & Scobie, M. (2017a) Global goal setting for improving national governance and policy. In: Kanie, N. & Biermann, F. (eds) *Governing through goals. Sustainable Development Goals as governance innovation*. Cambridge: The MIT press, pp.75-97.
- Biermann, F., Kanie, N., & Kim, R.E. (2017b) Global governance by goal-setting: the novel approach of the UN Sustainable Development Goals. *Current Opinion in Environmental Sustainability*, 26-27: 26-31.
- Bryman, A. (2012). *Social Research Methods*. New York: Oxford University Press.
- Bulkeley, H. (2005) *Reconfiguring environmental governance: Towards a politics of scales and networks*. *Political Geography*, 24 (8), 875-902
- Bull, B. & Aguilar-Støen, M. (2015) Environmental Governance and Sustainable Development in Latin America. In: Bull, B. & Aguilar-Støen, M. (eds), *Environmental Politics in Latin America, Elite dynamics, the left tide and sustainable development*. Routledge, Abingdon, pp. 1-14

Bøås, M. (1998). Governance as multilateral bank policy: the cases of the African Development Bank and the Asian Development Bank. *European Journal of Development Research*. 10:2, pp. 117-134

Concejo de Neiva. (2016). *Acuerdo Número 012 de 2016 “Por el cual se adopta el Plan de Desarrollo del Municipio de Neiva-Huila, para el periodo 2016-2019 Neiva La Razón de todos-Gobierno transparente y se dictan otras disposiciones”*. [online] Available at: <http://www.alcaldianeiva.gov.co/Gestion/PlaneacionGestionyControl/Acuerdo%20N%C3%BAmero%2012%20de%20%202016.pdf>

Concejo Municipal de Pitalito. (2016). *Acuerdo Número 022 de 2016 Plan de desarrollo Municipio de Pitalito, Somos Pitalito territorio ideal*.

Commission on Global Governance. (1995) *Our Global Neighbourhood*. Oxford University Press. New York.

Corporación Autónoma Regional del Alto Magdalena – CAM. (2016). *Evaluación Regional del Agua Superficial-ERA 2016*. [Regional Evaluation of Surface Water-ERA 2016]

Corporación Autónoma Regional del Alto Magdalena – CAM. (2018). *CAM realizó seguimiento a Plantas de Tratamiento de Aguas Residuales del Huila*. [online] Available at: <https://www.cam.gov.co/1325-cam-realiz%C3%B3-seguimiento-a-plantas-de-tratamientos-de-aguas-residuales-del-huila.html>

Departamento Nacional de Planeación (DNP). (2019) *Bases del Plan Nacional de Desarrollo 2018-2022: Pacto por Colombia, pacto por la equidad*. [Bases of the National Development Plan 2018-2022: Pact for Colombia, pact for equity]. [online] Available at: <https://colaboracion.dnp.gov.co/CDT/Prensa/BasesPND2018-2022n.pdf>

Departamento Nacional de Planeación (DNP). (2018) *Colombia hacia el Crecimiento Verde*. [Colombia towards green growth] Departamento Nacional de Planeación.

Ellen MacArthur Foundation (EMF). (2013) *Towards the Circular Economy, vol. 1*. [online] Available at: <https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf>

Findeter (no date). *Neiva Sostenible 2040: Líder del desarrollo para la región. Plan de acción*. [online] Available at: <http://www.alcaldianeiva.gov.co/Gestion/EstudiosInvestigacionesyOtrasPublicaciones/Neiva%20Sostenible%202040.pdf>

Food and Agriculture Organization of the United Nations- (FAO). (2017). *Reutilización de aguas para agricultura en América Latina y el Caribe*. [Reutilization of water for agriculture in Latin America and the Caribbean] [online] Available at: <http://www.fao.org/3/a-i7748s.pdf>

Fukuyama, F. (2013). What is Governance?. *GCD Working Paper 314*. Center for Global Development. Washington D.C. [online] Available at: <http://www.cgdev.org/content/publications/detail/1426906>

García Pachón, M. (2017). *Régimen Jurídico de los Vertimientos en Colombia*. Bogotá, Universidad Externado de Colombia.

