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Master's Thesis

COMPARATIVE ANALYSIS OF STORMWATER MANAGEMENT IN FINLAND AND LATVIA

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Stormwater management has entered environmental and political discourse especially with realisation and initiation of climate change adaptation measures, predominantly as the major contributor to the pollution of receiving waters. Defined as "excessive surface runoff that is generated on impermeable surfaces during precipitation events and snow/ice melt", the question of stormwater management is touching upon two contemporary problematic trends – adverse effects of climate change (e.g. raising level of precipitation) and increasing urbanisation and densification of the residential areas.

The purpose of this master's thesis is to define the notion of stormwater as it is seen by the legislation and policy documents of Finland and Latvia, to examine and compare structures of stormwater administration in the two states, and to investigate how stormwater administration is fragmented within the vertical and horizontal dimensions of environmental administration, taking into consideration highly cross-sectoral nature of stormwater management.

The result of my research is a comprehensive description and comparison of two case studies, where current state of stormwater administration is presented given the certain level of administrative fragmentation and mechanisms of stormwater management described. The thesis gives an overview of two different systems where relatively similar policies (transposed from the EU) are implemented in different ways and different circumstances.

Keywords:
Stormwater administration, environmental administration, stormwater management, fragmentation, decentralisation, water management, comparative study, Baltic Sea region, Finland, Latvia

TABLE OF CONTENTS

INTRODUCTION

Environmental concerns similar as we perceive them today started actively entering political dimension about 50 years ago, and by now are set to be one of the dominant narratives in global politics. Stormwater management has entered environmental and political discourse especially with realisation and initiation of climate change adaptation measures, predominantly as the major contributor to the pollution of receiving waters. Stormwater is excess water that accumulates on the impermeable lands, the roofs of the buildings and other built areas during the events of heavy precipitation or snow melting.

There are two main dimensions to the importance of effective stormwater management. The first one is connected with the rapid urbanisation and densification of the urban areas. The more densely built and impermeable are the areas, the more stormwater they accumulate during the heavy precipitation events within short periods of time. Land use modifications associated with urbanisation include removal of vegetation, replacement of pervious areas with impervious surfaces which leads to changes in the characteristics of the surface runoff hydrograph, increasing stormwater runoff volumes and peak flows (Barbosa et al., 2012). This results in the lack of capacity to treat the stormwater in a timely manner and causes floods, damages, deterioration of population's health and significant financial losses.

The other dimension of the problem is the increasing need for effective planning and implementation of climate change adaptation measures. Stormwater runs into stormwater sewers (if available) or wastewater sewers (consequently posing a risk during heavy precipitation events to overwhelm the capacity of wastewater treatment facilities and to reduce the effectiveness of wastewater treatment[1]) towards water bodies, such as streams, lakes or the sea. As a rule, stormwater is not cleaned, but it is discharged into the water body untreated. Whereas wastewater is regarded as the main source of nitrogenous and organic pollution to the receiving waters, stormwater is regarded as the main contributor of the heavy metals (ibid, 2). Thus, considering global warming and climate changes connected to it, the rising precipitation levels pose threat quantity wise, but also quality wise, resulting in the pollution of our already scarce drinking water sources. This calls

[1] https://www.hsy.fi/en/residents/water/stormwater/Pages/default.aspx

for urgent action to prevent further deterioration of the water bodies and protect the ecosystem by systematic management of the stormwater.

Resilient and sustainable future requires effective solutions not only from a scientific point of view, but also in terms of planning, decision making and organisation. In that case, for the most effective implementation of stormwater management solutions, it needs to be clear also who should be responsible, at what level of governance and at what cost.

Research aim

The purpose of this master's thesis is to examine and compare structure of stormwater administration in Finland and Latvia, and to investigate how stormwater administration in these two states is fragmented within the vertical and horizontal dimensions of environmental administration. While there are no separate legislation or institutions concerned with stormwater management in both case studies, this research aims at investigating stormwater administration within general environmental administration, taking into account highly cross-sectoral nature of stormwater management.

In order to fulfill the aim of the research, the following guiding research questions are to be answered: how is stormwater defined as a policy notion in the Finnish and Latvian water legislation, and, who is responsible for stormwater administration within the vertical and horizontal dimensions of environmental administration in Finland and Latvia?

The research is based on two important aspects. On the one hand, tracing and outlining the concept of stormwater based on the EU and national water legislation in Finland and Latvia helps to grasp the angle of perception of the notion of stormwater management for these two case studies. On the other hand, exploring actual responsibilities and institutions involved in stormwater management in Riga and Helsinki brings interesting research results. Thus, this research can contribute to understanding better mechanisms of stormwater management in these countries, identifying strengths and bottlenecks of the current systems/mechanisms, and bringing some meaningful conclusions and recommendations for improvement.

Relevance

The relevance of given research can be explained by the growing need of climate adaptation measures in the Baltic Sea Region related to the climate change. According to the European Environment Agency (Annex 1), level of precipitation and the rivers runoff in the region has been increasing drastically in the region over the past 60 years, which indicates the persistence of the challenges related to stormwater management planning in the future and the growing need for effective governance in this field. An effective early planning of climate adaptation measures also allows to save substantial costs from potential financial losses related to the consequences of climate change (e.g. heavy precipitation events, droughts, floods, water contamination, deterioration of health of citizens).

Particularly for the cases of Riga and Helsinki the importance of effective stormwater management can be observed from the geographical and climate peculiarities of the two cities. Both capitals are located at the coast, accommodate one third (Riga) and one-fifth (Helsinki) of the whole population of their respective country, and the cities are in the process of further growth and densification. Studying stormwater administration and stormwater management of the cities contributes to developing recommendations for improvement of the current planning and overcoming existing challenges.

The motivation of choice of Finland and Latvia for my comparative case study research can be justified by several reasons. First of all, both states belong to the Baltic Sea region, are full members of the European Union, Council of the Baltic Sea States, HELCOM and EU Strategy for the Baltic Sea Region. This, in principle, places them in the same line with the environmental regulations in the region. Secondly, Soviet past of Latvia vs. Finnish welfare state, relatively different historical, political, and even geopolitical backgrounds of the two states make an interesting ground for research into stormwater policy implementation. Finally, despite different backgrounds, common patterns of stormwater management challenges, such as geographical location and growing levels of precipitation, also make this comparative analysis feasible and relevant in terms of looking into two different perspectives of addressing relatively similar issues.

My personal interest for choosing these two case studies arouse from my brief work experience as an intern in the Interreg Central Baltic project "Integrated Stormwater Management (iWater)", where representatives of both Finland and Latvia participated as project partners. The aim of iWater project (2016-2018) was to "improve the urban planning in the cities of the Baltic Sea region through development of comprehensive stormwater management system which is integrated into the urban development processes of the city at all levels".[2]

Structure

For the purpose of delivering the research tasks outlined above, I arranged my thesis into six chapters. In the first chapter, I construct a general theoretical framework according to the concept of vertical and horizontal fragmentation of environmental administration by Lundqvist (1979), as well as describe key concepts related to the research: decentralisation/deconcentration and stormwater management. In the second chapter, I outline methodological foundations and data operated in this thesis and elaborate upon the research methods I have used conducting my analysis.

Chapter 3 is dedicated to outlining the national contexts and predispositions to the current state of stormwater administration in Finland and Latvia. In Chapter 4, I thoroughly analyse the EU, national and local legislation and policies in the two case studies, in order to define the notion of stormwater for each case study and mechanisms of its management in both cases. I produce a simplified infographic as well as the legislation tables (Annex 2, 3), which allow to effectively compare stormwater management systems, their legal basis, as well as the parties involved in the implementation in Finland and Latvia.

In Chapter 5, I further investigate structure of stormwater administration in the two case studies, by defining local level stormwater groups, identifying the governance level where the most power for stormwater management is concentrated and subsequently, I get a complete picture of vertical and horizontal fragmentation of stormwater administration in Finland and Latvia.

[2] http://www.integratedstormwater.eu/about

In the following discussion chapter, I present the research findings and reflect on the strengths and bottlenecks of the current stormwater management systems in both countries, given the level of administrative fragmentation. I also reflect on the possible ways to overcome existing challenges identified. Finally, in the concluding section, I briefly present the outcomes of the study.

I. THEORETICAL FRAMEWORK

1.1. Theoretical framework and methodological approach

In this chapter, I elaborate the theoretical approach to the question of decentralisation and fragmentation of environmental administration that I adopt for my work, and thus, construct theoretical framework for the given research. The aim of my research is to investigate and compare the vertical and horizontal fragmentation of environmental administration of Finland and Latvia, focusing specifically on stormwater administration in these two countries. For that reason, my objectives are to explore how stormwater is defined as a policy notion in Finland and Latvia, to define what units of environmental administration are responsible for stormwater management, and subsequently, to construct a comparative figure of administrative structures of stormwater management which will demonstrate vertical and horizontal fragmentation of stormwater administration in the two cases.

My theoretical approach is rooted in the theory of organisational institutionalism. Like the other schools of neo-institutionalism (or new institutionalism), including rational choice institutionalism or historical institutionalism, it examines the role of institutions and actors on social action, but the conception of what comprises an institution differs. Organisational institutionalism emphasizes the *subjective role* of institutions in decentralizing management (Saravanan 2009, 177). According to Staniland (2010), institutions are constructed by the actions of their members with reference to their shared frameworks of ideas, which can be used both to design and develop actions, and to make sense of the actions of other members or of outsiders.

According to Long (2001), for organisational institutionalism, actors are “individuals who process information and strategise in their dealings with various other actors, as well as with outside institutions and personnel” (Long 2001, 13). At the same time Powell (2007) highlights on the extent to which “organisational fields are fragmented, contain multiple institutional influence, and are thus subject to ambiguous requirements”. Rather than seeing the state as potent, imposing common practices across organisations, Powell argues that based on research by Edelman in 1992, Dobbin and Sutton in 1998, and

Edelman et al. in 1999, regulation and legal mandates are "as much an endogenous force as an exogenous constraint" (Powell 2007, 4-5).

Applying this theory on studying environmental administration would imply looking at the units of environmental administration, first of all, as people working at these units, employees who plan and implement the policies.

Based on key principles of organisational institutionalism, I further construct my framework for analysis over the concept of fragmentation of environmental administration, elaborated by Lennart J. Lundqvist. According to Lundqvist, every state has a certain pattern of organisational fragmentation, formed over long periods by various regulations, actors and state building processes, which may prove difficult to break. This fragmentation is divided into vertical and horizontal components (Figure 1). Vertical fragmentation explains distribution of responsibilities between different levels of government (central, regional and local). Horizontal fragmentation, on the other hand, explains distribution of these responsibilities between different authorities of each governmental level (Lundqvist 1996:18, Lægreid et al. 2003:7, Roness 2007:65). Therefore, the less there is of specialised environmental units, and the more environmental protection is integrated into the units responsible for other sectors of policy making, the more horizontally fragmented is the environmental policy organisation. On the contrary, independent units specialised specifically in environmental protection organised at each level of government indicate the level of decentralisation and/or deconcentration (Lundqvist 1996, 18).

Lundqvist goes further to elaborate '*decentralisation*' and '*deconcentration*' as related, yet different, terms. In cases of concentration of power, decision-making and its implementation is made centrally, at the level of the whole society and national political system, while in case of the *deconcentration* decision-making is at the national level, but the implementation is disseminated and delegated to the local agencies of the subsocieties of the central political system. *Decentralisation* differs from bare deconcentration by the fact the agencies of the subsocieties are directed by the political subsystem of their respective subsociety (Deutsch and Kochen 1975, 1429-1430). This creates diversity of means and tools for implementation of environmental protection. Decisions in case of

decentralisation are made locally, and their implementation is steered, supervised and reviewed primarily on a local level.

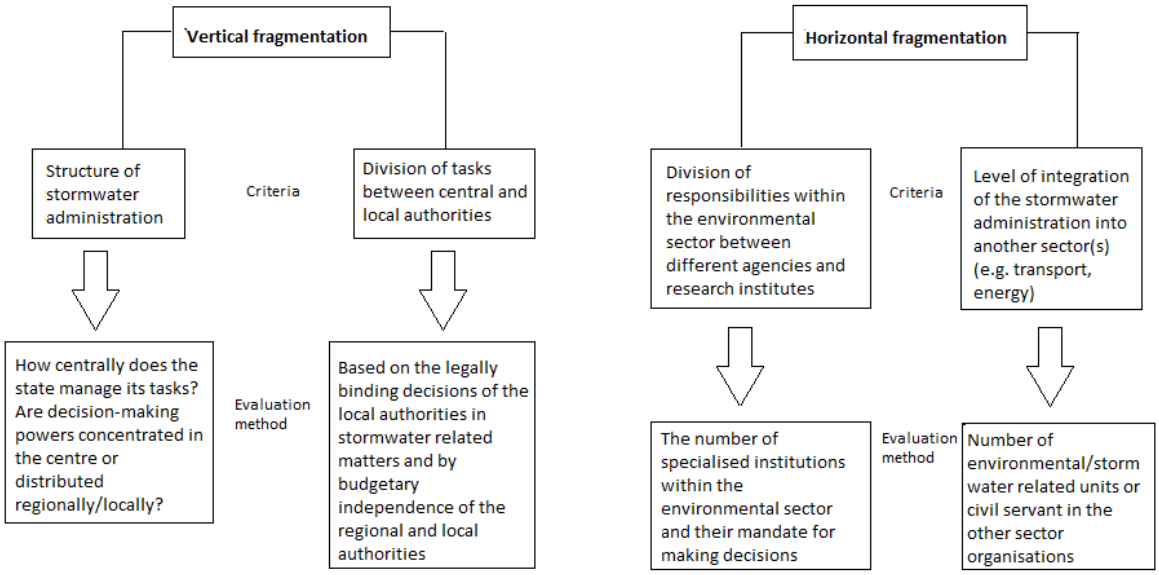

Figure 1. Graphic visualisation of the vertical and horizontal fragmentation framework by L. Lundqvist compiled by the author (adjusted to the theme of the present research)[3]

The aforementioned theoretical framework of administration fragmentation will structure my research on stormwater management and the analysis on how the administration of stormwater works in the two cases of Finland and Latvia.

1.2. Conceptualisation

The following subchapter covers the central research concepts of my thesis. Conceptualisation, together with the research questions and theoretical framework will construct the foundation for conducting the analysis.