Geissdoerfer, M., P. Savaget, M. P. N. Bocken and E. J. Hultink (2017). *The Circular Economy - A new sustainability paradigm?*. *Journal of Cleaner Production* 143: 757-768.

Gobernación del Huila (2014) *Plan de cambio climático Huila 2050: Preparándose para el cambio climático*. [online] Available at: http://planhuila2050.com/sites/default/files/imce/imagenes/plan_de_cambio_climatico_huila_2050.pdf

Gonzalez, L. E. (2005). *Reciclarán Aguas Residuales*. *El Tiempo*. [online] Available at: <https://www.eltiempo.com/archivo/documento/MAM-1621008>

Gupta, J. & Nilsson, M. (2017) Toward a Multi-level Action Framework for Sustainable Development Goals. In: Kanie, N. & Biermann, F. (eds) *Governing through goals. Sustainable Development Goals as governance innovation*. Cambridge: The MIT press, pp.275-294.

High-Level Political Forum on Sustainable Development (2018). *2018 HLPF Review of SDG implementation: SDG 6 – Ensure availability and sustainable management of water and sanitation for all*. [online] Available at:https://sustainabledevelopment.un.org/content/documents/195716.29_Formatted_2018_background_notes_SDG_6.pdf

IDEAM. (2019). *Estudio Nacional del Agua 2018*. [National Water Study 2018] [online] Available at: http://documentacion.ideam.gov.co/openbiblio/bvirtual/023858/ENA_2018.pdf

Kanie, N., Bernstein, S., Biermann, F., & Haas, M.P. (2017) Introduction: Global Governance through Goal Setting. In: Kanie, N. & Biermann, F. (eds) *Governing through goals. Sustainable Development Goals as governance innovation*. Cambridge: The MIT press, pp.1-27.

Kaufmann, D., Kraay, A., & Zoido-Lobaton, P. (1999). Governance Matters. *Policy Research Working Paper No. 2196*. The World Bank.

Kaufmann, D., Kraay, A. & Mastruzzi, M. (2008). Governance Matters VII: Aggregate and Individual Governance Indicators 1996-2007. *Policy Research Working Paper No. 4654*. [online] Available at:

Kjellén, M. (2018). Wastewater governance and the local, regional and global environments. *Water Alternatives*, 11(2): 219-237

Las Ceibas Empresas Públicas de Neiva ESP. (2018a). *Borrador Plan de Saneamiento y Manejo de Vertimientos PSMV del Municipio de Neiva 2018*. [Draft of the Sanitation and wastewater discharges management plan PSMV of the Municipality of Neiva 2018]

- Las Ceibas Empresas Públicas de Neiva ESP. (2018b). *Presentación “proyecto: Construcción Planta de Tratamiento de Aguas Residuales para Neiva -PTAR”*. [Presentation: “project: Construction of the Wastewater Treatment Plant for Neiva - PTAR]
- Las Ceibas Empresas Públicas de Neiva ESP. (2018c). *Informe de resultados de la caracterización fisicoquímica, microbiológica del agua residual urbana del municipio de neiva – huila*. [Report on the results of the physicochemical, microbiological characterization of urban wastewater in the municipality of Neiva - Huila]
- Las Ceibas Empresas Públicas de Neiva ESP. (2018d). *Presentación Técnica PTAR Neiva”*. [Technical presentation PTAR Neiva]
- Lemos, M. C & Agrawal, A. (2006) Environmental Governance. *Annual Review of Environment and Resources*, 31, 297-325
- Lopera, M. J., Campos, S. M., & Olarte, B. C. (2012). Producción de Aguas Servidas, Tratamiento y Uso en Colombia. Informe Nacional. *Proyecto de Desarrollo de Capacidades para el Uso Seguro de Aguas Servidas en Agricultura (FAO, OMS, ONU-AGUA, UNUINWEH, UNW-DPC, IWMI e ICID)*. [online] Available at: http://www.ais.unwater.org/ais/pluginfile.php/378/mod_page/content/127/COLOMBIA.pdf
- Madera, C.A., Silva, J., Mara, D.D. & Torres, P. (2009) Wastewater use in agriculture: Irrigation of sugar cane with effluents from the Cañaveralejo wastewater treatment plant in Cali, Colombia. *Environmental Technology*, 30:10. 1011-1015.
- Makoni, F. S., Thekiso, O. M., & Mbatia, P. A. (2016). Urban Wastewater for Sustainable Urban Agriculture and Water Management in Developing Countries. In: Younos, T. and Parece, T.E. (eds.) *Sustainable Water Management in Urban Environments*, pp. 265-268. Springer.