Decentralisation and fragmentation

One of the key concepts of my analysis is fragmentation, which is closely linked to decentralisation. The approach to decentralisation suggests forming effective sustainable

[3] Source: Kontio and Kuitto 2008, 98-102

local government structures that would replace weak and ineffective ones (ibid). However, since decentralisation presumes delegation of decision-making to the middle and bottom level of governance, it often leads to the certain level of fragmentation of responsibilities. There is no universal consensus, however, whether fragmentation within environmental administration inside the state carries positive or negative connotation, and what influence it has on the capability of environmental administration to act effectively Biermann et al. (2009, 31).

There is a vast variety of actors and institutions within any governance sector possessing diverse shades of formality, transparency and functionality that shape participation at the community level (Toner, 2008, Meinzen-Dick et al. 2002 in Osei-Kufuor 2013, 36-37). Biermann, however, defines fragmentation on the example of the global environmental governance as "institutional interlinkages, overlaps, interactions or interplay, highlighting on the *overall institutional setting* in which distinct institutions exist and interact" (ibid, 17). Fragmentation, according to Biermann, can be seen in policy documents as synonym to "decentralization", "multiplicity, "division of labour", or in more negative sense, "treaty congestion". Nevertheless, several climate governance architectures lean towards admitting the value of fragmentation, referring to it as "diversity" (ibid, 15).

According to Faust et al. (2008), on the other hand, fragmentation is a dangerous notion in a decentralised system of administration. When the units of administration and/or responsibilities are split into many small organisations, each party will represent rather insufficient percentage of sector- or region-specific interests, which in turn will lead to incapability to provide coherent strategies for decentralisation or to see the big picture (Faust et al. 2008, 5). The main challenges of administration fragmentation in decentralised governments outlined by Faust et al. (2008) are volatility and lack of horizontal and vertical coordination, as well as fragmented politics. The instability of units of administration as well as their degree of responsibility makes it difficult to maintain decentralised system of decision-making and implement long-term strategies in volatile environments. Therefore, as decentralisation processes affect a wide range of actors, there is a strong need for horizontal and vertical coordination among actors within these decentralisation processes (Faust et al., 2008).

Different degrees of fragmentation of administration will affect the level of performance. On the one hand, more integrated governance entities are likely to achieve higher effectiveness in terms of solving the core problems in an issue area. On the other hand, this statement is opposed by several other authors, emphasizing the “potential benefits of a multitude of agreements, institutions, and approaches within an overall fragmented architecture” (Bierman et al. 2009, 24). For instance, according to Lundqvist (1996), reasonable fragmentation of environmental administration and establishing it at the appropriate levels of state governance improves the position of environmental issues in the policy implementation, but at the same time runs risk of creating political conflicts with industry and other affected interests. Lundqvist also stresses on changes of the internal relations and emergence of functional specialisation within environmental administration in case of fragmentation. The point is, with some degree of fragmentation present within the organisation, the central level tends to engage intensively into conducting and supporting research and development, policy planning and strategic policy foresight, developing new policy principles into action programmes as well as evaluating previous policy, while lower levels of administration take the role of executors. This then allows professional environment administrators at the central level to gain "generalist" knowledge over the whole policy scope, making them forerunners in terms of new problem views and new solutions in environmental research (Lundqvist 1996, 19).

According to Christopher Pollitt, decentralisation of power with eventual fragmentation is regarded as the good form of evolution of state administration, opposed to centralised, sometimes quite undemocratic forms of bureaucracy often lacking specific expertise (Pollitt 2007, 112).

Nevertheless, when it comes to the Baltic Sea region countries, two trends can be observed: separation of environmental administration from the lowest levels of state organisation, and decentralisation of decision-making powers from ministry to regional level bodies (Kontio & Kuitto 2008, 98-102). In the Nordic countries (Finland, Sweden, Norway, Denmark) according to Lundqvist, despite the above-mentioned general trend to decentralisation, the “starting points”, such as institutional set-up at local and regional levels, still differ, resulting in different unique patterns of decentralisation with different implications for policy implementation. Lundqvist elaborates that should the

environmental policy be shifted more towards the "politicised" local level, it would potentially lead to the implementation of the decisions being compromised or substantially weakened. On the other hand, moving environmental decision-making to the regional level signposts the build-up of professional environmental competence.

In my research, however, I would not like to take a particular stance, and rather explore two sides of this issue, searching for answers and trying to contribute to this debate.

Stormwater management

In order to establish the scope of the research, it is essential to give a proper explanation and reasons behind the central concept of this research – stormwater.

The variety of definitions of stormwater reflects on the diversity in approaches to this phenomenon. According to the Oxford Dictionary[4], stormwater is "surface water in abnormal quantity resulting from heavy falls of rain or snow". VTT Technical Research Centre of Finland defines stormwater as "surface runoff that is generated on impermeable surfaces during precipitation events and snow/ice melt" (Korkealaakso et al., 12). Baltic Flows project report defines urban stormwater as "the extreme runoff from pervious and impervious surfaces that include roofs, driveways, pavements, footpaths, and road infrastructure characteristic of urban areas" (de la Trincheria & Yemaneh 2016, 13). Another definition by the Mississipi Department of Transportation sees stormwater as "precipitation that accumulates in natural and/or constructed storage and stormwater systems during and immediately following a storm event".[5] As we can see, each definition looks at the term from slightly different angle: whether somewhat more negative, or more neutral from the environmental point of view.

Traditional stormwater management directs the runoff water straight to streams, rivers or the sea, which, unlike wastewater, is untreated, hence often includes large quantities of pollutants that end up in the water bodies (Yang and Cui, 2012). Furthermore, human

[4] Definition of stormwater in English by Oxford Dictionaries, accessed on Feb 13 2018: https://en.oxforddictionaries.com/definition/storm_water

[5] Mississipi Department of Transportation. *Stormwater Management Terms And Definitions*. Accessed 17 May 2019, http://sp.mdot.ms.gov/Environmental/Pages/Stormwater-Management-Plan.aspx

activity in urban areas produces waste and contaminants on the catchment surfaces that may be washed out to water bodies during storms. Therefore, stormwater is very likely to become a source of significant amounts of contaminants to the water bodies and become a significant contributor to the pollution of fresh waters, if not treated properly or at all (Barbosa et al. 2012, 1-12, Roy et al. 2008, 344-345). Considering global warming and climate changes connected to it, the rising precipitation levels would not only pose threat quantity wise, but also quality wise, resulting in the pollution of our already scarce drinking water sources. Furthermore, not only overwhelming amounts of water, but also the prolonged dry periods might lead to the increased stormwater pollutant concentrations (Barbosa et al. 2012, 3). This calls for urgent action to prevent further deterioration of the water bodies and protect the ecosystem by systematic management of the stormwater.

There is, however, a different new approach to stormwater among the researchers and urban planners. According to Roy et al. (2008), it is the result of the old-fashioned stormwater management policies that stormwater became key contributors to deterioration of the freshwater ecosystems e.g. in the USA and Australia (Roy et al. 2008, 345). The problem of the old tradition in stormwater management was to consider only the quantities of water, trying to remove its excess amounts at any price for the protection of health and property of citizens, neglecting preservation of the ecosystem.

The new stormwater management approach integrates stormwater collection, treatment, storage and reuse (Yang and Cui, 2012). Moreover, densely built urban areas are not an obstacle to addressing the problem of stormwater runoff, provided there is enough green infrastructure which is included in the early land use planning stage. Besides, utilizing vegetation together with engineered soil media is becoming an increasingly common practice to manage urban stormwater runoff (Korkealaakso et al., 2).

New stormwater management solutions include, among others, infiltration and purification, conservation design and variety of concepts like BMP (Best Management Practices), LID (Low Impact Design), SUDS (Sustainable Urban Drainage Systems), WSUD (Water Sensitive Urban Design), ISWM (Integrated Stormwater Management) and so on. Different solutions are prevalent in different parts of the world (for instance, LID in the USA, WSUD in Australia and SUDS in the UK), however, the main principle

of all of them is comprehensive stormwater reuse. Therefore, there are numerous possibilities for enhanced stormwater management, but it should be based on the site-specific conditions, demands, as well as effective adaptation of the new systems to specific climate conditions (Korkealaakso et al., 3)

While the necessity of proper stormwater management is realised and is increasingly included in the climate change adaptation and mitigation strategies by many national governments and major international organisations, state administrations often lack capacity or consensus to proceed with its implementation when it comes to implementation of the stormwater management.

Therefore, capacity building and precise action plans are needed at all decision levels (political, regional or local scale) in order to effectively address the issue of stormwater management. For that, all levels would need efficient information and a clear understanding of the possibilities and consequences of each decision, as the decisions taken with insufficient information lead to waste of time, money and possibility of further complications of stormwater management problems. From the complexity of stormwater management issue, it becomes clear that it is not possible to avoid a certain degree of fragmentation within this sector of environmental administration, as it unites urban designers, architects, environmental specialists, researchers etc. around the issue. Thus, this fragmented administration needs appropriately established communication, cooperation and coordination for reaching success. On the local level, for instance, such "stormwater groups" are inevitably divided between different departments of city administration, which is rarely problem-free due to a limited culture of cooperation in this field. According to Barbosa et al. (2012, 6-9), "The approach to sustainable stormwater management must thus be flexible and multidisciplinary and shall consider law, economic, social and environmental aspects, among many others".

In my research, I perceive stormwater positively, as an important resource rather than the problem in the field of adaptation to climate change, but also as a complicated multilevel phenomenon which, by its nature, causes complex social and organisational processes in order to address it. As mentioned in the VTT research report (Korkealaakso 2016, 2), "Contaminated urban runoff can be a major source of water pollution; a cleaned stormwater, on the contrary, can be a useful resource in urban areas".

II. DATA AND METHODS

2.1 Process of data collection

In my research, I focus on the governance and administration side of the stormwater management by systematically collecting and analyzing the legislation and policies related to the issue. Due to the structure of the environmental administration in Finland and Latvia, and since both countries are EU member states, it is relevant to categorize the legislation and policies within three levels: EU, national and local.

As for the criteria of choosing the legislation, it is worth noting that while stormwater is a concept highly intertwined with other issues like wastewater management and directly or indirectly contributes to the quality and well-being of the groundwaters, in the legislation and policy analysis I limit my choice of documents to those fully or mostly connected to particularly the stormwater management field.

During the process of collection of data material, I faced the problem of the lack of legislative definition of stormwater in the Latvian legislation altogether. According to Cabinet Regulations No.34 “Regarding discharge of Polluting Substances into Water”, it is classified as one of the types of wastewater. This prompted me to widen my collection of the legislation documents of Latvia to those concerning wastewater and continue my analysis by identifying stormwater related regulations in that legislation. I was able to collect the primary source material for my research, i.e. EU Directives, national and local legislation, from the official governmental portals online.

2.2 Method of data analysis

In my thesis, I closely examine how stormwater administration is fragmented along the vertical and horizontal dimensions of general environmental administration in Finland and Latvia. According to Kontio and Kuitto (2008), some units of administration, such as land-use planning and administrative structure in the context of decentralisation, are two issues that are country specific in the EU member states and are not tightly regulated by the European Union. This allowed me to perform comparative analysis of the two case

studies of Finland and Latvia, where some aspects of regulations related to water management are being transposed from the EU level, while others are left to the consideration of each EU member state.

The comparison, case study and qualitative content analysis methods have been used in this research, and the recommendations on the improvement of the situation in the longer term have been developed.

One of the methods applied in this research is comparison. According to Rapoport (1955), "To compare is to discover unity in diversity and differences among similarities". In social science, the comparison method aims at providing deeper understanding of society. Two distinct aspects can be emphasised appealing to the process of comparison: identification of a phenomenon and its properties, and the degree of similarity of two or more phenomena at two or more different points in time and/or space. As a method, it suggests comparability of two (or more) cases and aims at demonstrating equality between them, or proving inequality (Nikolinakos, 1977). In case of this research, the comparable phenomena in question are the notion of stormwater, stormwater administration and its fragmentation in two different, yet similar governance systems.

I construct my research in the format of analyzing and comparing two case studies. Case study comes as one of the ways of testing the theory through observation (Van Evera, 2015). According to Gerring (2004), "Although much of what we know about the empirical world is drawn from case studies and case studies continue to constitute a large proportion of work generated by the discipline, the case study method is held in low regard". Case studies can serve multiple purposes, among which, for instance, testing and creating theories, or explaining cases of fundamental importance.

Case study is not intended as a study of the whole organisation, but rather to focus on a particular phenomenon or issue. As suggested by Noor (2008), it is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context using multiple sources of evidence".

While there is a certain level of criticism directed towards case-study research, including impossibility to generalize from just one or two cases, a degree of bias towards

verification of case study, its suitability mostly generating hypotheses and not testing them, or difficulty summarizing specific case studies, this qualitative methodology has a number of advantages (Flyvbjerg, 2006). Case studies first and foremost allow the researcher to gain a comprehensive overview of the phenomenon in question and eventually provide a bigger picture based on a strong set of evidence particular and very relevant to the case. The case study approach in my research allowed me to study the phenomena of stormwater administration fragmentation in in the cases of Finland and Latvia, given the specifics of political, economic, geographical, historical predispositions of the two cases.

In Section 4, I applied the qualitative content analysis research method in order to analyse EU, national and local legislation in Finland and Latvia on the subject of stormwater management related content. As mentioned by Crano et al. (2015), "Content analysis is a technique used to extract desired information from a body of material by systematically and objectively identifying specified characteristics of the material". Hsieh and Shannon (2005), in turn, highlight that "qualitative content analysis is a research method for the subjective interpretation of the content of text data through the systematic classification process of identifying themes or patterns". A prerequisite for successful content analysis, according to Elo et al. (2014), is that data can be reduced to the key concepts that allow creating categories, models, or conceptual maps within the research phenomenon.

As a popular method in social science, environmental science, international relations, political science and sociology, qualitative comparative analysis is a way of exploring causality among cases. According to Blackmann (2013), this methodological approach utilises reasoning based on the "logical reduction of conditions until only those conditions that clearly differentiate between outcomes are included in explanations". The results of this procedure represent causal pathways to outcomes (ibid, 2013). I use qualitative content analysis method in my research to bring two case studies into a comparable format and identify the main differences between the two systems.

Thus, the result of my research is a comprehensive and comparable description of two case studies, where the current state of stormwater administration and fragmentation, as well as key differences and similarities of the two systems are elaborated. This thesis

gives an overview of two different systems where relatively similar policies (transposed from the EU) are implemented in different ways and different circumstances.