Ministerio de Ambiente y Desarrollo Sostenible (2015) Decreto 1076/2015 “*Por medio del cual se expide el Decreto Único Reglamentario del Sector Ambiente y Desarrollo Sostenible*”. [online] Available at: <http://corponor.gov.co/ACTOSJURIDICOS/NORMATIVIDAD/decreto1076.pdf> (Accesed 12 March 2019)

Melgarejo, J. (2009). *Efectos ambientales y económicos de la reutilización del agua en España*. [Environmental and economic effects of water reuse in Spain.], CLM. Economía, 15, 245-270.

Municipio de Neiva (2016). *Plan de Desarrollo 2016-2019 documento didáctico*. [Development Plan 2016-2019 didactic document] [online] Available at: <http://www.alcaldianeiva.gov.co/Gestion/PlaneacionGestionControl/Plan%20de%20Desarrollo%20Neiva%201a%20Raz%C3%B3n%20de%20Todos%20-%20Gobierno%20Transparente%202016-2019%20-%20Did%C3%A1ctico.pdf>

Nilsson, M. & Persson, Å. (2012). Can Earth system interactions be governed? Governance functions for linking climate change mitigation with land use, freshwater and biodiversity protection. *Ecological Economics*, 75: 61-71.

Noyola, A., Morgan-Sagastume, J.M., & Guereca, L.P. (2013). *Selección de tecnologías para el tratamiento de aguas residuales. Guía de apoyo para ciudades pequeñas y medianas*. Instituto de Ingeniería, Universidad Nacional Autónoma de México.

OECD (2015). *Principles on Water Governance*. Paris. [online] Available at: <https://www.oecd.org/governance/oecd-principles-on-water-governance.htm>

Pahl-Wolst, P. (2015). *Water Governance in the Face of Global Change*. Switzerland, Springer.

Procuraduría General de La Nación. (2013). *RÍO MAGDALENA. Informe Social, Económico y Ambiental*. Procuraduría Delegada para Asuntos Ambientales y Agrarios.

- Read, G.F. (1997). The Development of Public Health engineering In: Read, G.F. & Vikcridge, I.G. (eds) *Sewers. Rehabilitation and New Construction Repair and Renovation*. Butterworth-Heinemann, pp. 1-21
- Rogers, P., & Hall, A. W. (2003). Effective water governance. *TEC Background Papers Nr. 7*. Global Water Partnership Technical Committee (TEC).
- Rosenau, J.N. (1992). Governance, Order and Change in World Politics. In: Rossenau, J.N. and Czempiel, E.O. (eds.) *Governance Without Government: Order and Change in World Politics*, pp. 1-29. Cambridge University Press.
- Silva, J., Torres, P., Madera, C. (2008). Reúso de aguas residuales domésticas en agricultura. Una revisión. *Agronomía Colombiana*, 26 (2): 347-359
- Stockholm International Water Institute (SIWI). (2018). *Policy brief: Wastewater governance: Balancing different interests*. [online] Available at: <http://www.watergovernance.org/resources/wastewater-governance-balancing-different-interests/>
- Sundaram, J.K. & Chowdhury, A. (2012) Introduction: Governance and Development. In: Sundaram, J.K. & Chowdhury, A. (eds.) *Is Good Governance Good for Development*, pp. 1-28. Blumsbury Collections.
- Superservicios (Superintendencia de Servicios Públicos Domiciliarios). 2014. *Informe Técnico sobre Sistemas de Tratamiento de Aguas Residuales en Colombia*. [Technical report on wastewater treatment systems in Colombia] [online] Available at: <http://studylib.es/doc/8045806/informe-t%C3%A9cnico-sobre-sistemas-de-tratamiento-de-aguas>
- Superservicios (Superintendencia de Servicios Públicos Domiciliarios) & DNP (Departamento Nacional de Planeación). (2017). *Estudio Sectorial de los servicios públicos domiciliarios de Acueducto y Alcantarillado 2016* [Sectorial Study of the public services of Aqueduct and Sewerage 2016]