III. DESCRIPTION OF NATIONAL CONTEXTS

Today over 40% of the global population live near the sea (OECD 2018, 2). The citizens of Baltic Sea region states are not an exception. Increasing urbanisation of the population, in addition to such significant coastal population together with climate change, indicates a growing need for adaptation and mitigation measures in the cities. Good governance and building of resilient cities resistant to changing environment are of direct interest for the states if they wish to provide security for their citizens, optimize the use of resources, and promote sustainably for the benefit of the future generations. In this chapter, I present the grounds and preconditions of the present state of one of the key climate adaptation measures – stormwater management – in the two cases that are investigated in this thesis: Finland (Helsinki) and Latvia (Riga).

According to Kontio and Kuitto (2008), the historical development, the cultural background, socio-economic conditions have an important effect on formulating environmental policy and governance in the states. For instance, in Western European and the Nordic countries, including Finland, environmental governance has been developing increasingly and steadily together with the general rising environmental awareness, already for decades. On the other hand, the Baltic states, including Latvia, faced the environmental governance issues rapidly, while trying to assemble an effective governance system from scratch on the ruins of the post-Soviet heritage (Kontio and Kuitto 2008, 83).

The comparison of Finland and Latvia is interesting in order to see how two Baltic Sea region states address it from the administrative perspective, taking into consideration their different backgrounds: on the one hand, there is Finland – a Nordic country with its relatively long tradition of environmental and sustainable development, as well as well-developed environmental protection mechanisms. On the other hand, there is Latvia – post-Soviet republic, with pressing environmental problems given the heritage of the Soviet past, but lack of resources and mechanisms to address them. Today both states are a part of the European Union, full members of the EU Strategy for the Baltic Sea Region, participants of the multiple layers of environmental governance that exist in the Baltic Sea region in the form of non-governmental and inter-governmental initiatives and

organisations in general. Such external political and governance processes might also influence the mechanisms of stormwater administration inside these two states.

Resilient future demands effective and innovative solutions not only from a technical point of view (e.g. “natural” vs. “built” infrastructure), but also in terms of planning, decision making and organisation, with a special focus on who does what, how and at what cost (OECD 2018, 2).

3.1 Stormwater administration in the context of environmental policy and governance development in Finland and in Latvia

Environmental concerns similar as they are today actively entered political dimension about 50 years ago, and by now have already been well established in global politics as one of the key narratives. According to Joas (2001), since the introduction of the concept of sustainable development, there have been active debates on what level it should be addressed. Is this a task manageable only by global community, or should this be the task of nation states? Within the nation states, on what level of governance should it be addressed (Joas 2001, 193)? With gradual realisation of the highly cross-sectoral nature of ecological governance, the need for more integrated modes of governance has been argued for in the 1980s. The main concerns voiced were regarding efficiency and effectiveness (Lundqvist 2004, 117).

When it comes to stormwater administration, however, we talk primarily about the local governments, and the reason for it is the process of decentralisation. Both Finland and Latvia went through the process of decentralisation and have reached quite effective local governments with wide autonomy, however, this happened not at the same time, nor in the same conditions. At the beginning of the 1990s Latvia, which gained its independence from the Soviet Union in 1991 and inherited the highly centralised system of administration built on a strict hierarchy, inflexibility, bureaucracy and general lack of care for the environment, was left with nothing but the non-functional mechanism of administration and, therefore, had to start building the new system from scratch. Even though Latvian Local government Act dates back to 1994, Latvian territorial organisation as it is today – 110 local districts (local governments), nine cities with special status and

five planning regions (equivalent to regional level authorities) – had been established only by 2009. Local governments by law have been given the competence, among others, to organize and manage water services within their areas.[6]

By that time, Finland has had already fully a functional welfare system, with extensive public participation, autonomy and decision-making given to the hands of local governments and years of experience in the field of sustainable development. Local governance legislation of Finland dates back to the 1860s, and the territorial organisation as it is today was established in the 1995 Local Government Act. In Finland, this is represented by 336 municipalities (local governments), as well as regional authorities, comprised of Six Regional State Administrative Agencies (AVI) and 15 Centres for Economic Development, Transport and the Environment (ELY) (EU Committee of the Regions 2012, 275-277).

Kern and Löffelsend (2008) suggest that the importance of national government and governance in the Baltic Sea region, particularly regarding environmental policy, has generally declined. Today it is increasingly defined and implemented beyond the nation state. Such new governance arrangements, as stated by Kern and Löffelsend (2008), "foresee the shift of national authority functions in three directions: 1. To the level of international and supranational institutions; 2. To civil society actors; 3. To sub-national actors" (Kern and Löffelsend 2008, 116).

Another distinctive feature of environmental policy development as comparison between Finland and Latvia is that even though situated in one region, these two states have been for decades on different sides of the "battlefield". The fact that Latvia has been a part of Soviet Union for over 50 years inevitably influenced country's ability to perform any independent political or economic activity. The way the Soviet system functioned was through imposing economic, administrative and legal structures on its member states. Environment, however, was not the priority of the Soviet leadership, thus, consequently, most of the Soviet republics experienced wastewater, waste management issues and heavily polluted air. At the same time, in Finland, already at the beginning of the XX century water administration has been enjoying a central position and strong organisation,

[6] https://www.oecd.org/regional/regional-policy/profile-Latvia.pdf

partly due to water bodies playing and important role in the Finnish society (Hermanson and Joas 1996, 84-85, 106). Therefore, the Baltic Sea region is still divided into two parts: Nordic countries and Germany are considered forerunners in the environmental field, while Poland and the three Baltic states still lag behind European environmental standards and face significant environmental challenges that cannot be solved in a short term (Kern and Löffelsend 2008, 115).

3.2 Climate change and preconditions for stormwater administration development

Stormwater management is a term closely related to climate change and, in particular, to climate change adaption and mitigation through, for example, reducing the adverse effects of storms and floods on urban citizens, and significantly reducing the amount of emissions and harmful substances ending up in water bodies, such as heavy metals or micro plastics, or recovering nutrients.[7] According to the European Environment Agency, during the period of 1963-2000, the run off in European rivers particularly increased in western and northern Europe (see Annex 1). Furthermore, intense urbanisation and densification of the cities lead to an increase of the impermeable surfaces which do not allow the proper absorption of the precipitation resulting in floods and increased pollution of the drinking water and open water bodies. Even in the absence of climate change impacts, projections show that, due to population growth and urbanisation alone total flood losses could increase to $52 billion per year by 2050 averaged across 136 of the world's largest coastal cities (OECD 2018, 2).

The importance of developing effective stormwater management in Riga and Helsinki can be seen already from the geographical and climate characteristics of the cities. The city of Riga is located at 1-10 metres above the sea level. The amount of precipitation is 130%, while the percentage of evaporation is just 100%, which means that after each heavy rainfall 30% of the water has to be handled in one way or another, or else it will accumulate on the streets or flow straight into the water bodies (Figure 2). At the same time, the city of Riga accommodates one third of the population of Latvia, a density of 2000 inhabitants / km^2. Helsinki, in turn, is home to 20% of the population of Finland,

[7] http://smartclean.fi/en/projects/sc-stormwater-management-en/

with the density of 3034,62 inhabitants / km^2. Both capitals are located on the coast, which makes the risk of flooding even higher.

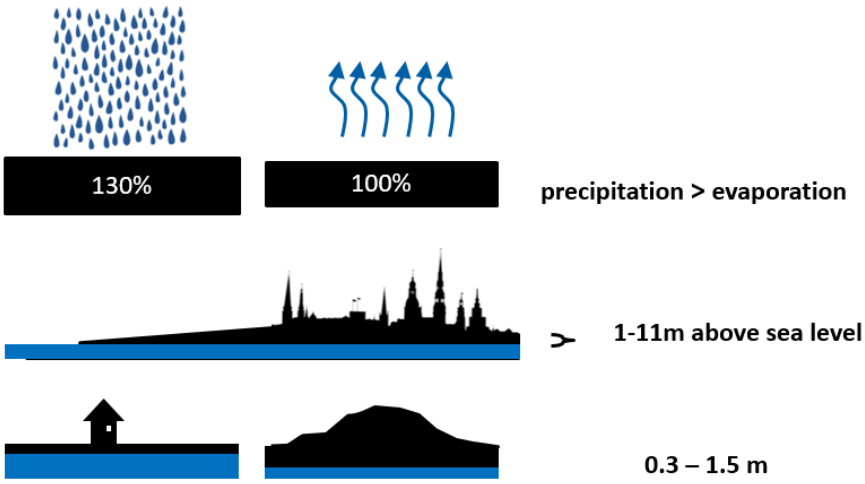

Figure 2. Specific geographical conditions of the City of Riga (source: Kotoviča, 2017)

Despite different backgrounds of the Baltic Sea region states, there are yet common patterns of challenges concerning stormwater management, which makes this comparative analysis feasible and relevant in terms of looking into two different perspectives of addressing relatively similar issues. As concluded by the UBC in the Stormwater Management Survey, the whole region is equally suffering from the increased precipitation levels and, particularly, more frequent and heavier rainfalls. Furthermore, both Helsinki and Riga handle growing urbanisation and densification trends. One of the important findings of the Stormwater Management Survey concluded that the challenge of effective stormwater management lies in the lack of political mandate of those responsible for its development and implementation, further complicated by responsibilities scattered among different units and departments, lack of citizens' involvement in decision-making and implementation (Kotoviča, 2017).

IV. TRACING STORMWATER IN POLICY DOCUMENTS

In this Chapter, I provide the comparative overview of the regulatory enactments regulating the rainwater management of Finland and Latvia. Based on their administrative structure, and since both countries are EU member states, it was relevant to categorize legislation and policies within three levels: EU, national and local. The EU level includes policies, directives and regulations imposed on all of its member states, as well as the non-binding ones. National level includes national and regional environmental legislation binding and is applicable for the whole territory of Finland and Latvia. Finally, the regulations of the local level are built based on the national legislation and are binding within the local units of administration (municipalities and counties and cities). The overview of the available stormwater related legislation will help to define stormwater as it is perceived in Finland and Latvia, as well as to understand the current mechanism of stormwater management in these states. The analysis of legislation will give me the first view on key stakeholders and administration units responsible for stormwater administration in Finland and Latvia, which consequently will help to identify vertical fragmentation of stormwater administration in two case studies.

4.1. Stormwater in the EU policy

When it comes to environmental regulations, the European Union proves to play an important role in environmental protection and sustainable development among the member states. Acting as a powerful forum for comprehensive political, economic and cultural cooperation for 28 states in Europe, it has set at least 130 separate environment targets and objectives to be met by its member states between 2010 and 2050 (European Environment Agency, 2017). Joining the EU, however, besides a set of benefits and advantages, brings also a certain set of responsibilities. A complex legislative system of the EU foresees diversity of binding and non-binding acts to be adopted into the national legislation, or implemented by each of its member states.

The main focus in this section specifically lies on directives and regulations – legal acts, that are binding among all the member states without exceptions, however, their implementation mechanisms may differ. While regulations are the legal acts that apply

automatically and uniformly to all EU countries as soon as they enter into force, without needing to be transposed into national law, directives set specific goals and targets to be reached, but leaving the ways and tools of reaching those goals to own consideration of the states (EC, "Types of law"). When it comes to the stormwater related legislation on the EU level, the most prominent come directives, thus, the final choice of tools and mechanisms of implementation of stormwater management in the European Union is left for each member state on their own.

Key legislation in the EU related to stormwater consists of the following Directives:

- The Water Framework Directive 2000/60 / EC (WFD)
- The EU Directive 2007/60 / EC, known as the EU Floods Directive
- The EU Directive 2006/118 / EC on the protection of groundwater against pollution and deterioration
- The EU Urban Wastewater Directive 91/271 / EEC
- Environmental Quality Standards Directive 2008/105 / EC and
- Bathing Water Quality Management Directive 2006/7 / EC

The Water Framework Directive 2000/60 / EC (WFD) is the central legislative act of the EU, which regulates water law for all EU member states. It defines water as "not a commercial resource, but rather, a heritage which must be protected, defended, and treated as such" (EC, 2000). Its primary goals are the maintenance and improvement of the aquatic environment, the reduction of discharge of hazardous substances in waters, as well as the prevention of deterioration of waters. The directive requires that all water bodies have a good ecological status, therefore, each member state is required to develop a River Basin Management Plan for every river basin district lying entirely within their territory, and to identify the main risks, as well as measures to achieve good ecological status. Good ecological status of waters largely depends on the reduction of the direct and indirect water pollution, hence stormwater management comes to attention. In this context, according to 2000/60 /EC directive, River Basin Management Plans are required to map specific territories where water bodies are at risk of getting pollution, threatening to lose their good ecological status, as well as to apply, where appropriate, specific preventive or remedial measures. According to the Finnish Environmental Institute, Finland has defined 8 River Basin Districts (RBDs), including one devoted to Åland Islands. Two RBDs in Finland are International RBDs (sharing the catchment area with

another country or countries). The planning of river basin management in their respective districts is the task of Finland´s Centres for economic development, transport and environment (ELY-Centres) (The Ministry of Environment of Finland, 2013). In Latvia, there are altogether four RBDs, and all of them are international. Furthermore, two RBDs in Latvia and 3 in Finland share the border with non-member states, such as the Russian Federation, Belarus and Norway, which do not necessarily comply with the regulations imposed by the EU. Responsibility for the planning of RBD management plans has been assigned to the Latvian Environment, Geology and Meteorology Centre (LEGMC), which is a state-owned national level organisation. Thus, it can be concluded that in Latvia, development of the RBD is made using the similar approach across the country, while in Finland the closer focus is on regional interests and peculiarities (EC 2019, 14).

Article 9 of the Directive lays down the principles of cost recovery for water services, including (in the context of the urban planning) water supply and household sewage (including the discharge of rainwater into the duct system of the city). These principles, however, apply only to rainwater discharged in the combined sewerage system, since water management services do not explicitly include the discharge of rainwater into a separated sewer system. This means that the regulations for discharging stormwater into the combined sewer are regulated at the EU level, while the fees concerning rainwater drainage into the separate sewer system are left to the consideration of the member states.

The EU Directive 2007/60 / EC, known as the **EU Floods Directive**, complements the Water Framework Directive, requiring member states to assess the coastline and water courses for flood risks with the aim to define and map the areas of risk, estimate the number of humans and properties within the risk areas. It also requires development of detailed flood risk management plans – a set of adequate measures for mitigating and reducing the risks for each River Basin Management district. This Directive plays a significant role in relation to stormwater as a major cause of floods and water related natural disasters and encourages all EU member states to comprehensively work and improve their flood- and, consequently, stormwater management. EU Floods Directive obliges each member state to complete three stages, which are preliminary flood risk assessment, flood mapping and flood risk management planning. The areas of potential significant flood risk (APSFRs) in Finland and Latvia are developed and implemented by

the same actors responsible for the River Basin Districts of the Water Framework Directive.