Superservicios (Superintendencia de Servicios Públicos Domiciliarios) & DNP (Departamento Nacional de Planeación). (2018). *Estudio Sectorial de los servicios públicos domiciliarios de Acueducto y Alcantarillado 2014 – 2017* [Sectorial Study of the public services of Aqueduct and Sewerage 2014 - 2017]

The Economist (2015). *The 169 commandments*. [online] Available at: <https://www.economist.com/leaders/2015/03/26/the-169-commandments>

Underdal, A. & Kim, R. (2017) The Sustainable Development Goals and Multilateral Agreements. In: Kanie, N. & Biermann, F. (eds) *Governing through goals. Sustainable Development Goals as governance innovation*. Cambridge: The MIT press, pp.241-258.

United Nations. General Assembly. (2012) *Resolution 66/288. The future we want*. Río de Janeiro. United Nations.

United Nations Development Programme (UNDP). (2014) *Governance for Sustainable Development. Integrating Governance in the Post-2015 Development Framework*. [online] Available at: <https://www.undp.org/content/dam/undp/library/Democratic%20Governance/Discussion-Paper--Governance-for-Sustainable-Development.pdf> (Accessed 14 May 2019)

United Nations Environment Programme (UNEP). (2006) *Ways to Increase the Effectiveness of Capacity Building for Sustainable Development*. [online] Available at: <https://www.unpei.org/sites/default/files/PDF/institutioncapacity/Ways-to-increase-effectiveness-SD.pdf>

UN Periódico Digital (2018). *Despite economic growth, Colombia continues to be one of the most unequal countries in the world*. Universidad Nacional de Colombia. [online] Available at: <http://unperiodico.unal.edu.co/pages/detail/despite-economic-growth-colombia-continues-to-be-one-of-the-most-unequal-countries-in-the-world/>

- Valencia, E., Romero, J. & Aragón, R. (2010). Esquema metodológico para reutilización de aguas residuales domésticas tratadas en riego. *Revista Ingeniería de Recursos Naturales y del Ambiente*. 9. 55-60.
- Weiss, T.G. (2000) Governance, good governance and global governance: Conceptual and actual challenges. *Third World Quarterly*, 21:5, pp. 795-814
- World Bank. International Bank for Reconstruction and Development (2016). *Using performance-Based Contracts to Reduce Non-Revenue Water*. [online] Available at: https://ppiaf.org/documents/3531?ref_site=kl&keys=performance%20based%20contracts%20non%20revenue%20water&restrict_pages=1&site_source%5B%5D=Knowledge%20Lab
- World Health Organization (WHO) (2006). *Guidelines for the safe use of wastewater, excreta and greywater, volume 1 policy and regulatory aspects*. France, World Health Organization.
- World Health Organization (WHO) (n.d.). *Water Sanitation Hygiene, Key terms*. [online] Available at: https://www.who.int/water_sanitation_health/monitoring/jmp2012/key_terms/en/
- World Justice Project (n.d.). *What is the rule of law*. [online] Available at: <https://worldjusticeproject.org/about-us/overview/what-rule-law>
- World Justice Project (n.d.). *Absence of Corruption (Factor 2)*. [online] Available at: <https://worldjusticeproject.org/our-work/wjp-rule-law-index/wjp-rule-law-index-2017%E2%80%932018/factors-rule-law/absence-corruption-factor>
- WWAP (UNESCO World Water Assessment Programme). (2017). *The United Nations World Water Development Report 2017: Wastewater – The Untapped Resource*. Paris, UNESCO.

WWAP (UNESCO World Water Assessment Programme). (2019a). *The United Nations World Water Development Report 2019: Leaving No one behind*. Paris, UNESCO.

WWAP (UNESCO World Water Assessment Programme). (2019b). *The United Nations World Water Development Report 2019: Leaving No one behind. Executive Summary*. Paris, UNESCO.

Yamada, T. (2017) Corporate Water Stewardship: Lessons for Goal-based Hybrid Governance
In: Kanie, N. & Biermann, F. (eds) *Governing through goals. Sustainable Development Goals as governance innovation*. Cambridge: The MIT press, pp.187-209.

Young, O. (2017) Conceptualization: Goal Setting as a Strategy for Earth System Governance.
In: Kanie, N. & Biermann, F. (eds) *Governing through goals. Sustainable Development Goals as governance innovation*. Cambridge: The MIT press, pp.29-51.

Zamudio Rodríguez, C. (2012). "Gobernabilidad sobre el recurso hídrico en Colombia: entre avances y retos " [Governance of water resources in Colombia: between progress and challenges] *Gestión Ambiental* 15:3. pp. 99 - 112.

APPENDICES

Appendix 1. Interview questionnaires

Interview Guide academic experts/civil society-NGOs.

Project: “Policies for the management and re-use of wastewater in Huila-Colombia: towards fulfilling the SDG no. 6?” Name of the interviewee: _____

Occupation/ Institution: _____ Date: _____

Place: _____ Received and signed information and consent letter?

Questions. N.B. The following interview is a qualitative interview using the semi-structured approach. We have prepared a list of questions that fairly cover the purpose of the research project, but you can expand on them and further questions could be asked that are not included in the list. This interview is meant to be flexible, and we are especially interested in your opinions and knowledge about the research questions. Thank you for your cooperation and enjoy the session!

1. Please tell me about you, what is your name, education and work experience related to wastewater management and re-use of wastewater.
2. Have you ever worked in the design, implementation or monitoring of policies for wastewater and re-use of wastewater? If so, what were these policies about?
3. What is your opinion about the current management of wastewater at the local/regional/national level? (Technical question)
4. To your knowledge, what are the current policies including: laws, plans, norms, or regulations, that serve or support the current management of wastewater and the re-use of wastewater at the regional/city/national level?

5. Do you think that re-use of wastewater is usually considered within the management of wastewater at the local, regional or national level?
6. Do you think that implementing the re-use of wastewater is currently needed?
7. Are you familiar with the Sustainable Development Goals? Have you heard about the SDG No. 6 and its targets and indicators?
8. What is your opinion about the public policies that govern the wastewater management and re-use of wastewater at the local, regional or national level? Are these policies useful to meet the SDG No. 6?
9. What is your perception about the level of water stress at the local, regional and national level? Has it increased or decreased over the time?
10. What is your opinion about the water-use efficiency during the last decades in the region?
11. Do you think that the re-use of treated wastewater would help to increase the proportion of population using safely and drinking water?
12. Do you perceive any changes over time in the water-related ecosystems area? Do you have any knowledge of changes in quantity of water in ecosystems and the quality of the water?
13. What do you believe are the biggest challenges in wastewater treatment and reuse of wastewater in your city/region/country?
14. What do you think are the challenges of implementing the public policies on wastewater management and re-use in your city/region/country? (if there exist)
15. Do you know any examples on re-use of wastewater in your city/region/country? Are these examples complying with the current policies?
16. Do you consider that there is enough support to the participation of the community in improving the wastewater management policies and enough support to the re-use of

wastewater? Are there any special administrative units in charge of guaranteeing the participation of the community in the elaboration of the policies or any policy or procedure that guarantees such right?