The EU Directive 2006/118 / EC on the protection of groundwater against pollution and deterioration, approved on 24 March 2006 provides specific measures and regulations for the prevention and control of groundwater contamination as set in Article 17 of the Water Frame Directive. The implications for stormwater management on EU Groundwater Directive lie in "the prohibition of any actions that may deteriorate groundwater quality", therefore, possibly affecting the application of infiltration-based stormwater management practices (European Parliament and the Council of the EU, 2006; de la Trincheria and Yemaneh, 2016).

The EU Urban Wastewater Directive 91/271 / EEC has been approved with the aim of protecting the environment from the negative consequences of untreated wastewater discharged from cities and certain industrial sectors. The directive applies to the collection, treatment and discharges of domestic wastewater or wastewater from certain industrial sectors. Urban wastewater is understood as a mixture of domestic wastewater or domestic wastewater mixed with industrial sewage and/or rainwater, while rainwater not mixed with household sewage is not covered by the Directive (The Council of the European Communities, 1991).

In the field of environmental quality standards of the water policy, **Directive 2008/105 / EC** sets environmental quality standards for priority substances and other pollutants in accordance with Article 16 of the Water Framework Directive 2000/60 / EC (WFD) with the aim of achieving good groundwater chemical status (European Parliament and the Council of the EU, 2008). Similarly, the **Bathing Water Quality Management Directive 2006/7 / EC** was approved on 24 March 2006 to supplement regulations for preserving, protecting and improving the quality of the environment and protecting human health as set by the WFD. The requirements of Directive 2006/7 / EC have been introduced in Latvian national legislation by Cabinet Regulation No. 608 of 6 July 2010 "Regulations on the monitoring of bathing water, quality assurance and requirements for informing the public", and in Finland – by Decree of the Ministry of Social Affairs and Health on the quality standards and supervision of bathing water in public beaches from 5 September 2014, as well as by updating existing legislation Law on Water Management,

Health Care Act and Law on Environmental Impact Assessment. In addition to that, separate Finnish Flood Risk Management Act was adopted in 2010.

Finally, since stormwater management is mostly associated with adaptation to the climate change agenda, it is worth mentioning the **EU Adaptation Strategy**. Adopted in 2013, it acts as a framework for member states in addressing the changing climate. Unlike climate change mitigation, which highlights the efforts to reduce or prevent emission of greenhouse gases, i.e. prevention of the potential damage caused by the climate change, the climate change adaptation foresees – "Anticipating the adverse effects of climate change and taking appropriate action to prevent or minimise the damage they can cause, or taking advantage of opportunities that may arise" (UNEP, 2018; EC, "Adaptation to Climate Change"). Therefore, the term "climate change adaptation" is much broader, and includes not only efforts to prevent the damage, but also learning to adapt to the changes of climate and using it for the benefit of the planet and society.

According to the EU Multiannual Financial Framework 2014-2020, at least 20% of the European budget is to be secured for implementation of the climate change objectives, including both adaptation and mitigation (European Commission, 2016). Though there is no real comprehensive overview of adaptation costs in the EU at the moment, additional flood protection measures are estimated for € 1.7 billion a year by the 2020s and € 3.4 billion a year by the 2050s. Such measures can be very effective, as for each euro spent on flood protection, six euro of damage costs could be avoided (Feyen and Watkiss, 2011).

4.2. Stormwater in the national policy

4.2.1 Finland

National legislation of Finland concerning environmental policy has developed gradually, in response to the commitments imposed by international agreements and the EU legislation. As for the stormwater management, in Finland so far there is no specific legislation dedicated to it, but there is a growing number of provisions, regulations and legislation acts, as well as strategies, that address stormwater, such as Finland's National Adaptation Plan, the Land Use and Building Act, Water Management Act, Water Act,

Flood Risk Management Act and Environmental Protection Act (de la Trincheria et al., 2016).

Overall, water management is one of the major areas of climate adaptation in Finland, with the special attention being given to the flood management and dam safety. **Finland's National Strategy for Adaptation to Climate Change** was first adopted in 2005 and its updated version, until the year 2022, was adopted by Finnish government in 2014. The focus of the adaptation strategy is the national level and the approach is sector-based. The strategy concentrates on the impacts of the climate change and proposes measures to be addressed. According to the national adaptation plan, the responsibility for the implementation, monitoring and reporting rests with the relevant ministries. When it comes to the water resource management in the adaptation to climate change in Finland, it goes under the jurisdiction of the Ministry of Agriculture and Forestry (Ministry of Agriculture and Forestry of Finland, 2014) (Figure 3).

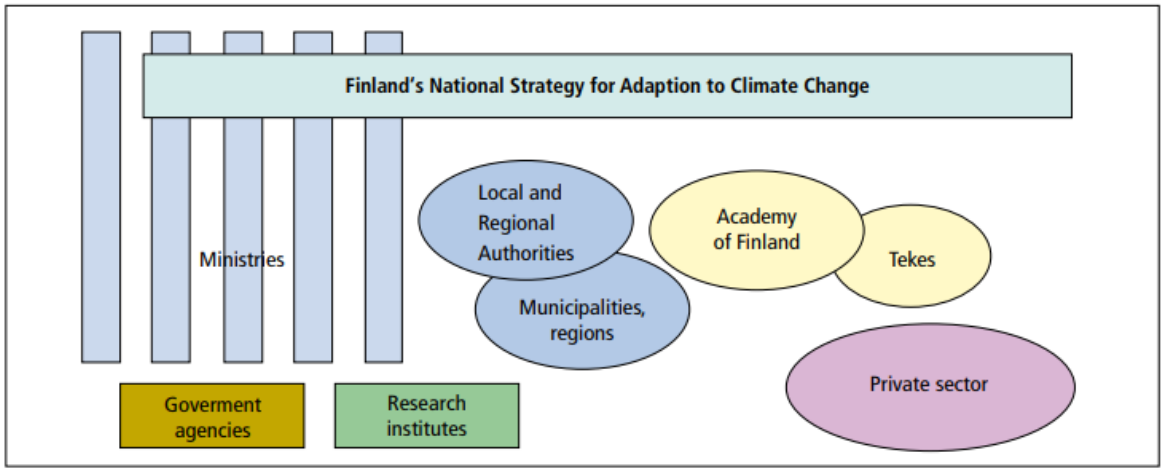

Figure 3. Finland's National Strategy for Adaptation to Climate Change is implemented in multisectoral cooperation, coordinated by the Ministry of Agriculture and Forestry[8]

One of the key parties involved in the water resource tasks concerning climate change adaptation are The Centres for Economic Development, Transport and the Environment (ELY Centres). The task of such centres, among many others, is to take care of the use, status and management of water resources in their own territories. Finland has a total of

[8] Source: Ministry of Agriculture and Forestry of Finland. Accessed 20 March 2018. http://www4.unfccc.int/nap/Documents%20NAP/Adaptation%20Strategies%20and%20Plans/Adaptation_Strategy_evaluation.pdf

15 ELY centres, which take care of 311 Finnish municipalities. In principle, it is the responsibility of municipal and regional authorities, together with the water supply utilities, real estate owners and holders to develop and upkeep the water services, as well as to prepare risk management and emergency preparedness plans (Ministry of Agriculture and Forestry of Finland 2005, 108, 198). Municipalities develop water services to match the requirements and development of their respective communities. At the same time, the Ministry of Agriculture and Forestry provides the legislative framework for water service activities, supports municipalities and projects carried out by them, as well as conducts and promotes research and development in the sector (ibid). The role of the Ministry of the Interior in stormwater management concerns the dams, primarily dam safety issues and rescue operations. The other ministries involved in climate adaptation group of Finland are the Ministry of Environment, the Ministry of Education and Culture, the Ministry of Economy and Employment, the Ministry of Social Affairs and Health, the Ministry of Foreign Affairs and the Ministry of Defence. Besides that, there is vast amount of research institutes and regional actors, as well as other independent experts such as SPEK (expert organisation in fire and rescue services) FFI (Finance Finland) and even private sector (Lilja-Rothsten, 2017). Therefore, it can be observed that climate change adaptation in Finland is highly cross-sectoral.

Another important legislative act significant in regulating stormwater in Finland is **Flood Risk Management Act 620/2010**. Being a part of Finland's adaptation strategy and transposition measure for the EU Floods Directive, the act establishes regulations concerning flood risk management in Finland, in commitment with sustainable use and protection of water resources. The document clearly defines the responsibility for implementation of flood risk management between the authorities, which are the Ministry of Agriculture and Forestry, the Ministry of the Interior, the Ministry of Transport and Communications, the Ministry of the Environment, Finnish Environment Institute and Finnish Meteorological Institute on the national level; Centres for Economic Development, Transport and the Environment (ELY Centres), Regional Councils and regional rescue services on the regional level and municipalities on the local level. According to the Act, the responsibility for stormwater and meltwater is given to the municipalities, which are expected to perform preliminary assessment of stormwater and meltwater flood risks, together with designation of significant stormwater flood risk areas

as regulated by Section 19 of the Flood Risk Management Act (Ministry of Agriculture and Forestry of Finland, 2010).

Land use and building are among the areas not regulated by the European Union Law and is left for member states to decide on. In Finland, **Land Use and Building Act** was last updated in 2014 and the new amendments included specific regulations on stormwater. The scope of stormwater in this act includes rain or melting water, which is collected from roofs or other built surfaces – including drainage water (Nordman, 2014). According to Finnish land use legislation, land use master plans are the responsibility of municipalities. They draw a general plan for the whole area, and then the role of the local authorities is to develop a local master plan taking into account the requirements of general municipal master plan and local area peculiarities. These plans are part of the right of self-governance of the municipalities, and in case the minimum requirements are met, the regional and state level do not have any impact on the planning of the municipalities (Behrend 2017, 18).

The 2014 updates of the Land Use and Building Act included provisions regarding stormwater management, according to which systematic stormwater management in Finland shall be organised and incorporated into the land use master plans (682/2014, section 103 §a-o). For this reason, municipalities are entitled to develop and approve stormwater plans, if necessary. The plan shall map the areas of natural absorption, such as wetlands, ditches, as well as drainage solutions and structures provided by the municipal water system, and it must be drafted in such a way that it takes into account the city plan, the area plan, as well as the municipal master plan and that it meets the requirements of functionality, safety and comfort, also with increasing rainfall. While the responsibility of the municipal and city authorities is to provide water systems and water service and upkeep them in a good condition, the accountability of proper management of stormwater on each property and residence area is on the property owners. Furthermore, section 103 of Land Use and Building Act from 2014 introduces municipal fees for stormwater management. The fee is determined based on the stormwater management solution provided by the municipality, the cost of its design and implementation, as well as the location of the property in relation to the stormwater plan of risk zones (Ministry of Agriculture and Forestry, Finland, 2014).

Water Services Act 119/2001 provides provisions regarding adequate water services for household use with respect to health and at reasonable cost, as well as appropriate sewerage in line with health norms and protection of the environment. It applies, among others, to "sewerage for rainwater or meltwater (runoff water) accumulated on the soil surface in built areas, or the roof or other surface of a building as far as this is the task of the water utility", as well as to the drainage waters from foundations (Ministry of Agriculture and Forestry, Finland, 2001). According to the Act, conducting stormwater sewerage into wastewater sewerage (combined sewer system) in Finland is forbidden for sewerage systems built after 2015, with the exception of those that have been specifically designed taking into account stormwater, or those built in the areas that lack other ways of stormwater sewerage / detention / impregnation, or in case water utility takes charge of combined sewerage properly and economically (Nordman 2014). In the rest, municipalities give freedom to the water utilities to manage the sewerage for stormwater in accordance with the development needs of communities and following the conditions of a contract between municipalities and water utilities. If no such contract exists, the sewerage for runoff water in the area is managed "in accordance with a zoning plan, runoff water plan, street plan, or general local plan referred to in the Land Use and Building Act" (Ministry of Agriculture and Forestry, Finland, 2001).

Finally, **Water Act 587/2011** applies to water resource management issues, including stormwater, which is defined in this act similarly as in the Water Services Act. In connection with Water Act, any water resources management project in Finland is subject to a permit in case it might cause a change in the ecological state, depth, water level or flow, change aquatic environment of a water body or result in a risk of flooding or general shortage of water. These activities include "the construction of jetties, bridges, cable crossings, pipelines, dams, hydropower plants, waterways, log-floating routes, drainage ditches, canals, weirs and sluices, as any urban construction projects in accordance with the Land Use and Building Act 682/2014" (Ministry of Agriculture and Forestry, Finland, 2011). The institutions held responsible for issuing such permits are the regional state administrative agencies.

Other Acts that have indirect influence on stormwater management in Finland are Dam Safety Act (412/1984), Act on the Organisation of River Basin Management and the Marine Strategy, Environmental Protection Act 86/2000, Government Decree on

Substances Dangerous and Harmful to the Aquatic Environment 1022/2006, Government Decree on Water Resources Management 1040/2006 as well as Government Decree on Water Resources Management Regions 1303/2004 (Korkealaakso et al., 2016).

4.2.2 Latvia

National level stormwater related legislation in Latvia includes The Law on Water Management, The Law on Territorial Development Planning, The Water Utilities Act, Land Amelioration Law as well as numerous regulations of the Cabinet of Ministers of Latvia, which are universally binding in Latvia just like the laws.

Cabinet Regulation No. 34 from 22.01.2002 Regarding Discharge of Polluting Substances into Water stipulates the procedures by which water utilities shall control and monitor the quantity of discharge of polluting substances and obliges local authorities to map highly sensitive areas which are entitled to increased requirements for the urban wastewater treatment. Regulations directly apply to stormwater (mentioned as run-off rain water), which is defined in this document as "*waters which form from atmospheric deposition by flowing down from the roofs of buildings, streets and other territories with a full or partial surface cover*", but is mentioned in this legislation document as a subcategory of the wastewater. Hence, based on this categorisation, stormwater in Latvia is treated in the same way as wastewater, and the same requirements for pollutants apply. Article 6 of the regulations demands the use of the most up-to-date technical methods or environmental abatement technologies, in order to restrict discharge present in the surface waters (Cabinet of Ministers of Latvia, 2002).

According to the **Law on Water Management Services**, wastewater management is performed either through centralised collecting systems, or through decentralised sewerage services. Centralised collecting systems are structures that provide water management services within the area, as well as collect and treat wastewater (including stormwater) from water management users. Decentralised sewerage services, in turn, are provided by the same water management service providers, but include wastewater discharge to the decentralised sewerage systems or wastewater containers, transport and further discharge into centralised collecting systems at the wastewater collection points. Furthermore, the law mentions stormwater as "*public water management services in the*

form of the collection and discharge of rainwater to the decentralised sewerage services or in the centralised collecting system" (The Parliament of the Republic of Latvia, 2015).