17. Do you have any information about any positive trend, support or opportunities that could strengthen the emergence of wastewater reuse as a useful tool in the future? What is your opinion about the emergence of wastewater reuse in the future?

18. Do you think that with the current policies (norms, regulatory frames, laws, plans, etc.) your city/region/country could meet the SDG No. 6?

19. What do you think is needed to improve the current situation?

20. Do you believe that the current policies were well formulated, have been successfully implemented and are efficient and working well in your region/city/country

Interview Guide public officers/Policy makers.

Project: “Policies for the management and re-use of wastewater in Huila-Colombia: towards fulfilling the SDG no. 6?” Name of the interviewee: _____

Occupation/ Institution: _____ Date: _____

Place: _____ Received and signed information and consent letter?

Questions. N.B. The following interview is a qualitative interview using the semi-structured approach. We have prepared a list of questions that fairly cover the purpose of the research project, but you can expand on them and further questions could be asked that are not included in the list. This interview is meant to be flexible, and we are especially interested in your opinions and knowledge about the research questions. Thank you for your cooperation and enjoy the session!

1. Please tell me about you, what is your name, education and work experience.
2. Have you ever worked in the design, implementation or monitoring of policies for wastewater and re-use of wastewater in your region/city? What were these policies about?
3. How is the current management of wastewater in your city/region/country? (Technical question). What do you know about it?
4. To your knowledge, what are the current policies including: laws, plans, norms, regulations, that serves or supports the current management of wastewater in your city/region? How are these policies linked to the national norms?
5. Is the re-use of wastewater being considered within the management of wastewater in your city/region? Do you think that re-use of wastewater is a need for your city/region?
6. Do you know something about the Sustainable Development Goals? And in specific, have you heard about the SDG No. 6 and its targets and indicators?
7. How do you think that the public policies that governs the wastewater management and re-use of wastewater in your region are related, connected or helping to meet the SDG No. 6?

8. Do you know what is the proportion of population in your city using safely managed drinking water services? (Target 6.1 – Indicator 6.1.1.)

9. Do you know what is the proportion of wastewater safely treated and the proportion of bodies of water with good quality in your region? (Target 6.3)

10. Do you know what is the level of water stress in your city/region? How has it changed? Do you have data? (Target 6.4 – Indicator 6.4.2)

11. Do you know how the water-use efficiency has changed during the last decades? Do you have data? (Target 6.4 – Indicator 6.4.1)

12. Do you know how the spatial extent of water-related ecosystems in your city/region has changed over time? And changes in quantity of water in ecosystems and the quality of the water? Is there any data? (Indicator 6.6.1)

13. What do you believe are the biggest challenges in wastewater treatment and the re-use of wastewater in your city/region?

14. And what do you think are the challenges of implementing the public policies on wastewater management and re-use? (if there exist)

15. Do you know any examples on re-use of wastewater in your city/region? Are these examples complying with the current policies?

16. Do you consider that there is enough support to the participation of the community in improving the wastewater management policies and enough support to the re-use of wastewater? Are there any special administrative units in charge of guaranteeing the participation of the community in the elaboration of the policies or any policy or procedure that guarantees such right?

17. Do you have any information about any positive trend, support or opportunities that could strengthen the emergence of wastewater reuse as a useful tool in the future? What is your opinion about the emergence of wastewater reuse in the future?

18. Do you think that with the current policies (norms, regulatory frames, laws, plans, etc.) your city/region could meet the SDG No. 6?