Law on Water Management provides the basis for development of river basin management plans as provisioned by the EU Water Framework Directive. Among others, its objective is to "protect deterioration of terrestrial ecosystems and wetlands directly depending on water, as well as to ensure the protection of the land against floods and droughts" (The Parliament of the Republic of Latvia, 2002). Article 21 of the Law states that activities, which involve regular changes in surface water level or stream-flow regime, are subject to the water resources use permit. The conditions and procedure for application and issuing of water resources use permits, as well as monitoring and control of the permit conditions are determined by the Cabinet of Ministers (ibid., 2002).

The Law on Local Governments of Latvia stipulates that water supply and sewerage as well as conducting and purification of wastewater is the autonomous function of the local governments, irrespective of the ownership of residential property. Local government may determine, if it is not prohibited or prescribed by laws or Cabinet regulations, the charges for the use of water supply and sewerage, however, as concluded earlier, these are the charges for the municipal wastewater treatment, as there is no separate rainwater sewerage stipulated by law in Latvia. The monitoring of the local governments for proper implementation of their responsibilities is done by the Ministry of Environmental Protection and Regional Development (The Parliament of the Republic of Latvia, 2013).

Cabinet of Ministers 22.03.2016 regulation No. 174 Regulations on public water services and use defines procedures and conditions of connecting properties to the central water supply or centralised wastewater collection systems and sets additional fees for the treatment of polluting substances according to the allowed limits if it is not already included in the tariffs established by the local government in question or the Public Utilities Commission. According to the regulations, wastewater (including stormwater) that complies with all the requirements regarding polluting substances and the capacity can be discharged into the centralised collecting system. Specific parameters and permitted concentration of polluting substances in the wastewater is stipulated by the Cabinet Regulation No. 34 from 22.01. 2002 "Regarding Discharge of Polluting Substances into Water".

Analysis of the land use legislation of Latvia, such as Latvian Law on Land Use and Land Survey, showed that, unlike in Finland, land use legislation does not directly or indirectly address stormwater administration, or water administration in general. However, stormwater is addressed in the construction norms and standards, such as LBN 223-15 "Sewerage construction" which provides technical regulations for sewerage construction, drainage systems' design, as well as the methods for calculating the amount of rain water to be discharged in the household sewerage (Cabinet of Ministers of Latvia, 2015).

Based on the aforementioned legislative acts, stormwater management in Latvia has the following features:

- Organisation and maintenance of the water services and sewer systems are given to the local level authorities;
- Stormwater is discharged mainly into the combined sewer system, designed for both stormwater and wastewater; water collection is done through both centralised and decentralised systems;
- Water services and water collection is operated by the private/public water service providers upon entering in a contract with the local authorities;
- Public Utilities Commission (PUC) acts as the national level regulator of the water service providers/merchants, and is an independent institution based on the public law.

4.3. Stormwater in the local policy

4.3.1 Finland

On the local level, stormwater in Finland is administered by a combination of national legislation regulations, as well as various local documents and strategies that apply only within each area. For the city of Helsinki, the main documents regulating stormwater management on the local level are:

- Stormwater guidance (2012), compiled by the Association of Finnish local and regional Authorities;
- The Stormwater Strategy of the City of Helsinki (2009);
- Construction Order (2010) by the City of Helsinki Building Control Department;

- Construction site water guidance (2013) by the City of Helsinki Environment Centre
- The City of Helsinki Instructions on Prevention and Control of Floods (2013) by the City of Helsinki.

The stormwater strategy of the City of Helsinki was approved already in October 2008. According to the strategy, the city of Helsinki strives to prevent the flooding caused by the stormwater and eliminate damage connected to it, to provide functional regional and local drainage, as well as to promote the utilisation of stormwater (the City of Helsinki, "Drainage and stormwater"). The strategy established 15 measures and goals to be achieved, among which, promotion of continuous stormwater management and monitoring, incorporating stormwater management into city planning, mapping flood risk areas, gradual expansion of a separate sewerage system, developing regulations regarding quality and infiltration of stormwater, as well as stormwater fees, establishing stormwater group etc. (ibid). **Helsinki stormwater plan** highlights the use of stormwater in urban planning as a resource for pleasant environment and for increasing a good status of surface and ground waters. It aims at further decreasing the length of combined sewer network and support integrated comprehensive planning and management of stormwater and resources by introducing new cooperation and management models (Rosqvist, 2017).

The City of Helsinki Instructions on Prevention and Control of Floods developed in 2013, describe how to protect property against seawater flooding, flooding from waterways and stormwater flooding caused by heavy rainfall and melting snow. The document distributes responsibilities during flood events between owners and occupants, rescue authorities, ELY Centre, as well as the city administration. In particular, the operator and occupants of the property are responsible to prepare the property for a flood for their part, as well as to prepare for protecting persons and belongings in the event of a flood. Property tenants are responsible for protecting themselves and their possessions through their own action. The rescue authorities, in turn, are responsible for carrying out their duties related to rescue operations as to protect human lives, health, possessions or the environment (the City of Helsinki, 2013).

Besides earlier mentioned documents, stormwater is heavily regulated by the construction related city legislation, such as Construction Order by the City of Helsinki Building

Control Department and Construction site water guidance by the City of Helsinki Environment Centre, however, these regulations are mainly applicable to the properties outside of the municipal water networks. For instance, according to the article 17 of the City of Helsinki building regulations, stormwater can be absorbed at the site if soil conditions allow. In special cases, stormwater can be conducted to an operational open ditch network **(**the City of Helsinki, "Drainage and stormwater").

Therefore, there are two main scenarios of urban stormwater management in Finland. In the case of the property being connected to the municipal (storm)water network, stormwater management will be regulated by the Water Services Act, which foresees stormwater collection as rule into a separate sewerage system (excluding several exceptions regulated by law). If the property is outside of the water networks operation area, stormwater will be regulated according to the Land Use and Building Act. In this case, it is the responsibility of the land/property owner to take care of stormwater within the area, either through absorption, or by various stormwater management solutions provided by the municipalities according to the specific demands of separate communities (defined in the stormwater plans), for the established stormwater fee.

4.3.2 Latvia

Stormwater management in Latvian capital region can be analysed by looking into local binding regulations regarding wastewater and sewerage networks. This is due to national legislation that defines stormwater as a type of wastewater, and due to relatively poor rainwater collection infrastructure in the city, which prompts stormwater collection to a greater extent by the wastewater sewerage network, threatening overflowing and flooding of the systems during the heavy rainfall and snow melting periods.

According to **Riga City Council binding regulations No.147 "Rules for the use and maintenance of the city of Riga hydrographic network"**, stormwater in Riga collected to the separate stormwater collectors is then discharged into the open water bodies. Regulations do not foresee treatment of the stormwater, as it was observed in Latvian national level regulations. The party responsible for the maintenance of the stormwater drainage collectors, stormwater collection and storage is the traffic department of the Riga City Council. At the same time, the maintenance of the pipelines and other building

elements that connect to the main rainwater collection systems is the responsibility of the legal owner or user(s) of the pipelines (Riga City Council, 2011).

Riga City Council binding regulations No.17 "Obligatory regulations for the operation, use and protection of the central water supply and sewerage system of Riga city" stipulate the procedures of connection of households to the centralised water and sewerage networks, as well as requirements for the operation and maintenance of the systems. The document also regulates discharge of stormwater to the centralised sewerage system in the Riga region. According to the given regulations, the water services provider does not own or is held responsible for the rainwater drainage systems, but only for the centralised water supply and sewerage networks. Furthermore, water service providers do not own and operate local wastewater treatment plants, sewage pumping stations with the internal diameter of pipes less than 100mm, water pressure-booster stations as well as internal water supply and sewerage networks of the buildings.

Among the types of wastewater allowed to be discharged into the centralised sewerage system are household wastewater, industrial wastewater as well as rain water that do not contain exceeding amount of the substances than it is allowed by this regulation, or by the national legislation act No. 34 from 22.01.2002 Regarding Discharge of Polluting Substances into Water (Riga City Council, 2017).

Drawing a conclusion from this and previous regulations, it becomes obvious that the parties responsible for the stormwater collection and discharge in the Latvian capital area are Traffic department of the Riga City Council as well as the local water service provider in Riga, which is Riga Udens. None of the regulations, however, state anything regarding the treatment of the stormwater, except of mere collection and discharge of it into the open water bodies.

Riga City Council binding regulations No.4 "The provisions of the contract on public water services, the procedures for its conclusion, modification and termination" stipulate the legal grounds for the conclusion of the contract between water services users and water services providers (water utilities) in Riga, as well as the possible criteria influencing the calculation of water services tariffs. While being calculated and approved by the Public Utilities Commission, the tariff can be modified unilaterally by

the service provider based on the water consumption, amount of wastewater discharged per capita, as well as depending on the type of drainage service – whether rainwater collection is operated by the water utility or not. Additional criteria influencing the water services tariff are location of the property outside of the centralised sewerage networks (decentralised sewerage system), or additional fees for treatment of the wastewater due to excess amount of polluting substances in the water.

Therefore, the contract for wastewater treatment, either through decentralised or centralised sewerage system, shall include permissible concentration of pollutants accepted for purification, minimum and expected amount of the discharged water based on each separate household and the amount of residents, methods of calculation of the amount of discharged wastewater and extra fees for the wastewater treatment. In addition, a decentralised water service contract should include the registration certificate, as well as the license for the use of a vehicle and tank for transferring wastewater to the wastewater collection point (Riga City Council, 2017).

Therefore, based on the local water legislation of Riga, water management, and especially stormwater management, needs significant financial aid and is still relatively poor and merely present. It is, however, included in the long-term plans of Riga environmental administration to change this situation. Examples of the commitments are visible, for instance, in the **Sustainable Development Strategy for Riga 2030**, approved by the decision of Riga City Council No. 1173 on 27 May 2014. Despite the fact that currently there are no clear separate regulations regarding stormwater collection and treatment stipulated by the national legislation of Latvia, this local level strategy for the capital region includes the following long-term measures:

- Stormwater drainage should be developed and executed on the whole territory of the city;
- New construction objects should be developed and constructed taking into account quality and safety of the green corridors, which are to be enhanced and maintained by introducing the sustainable stormwater solutions;
- New transport infrastructure should be designed in integrity with open stormwater collection systems;
- The need to build drainage systems in the form of open ditches and basins shall be evaluated;

- When possible, systems for stormwater re-use should be applied (Riga City Council 2014, 50-53, 75-76).

Drawing conclusions on the stormwater related national legislation in Finland and Latvia, the first observation is regarding the plurality of actors and stakeholders engaged in stormwater management in various ways. It becomes obvious already at this point that stormwater is treated in different ways in these two countries: in Finland it is separated from wastewater and, where possible, collected in separate stormwater sewers. In Latvia to this day, stormwater is collected together with wastewater (Figures 4, 5). In both cases, collected stormwater is treated at the wastewater plants, however, in Finland, the capacity for it is better, as it is conveyed through separate infrastructure and thanks to stormwater fees collected from population and municipalities, stormwater infrastructure is constantly maintained and improved. Moreover, other water retention solutions (e.g. ditches, brooks, green infrastructure) are foreseen by municipalities. In Latvia, on the other hand, with growing levels of precipitations due to climate change, the capacity of old municipal water collectors is exceeded, and often is not enough during heavy rainfalls. This, in turn, leads to stormwater being discharged directly into the water bodies.

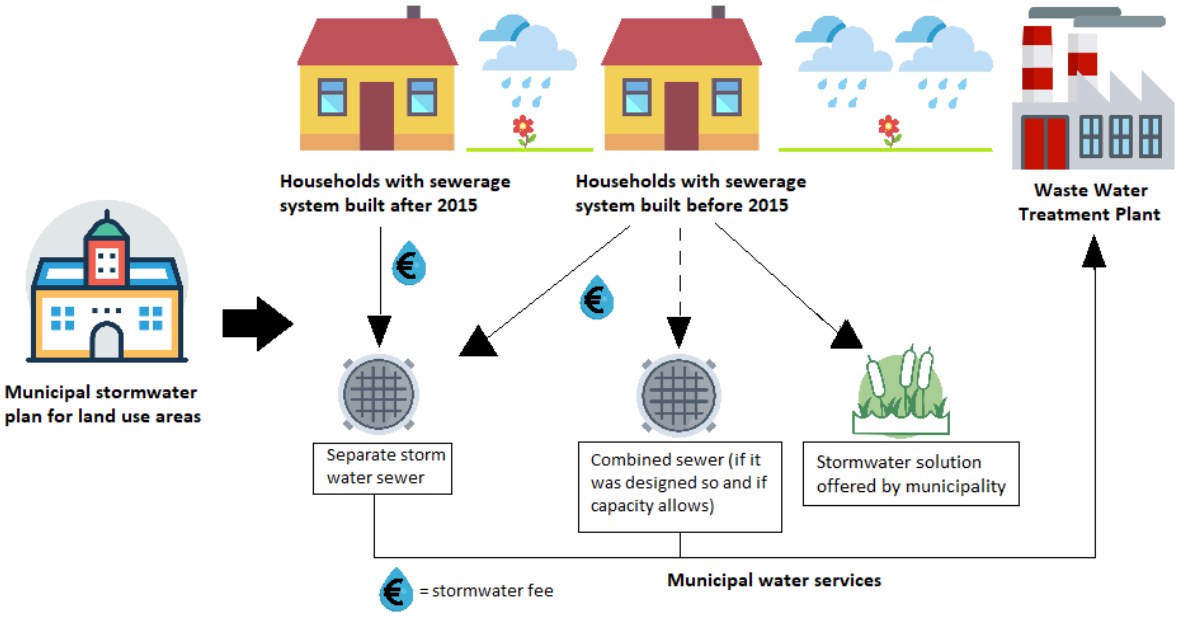

Figure 4. Legislative regulation of stormwater in Finland (author's compilation)

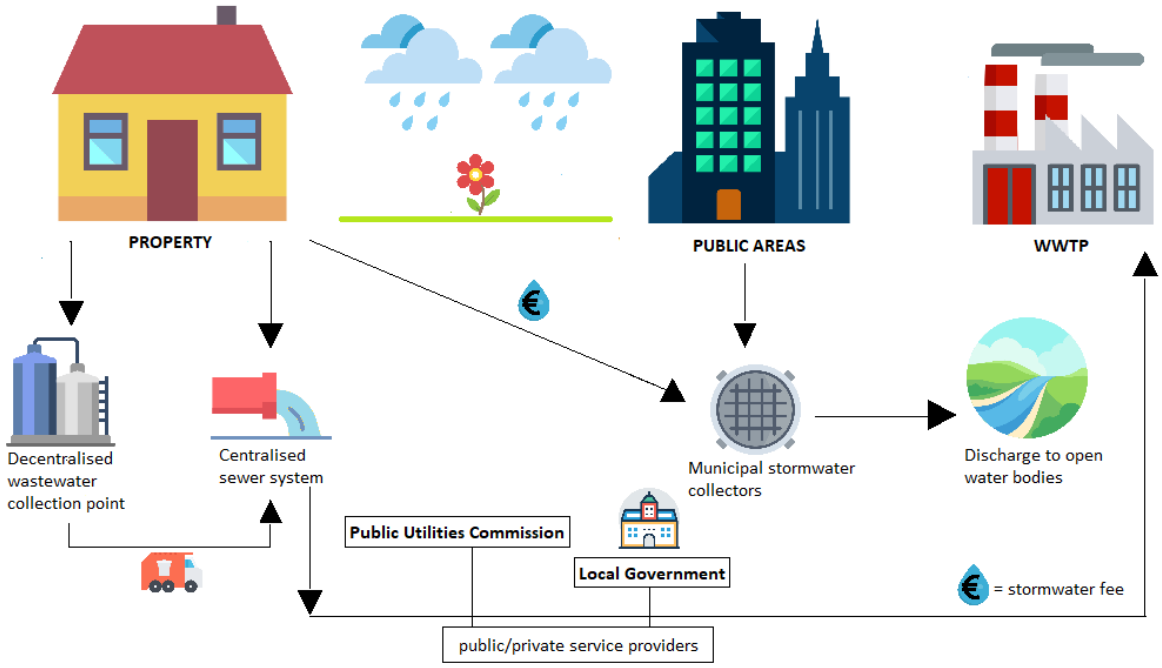

Figure 5. Legislative regulation of stormwater in Latvia (author's compilation)

To sum it up, an overview of the legislation in Finland and Latvia gives a picture of rather broad horizontal and vertical involvement of authorities in coordination of climate change adaptation (see summary of involved actors in Annex 2, 3). Such distribution is good in terms of engagement of diverse expertise and knowledge. Also, environmental issues are location-specific, therefore, dispersing decision-making allows development of local capacities for the provision of services that are more appealing to specific local requirements. Moreover, decentralised and well-distributed coordination is more likely to involve less favoured groups and communities in the decision-making and provide higher transparency of the decision-making process (Cistulli, 2002).

However, such fragmentation of stormwater management across institutions and levels or governance could cause difficulties regarding effective stormwater management and overlapping of jurisdictions. Unless the cooperation and communication between all units involved is well established and responsibilities distributed clearly, there is a risk of miscommunication and weak initiative due to dispersed points of decision-making. For instance, when delegating the decision-making to the local level, there is a risk of weak administrative or technical capacity, inadequate financial resources, considerably higher costs of enforcement, conflict between different units, which could potentially slow down decision-making and / or the implementation process. While practical knowledge of

specifics of the issue on the local level is considered generally as the beneficial feature of decentralisation, the lack of scientific knowledge to complement the practical experience could become an obstacle, which again would require a good level of communication with the regional and national level institutions. The bottom line, however, is that stormwater by its nature is a highly cross-sectoral phenomenon, hence, fragmentation is unavoidable. There are issues that are difficult, if not impossible, to reorganize or restructure to be more integral due to the nature of the very phenomenon. Moreover, a human factor plays an important part when it comes to administration – organisations are not only about governance, but also about people working for them. Finally, civic engagement and interest, no matter on what level stormwater is managed, are among the most important prerequisites of its successful implementation. Therefore, stormwater is a highly cross-sectoral and multidimensional issue that requires participation of various actors and society in order to successfully manage it. But even despite the fragmentation, it is important to organize functional cooperation of those actors.

V. FRAGMENTATION OF STORMWATER ADMINISTRATION IN FINLAND AND LATVIA

This chapter will give an overview to the extent of fragmentation of stormwater administration in Finland and Latvia with the focus on the cases of capital cities Helsinki and Riga. Based on the analysis of legislation in the previous chapter, I will define who is responsible for stormwater management, and on what level of governance, using the framework of fragmentation of environmental administration by Lundqvist.

In order to define the extent of responsibilities shared between different levels of stormwater administration, I will define and compare stormwater groups relevant to each case study. Going from there, I will analyse how centrally the decision-making process is concentrated in each state, and how financially independent regional and local units of the environmental administration in question are. According to Lundqvist, the higher number of independent units specialised specifically in environmental protection, organised at each level of governance, will indicate the higher level of fragmentation (Lundqvist 1996, 18).

5.1. Helsinki and Riga stormwater groups

As can be observed from the analysis of the national legislation of Finland, municipalities and the local authorities are those that have the most power in stormwater management. In particular, based on Land Use and Building Act, cities can autonomously develop their stormwater plans, if they deem necessary (but it is not obligatory).

However, with the intensified work on the adaptation to climate change, cities became urged to adopt stormwater strategies. In Helsinki, the first stormwater strategy was approved by the City Board already in 2008, and in 2018 updated into Integrated Stormwater Management Programme (the City of Helsinki, 2018). The focus of the Programme is developing comprehensive stormwater management systematically and on a long-term perspective. Helsinki Integrated Stormwater Management Programme also aims to establish a clear division of responsibilities between units, divisions and services of the city administration.

In Riga, unlike Helsinki, at the moment there is no special Stormwater Strategy that would address specifically stormwater. Riga municipality, however, adopted Sustainable Development Strategy for Riga 2014-2030, which includes also issues related to stormwater management in the municipality and the City of Riga. As a long-term document on development of Riga municipality, the document includes 5 long-term measures to be developed regarding stormwater management, such as development of stormwater drainage in the whole vicinity of the cities, development of stormwater sensitive new transport infrastructure, building of new construction objects taking into account the safety of the green corridors in the city, stormwater re-use, as well as assessing the need for the open drainage systems such as open ditches and basins (Riga City Council 2014, 50-53, 75-76).

Parties involved in stormwater planning and management in each city can be united into the so-called stormwater groups. Depending on legislation and regulations in different countries, and even within different municipalities of one country, a stormwater group can be comprised of different units. The composition of the stormwater group reveals the structure of stormwater administration and the distribution of power on the horizontal and vertical hierarchies of administration.

According to the Helsinki Integrated Stormwater Management Programme and based on the local level legislation analysed in the previous chapter[9], in Helsinki, the stormwater group is comprised of the following units:

1. Urban Environment Division of the City of Helsinki, within following departments:
    a. Services and permits (Environment services, building supervision)
    b. Land use and city structure (general and detailed planning, streets and landscape planning)
    c. Building and public areas (real estate and maintenance)
2. The City of Helsinki Central Administration
3. Helsinki Regional Environment Services HSY (the City of Helsinki 2018, the City of Helsinki 2019).

[9] See section 4.3 “Stormwater in the local policy”

The processes concerning stormwater fall mainly under the responsibility of the Urban Environment Division and its departments. Additionally, the work of Helsinki stormwater group is supervised by Helsinki Climate Change steering group and the Mayor of Helsinki City. Due to the agreement between Helsinki Regional Environment Services HSY and the authorities of its member municipalities, the responsibility of HSY regarding stormwater includes construction, investment, renovation and maintenance of stormwater sewers in the wastewater drainage area as well as in the mixed drainage area. A separate agreement has been concluded between HSY and Helsinki on the management of stormwater in the mixed drainage area (the City of Helsinki, 2018). That is, HSY would be responsible for stormwater sewerage, and other stormwater matters in Helsinki would fall under the responsibility of the city. Nevertheless, under Section 17a of the reformed Water Services Act, the final decision on the party that is responsible for stormwater sewerage is made by the City Council.

On the other hand, the main actors of the Riga Stormwater group, as defined by iWater project, are (Kotoviča, 2017):

1. City Development Department of the Riga City Council;
2. Riga City Construction Board;
3. Riga Water & Sewage Utility (PSIA «Rīgas ūdens»);
4. Traffic Department of the Riga City Council (Specialist for Transport Infrastructure Building & Maintenance;
5. Environment & Housing Department of the Riga City Council;
6. Property Department of the Riga City Council.

When comparing stormwater groups of Helsinki and Riga, it can be observed that stormwater is handled involving mostly similar types of actors in both cases. The differences lie in the extent of responsibility of the parties, as well as financial independence, which is analysed and elaborated more deeply in the next subchapter.

Stormwater groups of Helsinki and Riga give us an overview of the local-level tier of the vertical fragmentation of stormwater administration, at the same time also indicating on

the broad horizontal fragmentation and involvement of the number of actors in the stormwater administration in both case studies.

5.2. Who rules stormwater?

In order to further define vertical fragmentation of the stormwater related administration in Finland and Latvia, separate assessment of key stakeholders involved in it is needed. According to L. Lundqvist, defining the fragmentation of environmental administration is possible by outlining the structure of the administration as well as division of tasks between central and local authorities. In the following subchapter, I outline the structure of stormwater related administration by assessing its key stakeholders in both case studies against the following question: are decision-making powers concentrated in the centre of distributed regionally/locally? Furthermore, I assess the division of tasks between central and local authorities by analyzing where are binding decisions adopted and how financially independent are regional and local authorities?

Decision-making

The general assumption is that stormwater management is mostly managed on the local level. However, where is the decision-making concentrated? The first significant difference related to the vertical hierarchy of stormwater related administration is the presence of national water regulatory authorities in Latvia and the absence of it in Finland.

The Public Utilities Commission of Latvia (PUC) is an independent, multi-sector regulator established in 2001. Besides water management, its regulatory responsibilities also cover the following sectors: electronic communications, energy, postal services and waste disposal. The PUC started regulating the water supply and sewage since 2009, when these tasks have been transferred from the municipal level, after the assessment of the implementation of regulatory reforms introduced in 2000 showed that municipal regulators were relatively ineffective in guaranteeing the efficient functioning of public utilities, partly due to the lack of institutional and financial independence. Today, the Commission regulates all 67 water utilities in the state with the provider in Riga owning

59% of the market share and a total annual turnover around €85 million (OECD 2016, 49-68).

The PUC is by law independent from the State or local environment institutions. It independently performs the functions delegated to it by law, makes decisions and issues administrative acts binding upon specific providers and users of public utilities within the scope of its competence. Original legal status of the PUC, defined as derived public institution "under the supervision of the Ministry of Economy" – was amended in 2011 by the Parliament, making it an autonomous public institution. According to Section 7 of the Law on Regulators of Public Utilities, "the Regulator shall be institutionally and functionally independent, full-fledged, autonomous body governed by public law and unassisted in the implementation of its budget approved by law" (Parliament of the Republic of Latvia, 2000).

The main functions of PUC include developing methodologies for calculating tariffs, as well as approving and enforcing the tariffs. In the water management sector, tariffs cover the following areas: water production and supply, wastewater collection and treatment. The most important challenge for stormwater from a regulatory perspective, however, is still a lack of definition of who bears the responsibility as such for funding the stormwater management system. The plan of the Parliament of Latvia is to amend the Law on Water Management Services in order to define the liability and rights of municipalities who ensure the collection, treatment and conducting of wastewater and stormwater. The Law will enable municipalities to charge natural persons and legal persons for water management services, thus, introducing rainwater tariff in Latvia. A mentioned by Leal Filho (2017), this will allow municipalities to "increase the investment in public water management infrastructure and the users of rainwater sewage network will pay for using the service" (Leal Filho et al. 2017, 549-559).

While the Public Utilities Commission of Latvia is an actor of national level and plays a central role in regulating water management in Latvia, in Finland, on the other hand, there is no single regulatory body for water management and these responsibilities are instead dispersed at the regional and local level.

Helsinki Region Environmental Services Authority HSY is a municipal body, which provides waste management and water services in the Metropolitan area of Helsinki (including Espoo, Helsinki, Kauniainen and Vantaa). While the city administration is responsible for coordinating stormwater management as a whole, i.e. preparation and implementation of a stormwater programme for the city, stormwater management in public areas, street drainage as well as taking care of open canals and detention structures, the responsibility of HSY is construction and maintenance of the stormwater drain network (HSY, "Stormwater"). While the organisation is free to establish fees for services and operate according to own assessment, the organisation is a municipal federation, and the highest decision-making in it is made by member municipalities.

As for the Latvian counterpart of HSY – **SIA Rīgas Ūdens** – the situation slightly differs. As the national regulator Public Utilities Commission is in charge of the water management tariffs in the whole country, Rīgas Ūdens does not have a role in it. As stated on the website of the organisation, "Rīgas Ūdens" is a municipal government corporation, and "SIA" prefix in the official name of the organisation stands for the abbreviation in Latvian for "Limited Liability Company". According to the 2018 financial statement of the organisation (Rīgas Ūdens, "Unaudited Financial Statement"), operation of is regulated by the following binding legislation of the Riga City Council:

- No.4 "On the terms of the contract of public water management services, its closure, amendment and termination order";
- No.17 "Binding regulations of operation, use and protection of the Riga city centralised water supply and sewerage system";
- No.67 "On the co-financing of Riga City Municipality to connect real estate to the centralised for sewerage and water supply systems".

The article 15 of the law "On Local Governments" of Latvia states that local governments shall retain autonomy, among others, "to organise for residents the provision of utilities (water supply and sewerage; supply of heat; management of municipal waste; collection, conducting and purification of wastewater) irrespective of the ownership of the residential property" (The Parliament of the Republic of Latvia, 1994). This proves that in Riga, just like in the Helsinki case, stormwater management is concentrated at the local level.

In the case of Helsinki (like in other Finnish cities), stormwater plan is developed and implemented voluntarily and autonomously by the cities and municipalities; in case of Riga and Latvian cities – to this date the mechanism of stormwater plans hasn't been developed, as the sewer system is mostly still combined with wastewater and does not foresee separate stormwater sewers.

As for the environmental permits related to water and pollutant discharge, in Finland it is the responsibility of Regional State Administrative Agency, which provides permit services under the guidance of the Ministry of Environment of Finland, in Latvia – Regional Environmental Boards, part of State Environmental Service and subordinate of the Ministry of Environmental Protection and Regional Development of Latvia.