19. What do you think is needed to improve the current situation?

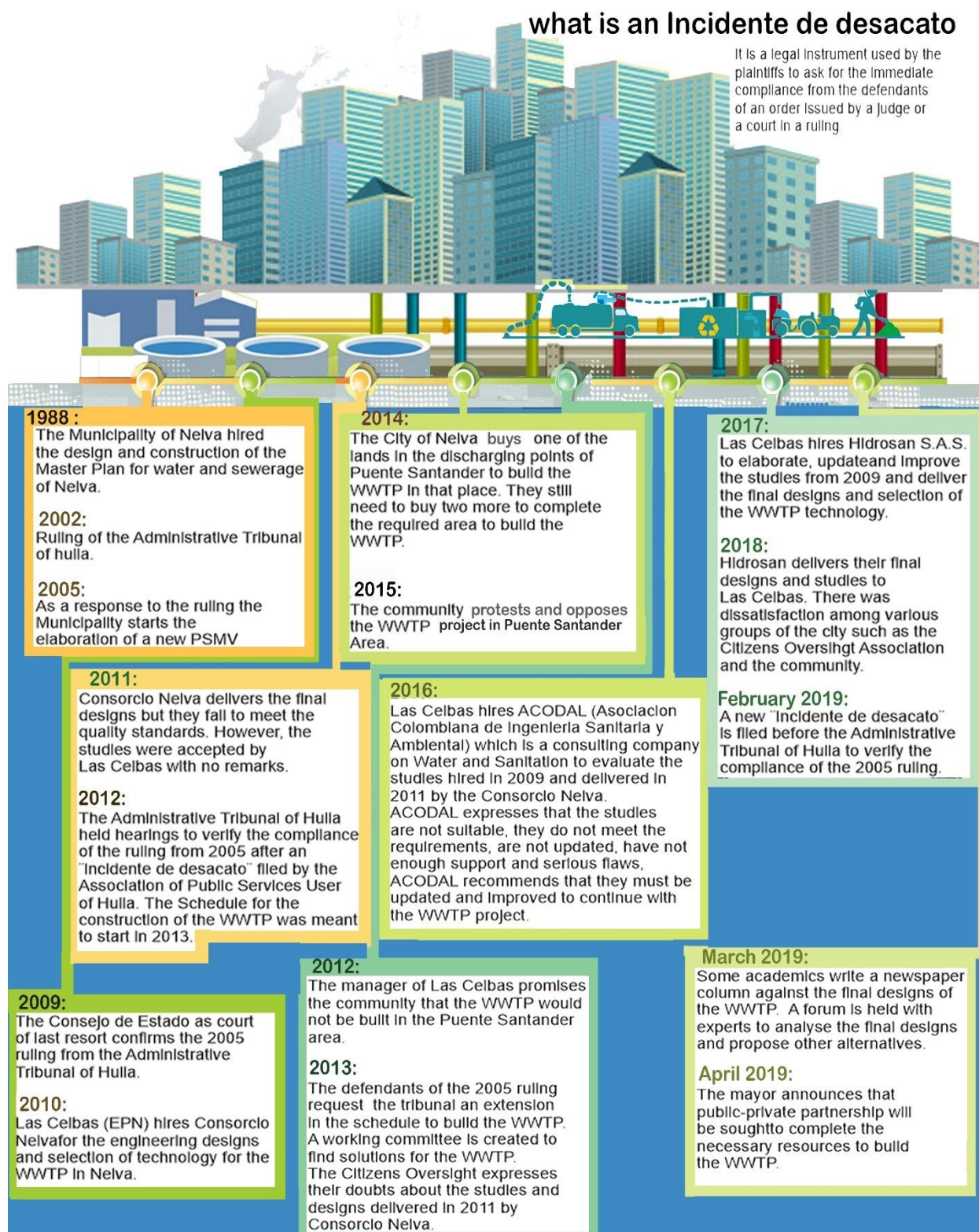
20. Do you believe that the current policies were well formulated, have been successfully implemented and are efficient and working well in your region/city/country?

Appendix 2. Timeline of Neiva's wastewater plan project

Timeline of Neiva's WWTP

what is an Incidente de desacato

It is a legal instrument used by the plaintiffs to ask for the immediate compliance from the defendants of an order issued by a judge or a court in a ruling.





Norges miljø- og biovitenskapelige universitet
Noregs miljø- og biovitenskapelige universitet
Norwegian University of Life Sciences

Postboks 5003
NO-1432 Ås
Norway