Finally, when talking about the national level authorities, in Finland the Ministry of Environment together with the Ministry of Agriculture and Forestry bear the policy-making and expert role in stormwater administration by, e.g. formulating strategies, drawing maps of significant flood risk, adapting the environmental legislation of the European Union and overseeing environmental politics in Finland in general. These actors normally do not have direct control over the local level stakeholders, therefore, we can talk about the high level of decentralisation regarding Finnish stormwater administration. The national level authorities in Latvia, however, also include national regulator Public Utilities Commission (PUC), which directly influences local level actors – water utilities, therefore, we can talk about the degree of concentration of power, even if the implementation of the policies is still performed on the local level.

Above-mentioned analysis allows outlining a comprehensive comparative structure of stormwater administration in the case studies of Finland and Latvia, taking into account three levels of governance (Figure 6). Analysis of the structure shows that in both cases stormwater administration is concentrated largely on the local level, however, in the case of Latvia – with a significant tendency of control from the top. This conclusion can be made based on the control of national regulatory authority on the matters like setting water-related fees and absence of the comprehensive autonomy of the cities to plan their own stormwater management and having to rely heavily on the national legislation, while in Finland these issues are taken care of at the local and regional levels.

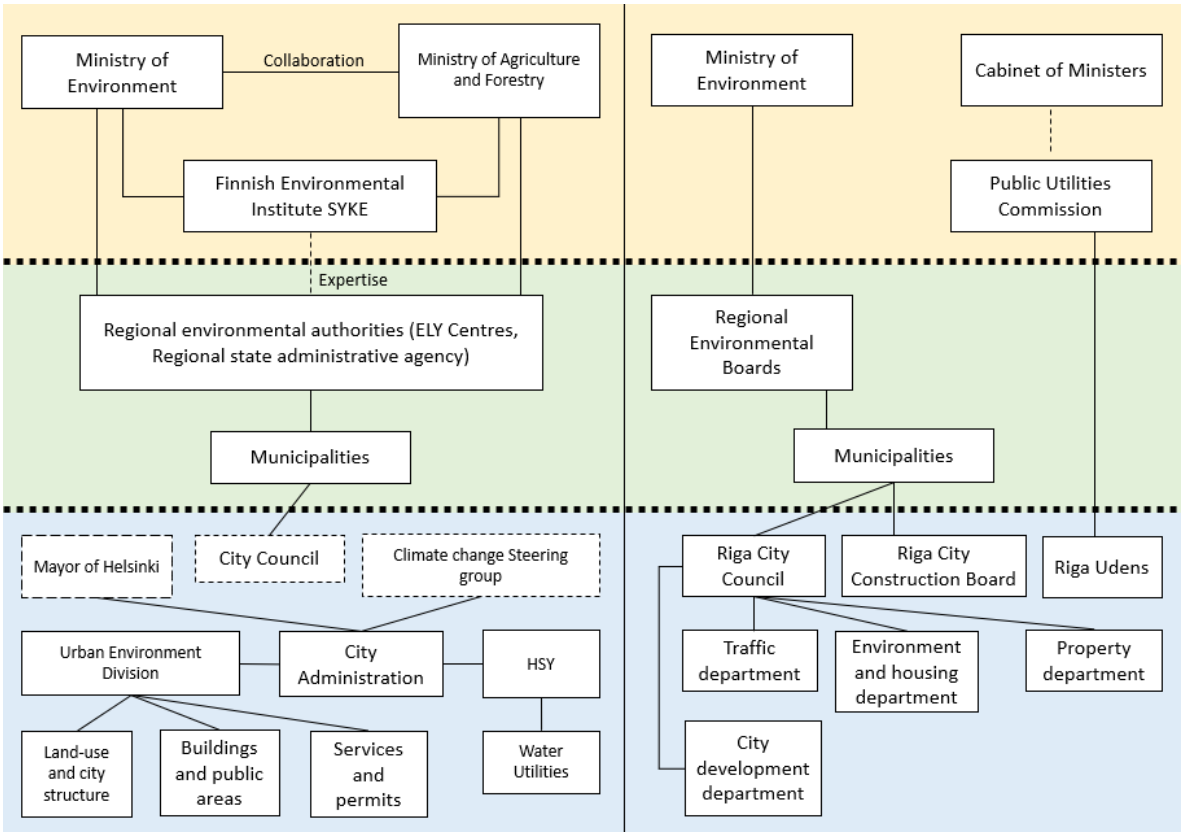

Figure 6. Administrative structure of stormwater management administration on national, regional and local level of governance in Finland (on the left) and Latvia (on the right) (author's compilation)

Financial independence

As was mentioned above, one important difference regarding the financial independence of water utilities in the case study of Helsinki and Riga is the presence in the latter of the national regulatory body.

An appropriate funding of the regulator is essential to determine the level of independence of operational environment and capacity to perform assigned duties of the regulator. In Latvia, the Public Utilities Commission operates on the fees collected from the local service providers (as the organisation covers not only the water sector, it is not only water utilities). The rate of the fees is set by the Cabinet of Ministers on the proposal of the Ministry of Economy and the Ministry of Finance and shall not exceed 0.2% of the net revenue of service provider as of previous financial year. However, the fact that a number of ministries in Latvia are shareholders of public utilities regulated by the PUC, raises concerns regarding the possible conflict of interests and potentially can create

mechanisms of influence on the regulatory body that by law is supposed to be independent (OECD 2016, 68).

The revenue of HSY of €368.5 million in 2017 consisted 68.6% of sales revenue from water services, 28.5% - revenue from waste management services, 1.8% - from other revenues and 1.1% - from municipalities. At the same time, operating costs on the same year were €173.5 million (HSY, "About HSY"). The founding capital of HSY, according to its Charter, is €505,000,000 and is divided between founding member municipalities as follows: Helsinki 58.0%, Espoo 22.3%, Vantaa 19.4% and Kauniainen – 0.3% (HSY 2009).

As can be seen, income for the operation of Helsinki Region Environmental Services Authority HSY is acquired through providing services and collecting service fees. According to the 2014 amendments to Water Services Act of Finland (681/2014), stormwater fee shall be collected by water utilities providing stormwater services, including runoff water sewerage and connection fees. The rates of such fees are to be established by the water utilities independently, considering appropriate cost allocation or implementation of the polluter pays principle and depending on the purpose of use of the property (Ministry of Agriculture and Forestry of Finland, 2001). Concerning stormwater services of the public areas, water utilities are to collect the fees directly from the municipalities. Stormwater rates in Helsinki municipality are therefore decided by HSY Board of Directors. The following findings allow drawing a conclusion of a high degree of independence of HSY in its operations.

The biggest water utility of Latvia, Rīgas Ūdens, just as the HSY, is the body of municipal ownership, and gets its revenue from the water fees and provided services. Net revenue from providing services and collecting fees in 2018 was €53.72 million and grew by 15.7% compared with 2017 (Rīgas Ūdens, "Unaudited Financial Statement"). The only difference is that the HSY is able to establish such fees on its own, while in Latvia this is approved at the national level, therefore, directly influencing the local level utility. The share capital of the company is €127.5 million, 100% of the capital belongs to City of Riga and is managed by the Deputy Chairman of Riga City Council, who, as the representative of the shareholder, makes the decisions within the competence of the

shareholder at the Board meetings (Rīgas Ūdens, 2015; Rīgas Ūdens, "Corporate Governance").

Results indicate the insufficient level of financial independence of key Latvian stakeholders, potential influence from the state as well as concentration of decision-making on the national level, while the implementation is left to the local level. As for the Finnish case, the high level of autonomy and independence of acquiring funding sources allows concluding on the general independence of the local level authorities in their water management operations.

VI. DISCUSSION

Fragmentation of governance appears in case there are too many agencies, or because there is lack of a political will or purpose to unify these agencies (Lægreid 2007, 32). In case of both Finnish and Latvian environmental administration, plethora of actors, stakeholders and agencies can be observed on each of the three levels of governance, which is natural due to decentralisation processes in both states. The practical aspects, as well as planning and implementation of stormwater management, according to the analysis, are naturally mostly concentrated on the local level, as the water management in general is assigned in both countries to local governments as their right for the autonomy. However, addressing such a complex issue as stormwater management on the local level only may be not quite efficient, for instance, in Latvia, since the water regulatory authority is situated on the national level; furthermore, in both countries implementation of the stormwater management on the local level indicate lack of knowledge transfer between local governments. Finally, excessive horizontal fragmentation of administration on every governance level may lead to slow decision-making, lack of responsibility and initiative, as well as weakened or even distorted communication.

Environmental issues, such as climate change and global warming, are regarded as general concern impacting multiple dimensions in society. In those circumstances, it is seen as a better solution either to have separate, professional, narrowly specialised units of administration approaching each dimension of the problem, or to have a separate unit established to address the problem in an integrated way.

According to L. Lundqvist, horizontal fragmentation may have far-reaching repercussions on the capacity of the political system to meet new environmental challenges (Lundqvist 1996, 18-19). Increased horizontal fragmentation of the policy is seen in the drive to integrate "environmental concerns" into all or most ministries at the central governmental level. In case of Finland, the current decentralised way of handling stormwater indicates on the vertical fragmentation in which the national level takes part in the legislation and policy development and creating advisory guidelines, while local government is autonomously responsible for implementation of the legislation and policy in their respective communities. In Latvia, the implementation is similarly happening by

the local level, however, not entirely autonomously. For instance, there is a central level regulatory authority that approves fees for water services, even despite the planning is happening at the local level. Furthermore, in Finland the intermediate regional level (ELY-Centres and regional state administrative authority) seems to be more functional regarding stormwater than regional level in Latvia (Regional environmental boards), (see Chapter 4). In certain cases, however, moving regulations towards more politicised local level could cause more compromising implementation which, in turn, could lead substantially weaken environmental policy. On the other hand, it is argued that enhanced stormwater management should be based on the site-specific conditions and demands, responding to specific climate conditions. Moving responsibilities to the regional level, in turn, could enhance the position of environmental issues in policy implementation but has the potential of creating conflicting situation with the industry.

The need for big picture

Processes of decentralisation across the Western world led to the establishment of numerous specialised units of environmental governance and contributed to development of functional specialisation across units. Many Western countries are dominated by strongly specialised ministries, partly as a result of the ministerial responsibility principle (Lægreid 2007, 13). However, this created challenges for intersectoral issues, such as stormwater management. Ministries and separate units tend to focus on their own narrow field of responsibilities and approach the issues from the perspective of their respective sectors. On the regional and local level, the situation might be different from the perspective of cross-sectoral involvement and exchange, but the lack of political initiative on the national level, as well as the lack of knowledge transfer between the regions, considerably slow down the planning and implementation process.

More engagement at the political level can create the momentum when stormwater becomes an important issue to be addressed, for instance, in order to receive political support from civil society. There is a need, especially in Latvia, to evaluate the strategic value of stormwater management, and to prove to politicians that not implementing proper stormwater management can cost more in losses than investing into its timely management. European Commission argues that EU economy could save €9.3 billion in

direct costs and health costs to the environment only from full implementation of the EU water related environmental legislation (EC 2019, 7). Similarly, only in Riga, the potential value of real estate value growth from improving stormwater management and applying green infrastructure solutions is estimated for ca. €200-500 million (Kotoviča, 2017).

At the same time, horizontal fragmentation of stormwater administration is most likely unavoidable, as long as there is no comprehensive integrated administration unit addressing the issue. The establishment of a specialised unit of advisory nature on the national or regional level that would oversee stormwater management across the whole country would enhance expertise accumulation and provide knowledge transfer evenly to the municipalities. Such unit would strategically assess and plan stormwater management taking into account the big picture – requirements, good practices from the regions as well as foreign ones. The establishment of a central stormwater planning unit could as well facilitate consultations of legislative bodies regarding enhancing the legislation in terms of stormwater and serve as communication point with the European Union regarding the issue.

It might be argued that the establishment of yet another unit can only contribute to further horizontal and vertical fragmentation of administration. However, as can be seen from Figure 7, there are multiple components behind stormwater management, that need to be addressed by different units and agencies on different levels, which needs to also happen "at a right time at a right place". According to the iWater project results, at the moment, facilitating proper stormwater management proves difficult in Latvia because of poor political interest, the limited availability of data and competent specialists and high potential costs or changing water collection infrastructure, and in Finland – due to lack of data, lack of awareness and attitude problems, unclear roles and responsibilities, lack of human and/or financial resources, as well as handling stormwater on a very detailed level (Kotoviča 2017; Rosqvist 2017). Hence, the establishment of the body of a scientific, planning and advisory nature on the national level under existing environmental units could, together with raised awareness on the political level, considerably improve addressing stormwater management in a more integrated, beneficial way for the environment.

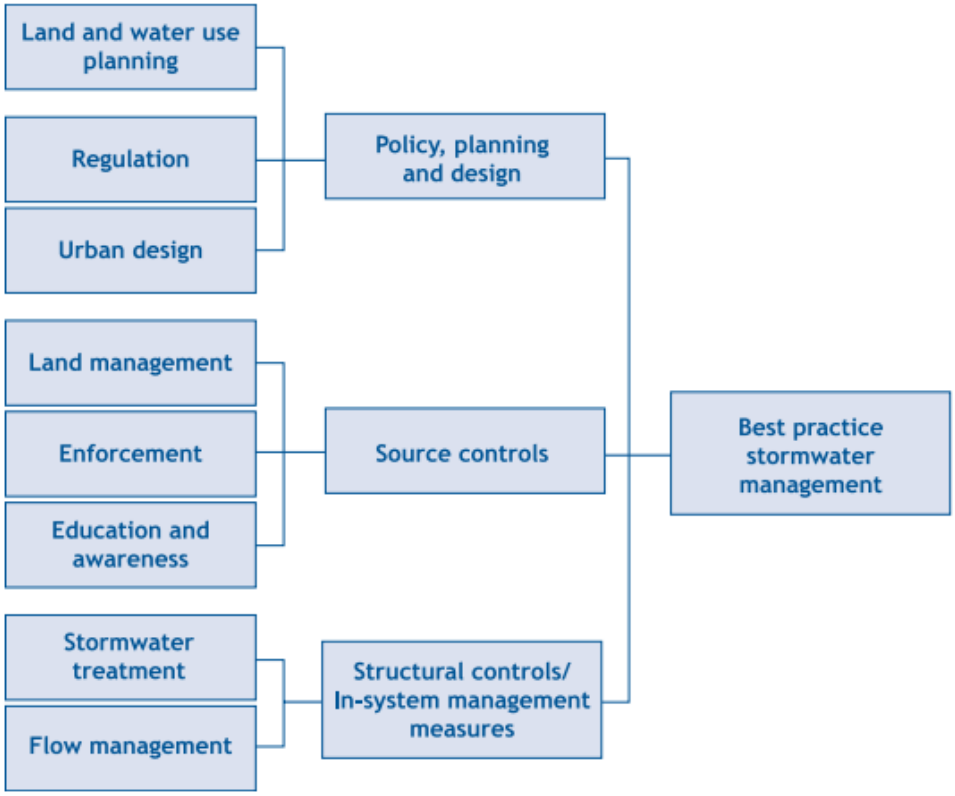

Figure 7. Stormwater management requires the integration of a range of measures[10]

Importance of civic participation

The role of humans as the constituting part of any institution or agency cannot be overestimated. Organisational institutionalism emphasizes the *subjective role* of institutions in making decisions. Institutions are constructed and are driven by the actions of their members, which can be used both to design and develop actions – and to make sense of the actions of other members or of outsiders. In case of stormwater management, it is a combination of units and agencies united by addressing the same issue in one way or another. It is important, therefore, that each sector and each party sees the value in involvement. From this point of view, a response to negative effects of fragmentation could be better training, capacity building, understanding among citizens and politicians why this is an important issue that needs to be tackled for the wellbeing and building smart resilient citizens in the future.

[10] Source: Department of Water Government of Western Australia. *Stormwater Management Manual for Western Australia.* Accessed 11 April 2019, https://www.water.wa.gov.au/__data/assets/pdf_file/0020/4772/44217.pdf

One of the core principles of decentralisation, the subsidiarity principle, holds that "decisions should be made by the populations affected or, on their behalf, by the authorities closest to them unless the origin of problems and/or their solution is out of control by the local communities" (Cistuli, 2002). Consequently, this means that, as a key party in a decentralised governance system, civil society shall have a say in formulating and planning of stormwater management in their communities. Civic participation is a very important instrument for urban planning. On the one hand, it helps to get different perceptions and points of view on the issues and makes an important impact on the subsequent decisions of the local government. On the other hand, civic participation seeks for legitimation, the approval of the residents. Beneficiaries of stormwater management in the cities and communities should be represented in the planning process just like authorities, political groups or other professionals. It is important as well to not use civil participation as mere instrument of approval, but make most of the citizen participation at the early stages of planning, which will also provide an appropriate level of influence for the communities in regard to developing their own residential surroundings.

As one of the core human rights, water issue needs to be addressed in cooperation with groups directly affected by it. However, the factors that could impact civic engagement are, among others, general environmental awareness in the country, economic and social welfare, level of bureaucracy, citizens' trust to the government in general as well as elementary satisfaction of citizens with their quality of life. That is, the life standards, tense political situation in the state or some more pressing issues could stand in the way of more active civic support and engagement. For instance, the UN global survey "My World" shows that citizens of poorer countries tend to place climate change lower on their priority list than richer countries, and that is naturally connected to citizens having more immediate concerns, like unemployment, healthcare, an honest government, or protection against crime and violence.[11] Even despite the fact that Finland and Latvia, in this concern, are situated in a similar position, both being members of the EU, OECD, the political system developing in the aftermath of the Soviet rule in Latvia compared with the welfare state of Finland, still needs to catch up in regard to some of the more

[11] Source: Why rich countries worry more about global warming than poor ones, Vox. Accessed 12 April 2019. https://www.vox.com/2014/9/23/6835285/why-rich-countries-worry-more-about-climate-change-than-poor-ones

fundamental issues in question. Improving those in Latvia would turn political interest towards reforming environmental policy as well as possibly boost awareness and dedication of civil society.

My analysis showed that stormwater management in Finland, at the moment, is at a more advanced level than in Latvia. The reasons behind this are separate status stormwater carrying in the Finnish water legislation, presence of comprehensive stormwater infrastructure and prohibition of stormwater discharge in wastewater sewers, stormwater fee foreseen in the water legislation, and the fact that, by the Finnish legislation every new construction plan need to include a dedicated plan for addressing stormwater. Nevertheless, the bottom problem stays: in both Finland and Latvia, assessment of the quality of stormwater, and hence, effective stormwater management is impaired by the lack of national stormwater quality criteria in case of Finland, and in case of Latvia – the lack of definition of stormwater as a separate category from wastewater, as well the as lack of definition of who bears responsibility for funding the stormwater management system (the City of Helsinki 2018, Leal Filho 2017).

CONCLUSIONS

This master's thesis investigated the structure of stormwater administration of two Baltic Sea region states: Finland and Latvia considering vertical and horizontal fragmentation of stormwater administration. The importance of the research is in promoting significance of integrating enhanced stormwater management in urban planning and development processes of environmental policy at all levels.

The analysis conducted in my research has revealed several important findings. First of all, qualitative content analysis has shown that the two countries define and, therefore, regulate stormwater differently according to the legislation. In Finland, the notion of stormwater is independent from wastewater and includes separate regulations, permits, and incorporation of a stormwater plan in the construction of new properties and obligatory connection to separate sewerage systems if those are available in the area. In Latvia, on the other hand, stormwater is still treated today as a category of wastewater, and the respective regulations apply. The City of Helsinki specifically emphasizes human factor when defining stormwater, which differentiates it from other runoff (for instance, runoff from unbuilt areas is not stormwater but natural runoff).[12]

Clear legislative definition of the stormwater and stormwater management is important for few reasons. Firstly, it helps to consolidate expertise, resources and sectors of administration under one umbrella, which will make its planning and implementation much more effective. Secondly, it pushes for further policy development in the field. Finally, it raises awareness and active participation in the society, which is crucial for successful implementation of stormwater management (Leal Filho, 2017).

The analysis of stormwater administration in case studies of Finland and Latvia regarding the subject of horizontal and vertical fragmentation, has revealed a diversity of actors, stakeholders and agencies on each level of governance (national, regional and local), which corresponds to the current state of decentralisation in the mentioned cases. It was confirmed that planning and implementation of stormwater in both cases are mostly concentrated on the local governance level, citing the right for autonomy of municipalities to conduct, among others, water services. Another important challenge in Latvia, as in

[12] https://www.hel.fi/static/liitteet/kaupunkiymparisto/julkaisut/julkaisut/julkaisu-03-18-en.pdf

other countries of the post-Soviet bloc, lies in limited financial possibilities of the local governments, while holding major responsibilities of implementation of stormwater management. That is, while the powers have been "decentralised" and delegated to the lower levels of governance, regional and local governments are still left dependent on the central budget, which significantly reduces and restricts their capacity to act (OECD, 1999). Therefore, addressing such a complex issue as stormwater management on the local level only proves to be not entirely efficient, as, for instance, in Latvia, where the water regulatory authority is situated on the national level.

Limiting the implementation of the stormwater management to only local level can cause lack of knowledge transfer between local government, while excessive horizontal fragmentation of administration on every governance level may lead to slow decision-making, lack of responsibility and initiative as well as weakened or even distorted communication. Thus, integration strategies for stormwater management are necessary not only at one, but at all governance levels (political, regional and local). Based on the results of my analysis, I agree with Barbosa (2012) that all actors and stakeholders involved "need information and a clear understanding of the possibilities that are at stake as well as the main consequences of each decision".

Stormwater is a highly cross-sectoral and multidimensional issue that requires participation of various actors and society in order to successfully manage it. Even though highly fragmented, it is important to organize functional cooperation of those actors. Response to fragmentation is policy integration, better training, capacity building, as well as awareness raising and acceptance among citizens and politicians as to why this is an important issue that needs to be tackled for the wellbeing and building smart resilient citizens in the future.

The most important challenge regarding stormwater management from a regulatory perspective is the absence of a definition of who bears the responsibility for funding the rainwater management system in Latvia, and the lack of national stormwater quality criteria that would allow to further improve stormwater management, in Finland.

Given the outcomes of the conducted analysis, the following recommendations could be considered for improving the current state of stormwater administration and management.

First of all, there is a need for a bigger picture – as of now, when it comes to water management in the European Union, the final choice in tools and mechanisms of how to manage stormwater is left for the member states to decide. Inside member states, water is managed mostly on the local level, however, for the complex multi-sectoral issues like stormwater, such micro-level management is not enough. Comprehensive, functional policy in cooperation with all-level governments and civil society needs to be developed on the national, or even European Union level, in order to bring all existing expertise and experience and to then delegate local level governments with clear, transparent responsibilities, also supported by citizens. Furthermore, irrespective of the level of administration, the importance of incorporating stormwater management at the earliest possible stage of urban planning cannot be overestimated.

Finally, the problem of lack of political initiative on the national level needs to be addressed in such a way as to demonstrate the positive side of stormwater as a resource, rather than hazard. It has been proven already and mentioned in this thesis that the cost of implementation of climate adaptation and mitigation measures is much lower than the costs of facing the consequences of climate change. Wellbeing and health of citizens does not have a price, therefore, it is important for governments to act accordingly. As of now, climate adaptation measures like stormwater management might be unattractive to politicians, as they are costly and, therefore, unfeasible and unpopular in terms of promotion to the electorate. Furthermore, the likelihood of citizens of less developed countries to be less interested in climate adaptation measures is naturally connected to having more immediate concerns, such as freedom of speech healthcare or unemployment.[13] Nevertheless, awareness raising, cooperation and involving with civil society in the policy development is crucial in successful policy implementation, and subsequently, enhances trust to the government in question.

[13] Source: Why rich countries worry more about global warming than poor ones, Vox. Accessed 12 April 2019. https://www.vox.com/2014/9/23/6835285/why-rich-countries-worry-more-about-climate-change-than-poor-ones

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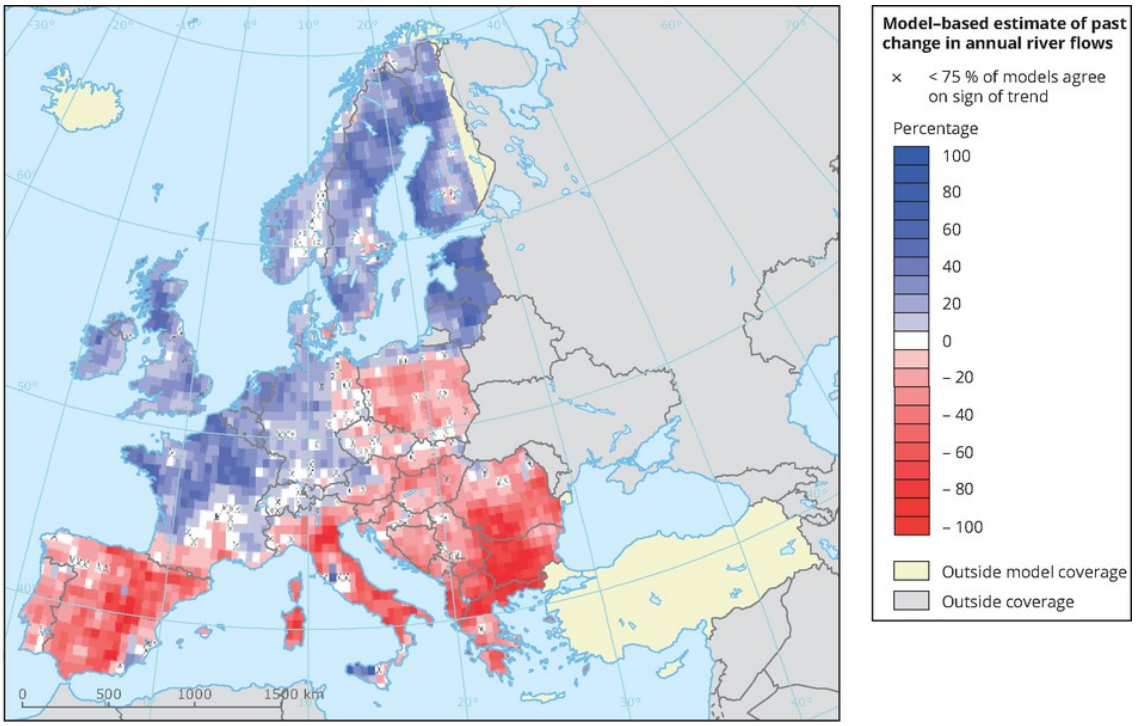
ANNEXES

Annex 1 (Source: European Environmental Agency, accessed 19 April 2019: https://www.eea.europa.eu/data-and-maps/indicators/river-flow-3/assessment)

Model-based estimate of past change in annual river flows



Annex 2 (author's compilation)

Summary table of the Finnish stormwater related legislation

Legislative Act/Document	Reference to stormwater	Responsible parties
Finland's National Strategy for Adaptation to Climate Change	Requires mapping of stormwater flood hazard risk areas and including them into flood risk management plans.	Ministry of Agriculture and Forestry in cooperation with multiple ministries and actors on the national, regional and local level
Flood Risk Management Act 620/2010	Includes mapping of stormwater and meltwater hazard areas into flood risk management maps	Municipalities
Water Services Act 119/2001	Regulates stormwater sewerage in Finland, prohibits combined sewer systems	Municipalities and water utilities
Land Use and Building Act 682/2014	- Introduces stormwater plans for municipalities (non-binding); - Assigns responsibility of stormwater management in land use and building to property owners; - local authority are responsible for organization of adequate stormwater management solutions - Sets municipal charges for stormwater management	Municipalities and local level administration, property owners
Water Act 587/2011	Regulates distribution of permits regarding water resource management, including stormwater as far as this is the task of the water utility	The regional state administrative agency

Annex 3 (author's compilation)

Summary table of the Latvian stormwater related legislation

Legislative Act/Document	**Reference to stormwater**	**Responsible parties**
Cabinet Regulation No. 34 from 22.01.2002 Regarding Discharge of Polluting Substances into Water	Classifies stormwater as a category of wastewater Sets limits and extra fees for discharge of dangerous or priority substances Regulates issuing permits A and B for pollutants discharge into water	Ministry of Environment (assessing information) Regional environmental boards
Law on Water Management	Regulates water resources use permits Stipulates development of river basin management plans	Cabinet of Ministers
Cabinet of Ministers 22.03.2016 regulation No. 174 Regulations on public water services and use	Defines terms and conditions of connecting property to central water supply and wastewater discharge systems, maximum permissible concentration of polluting substances in wastewater, additional fees for treatment of polluting substances	Property owner, local government Public Utilities Commission
Law on Water Management Services	- Water management services include centralised and decentralised sewerage services - Water supply, sewerage as well as conducting and purification of wastewater is the autonomous function of the local governments - Public Utilities Commission is the regulator of water management services in Latvia and keeps the register of public water management services providers	The Cabinet of Ministers Public Utilities Commission Local Government Public water management services providers (merchants)
The Law on Local Governments	Stipulates the role of local governments regarding water supply, sewerage and purification of wastewater as the autonomous function of the local governments, irrespective of the ownership of residential property.	Local government