

**Athens Institute for Education and Research**

**ATINER**



**ATINER's Conference Paper Series**

**ENV2013-0396**

**The Management of Vilnius'  
Rainwater Runoff System:  
Achievements, Problems,  
Prospects**

**Algimantas Vilūnas**

**Director of Vilnius' Municipal Private Limited Company "Grinda"  
Lithuania**

**Rimantas Kupliauskas**

**Head of Vilnius' Rainwater Runoff System Exploit Department of  
Municipal Private Limited Company "Grinda"  
Lithuania**

**Sigita Svedienė**

**Head of the Environmental Treatment Laboratory of Vilnius' Municipal  
Private Limited Company "Grinda"  
Lithuania**

Athens Institute for Education and Research  
8 Valaoritou Street, Kolonaki, 10671 Athens, Greece  
Tel: + 30 210 3634210 Fax: + 30 210 3634209  
Email: [info@atiner.gr](mailto:info@atiner.gr) URL: [www.atiner.gr](http://www.atiner.gr)  
URL Conference Papers Series: [www.atiner.gr/papers.htm](http://www.atiner.gr/papers.htm)

Printed in Athens, Greece by the Athens Institute for Education and Research.  
All rights reserved. Reproduction is allowed for non-commercial purposes if the  
source is fully acknowledged.

**ISSN 2241-2891**

12/06/2013

## An Introduction to ATINER's Conference Paper Series

ATINER started to publish this conference papers series in 2012. It includes only the papers submitted for publication after they were presented at one of the conferences organized by our Institute every year. The papers published in the series have not been refereed and are published as they were submitted by the author. The series serves two purposes. First, we want to disseminate the information as fast as possible. Second, by doing so, the authors can receive comments useful to revise their papers before they are considered for publication in one of ATINER's books, following our standard procedures of a blind review.

Dr. Gregory T. Papanikos  
President  
Athens Institute for Education and Research

This paper should be cited as follows:

**Vilūnas, A., Kupliauskas, R. and Svedienė, S. (2013) "The Management of Vilnius' Rainwater Runoff System: Achievements, Problems, Prospects" Athens: ATINER'S Conference Paper Series, No: ENV2013-0396.**

## **The Management of Vilnius' Rainwater Runoff System: Achievements, Problems, Prospects**

**Algimantas Vilūnas**

Director of Vilnius' Municipal Private Limited Company "Grinda"

Lithuania

**Rimantas Kupliauskas**

Head of Vilnius' Rainwater Runoff System Exploit Department of Municipal Private Limited Company "Grinda"

Lithuania

**Sigita Svedienė**

Head of the Environmental Treatment Laboratory of Vilnius' Municipal Private Limited Company "Grinda"

Lithuania

### **Abstract**

As a significant part of the city, the pollution control and resource recovery of urban street rainwater are becoming more and more important. EU Water Framework Directive 2000/60/EC emphasizes the need to solve fundamental problems that occur when urbanized rainwater run-off is injected into the surface waters bodies. One of the principal objectives of the Directive is to reach 'a good status' of all the Community waters and to ensure its maintenance until 2015. HELCOM Recommendation 23/5 (2002) calls for preventing or at least minimizing rainwater runoff pollution by harmful substances in order to assist the Baltic Sea – one of the most vulnerable seas – ecological state rehabilitation.

All major Lithuanian cities already have domestic wastewater treatment facilities. Currently, in the capital of Lithuania the largest pollution into the surface waters comes through rainoffs. Many authors studied the influence of stormwater pollution on the ecological state of surface waters. This article analyzes Vilnius City's rainwater runoff management problems that arise in conditions of sustainable city development when some attempts to combine social, economic and environmental interests into a single whole, as more fully meet the needs of the urban population. The authors of the article are managers of municipal company that operates the rainoff of the largest Lithuanian city. They present the existing system of urban stormwater collection and treatment comprehensively, evaluate its positive sides, name weaknesses and look for opportunities to solve problems that arise due to insufficient legal framework, lack of normative documents and uneven growth of residential areas of the capital of Lithuania.

**Keywords:** sustainable development, rainwater runoff system (rwrs), urban pollution.

**Corresponding Author:**

## **Introduction**

Rapid growth of economy and population well-being adjustment with healthy environment preservation is a complicated task. In most cases the public tends to concentrate on solving economic problems and it is usually done at the expense of environmental quality. At the current stage of development of Lithuania it is very important to implement effective environmental protection in time, because the solution of those problems is more expensive than prevention.

From the the city's urbanized areas rainwater runoff washes away all kinds of pollution that enters the surface waters bodies through rainwater sewer system. Pollutants that come with rainwater runoff are the main reason that worsen the conditions of waters' life existence (Makepeace, 1995; Novotny, 1995; Davis, 2001; Eriksson, 2005). The physical, chemical and biological effects caused by rainwater runoff that comes to the clean ecosystems were analyzed by many authors (Marsalek, 1999; Herrmann, 2000; Robson, 2006; Nolde, 2007; Zhang, 2010; Xue, 2012). In the EU Water Framework Directive 2000/60/EC which was adopted in Europe, the need to solve substantial problems is emphasized. These problems occur when urban rainwater runoff is injected to the surface waters bodies. One of the principle objectives of the Directive is to reach 'a good status' of all the Community waters and to ensure its maintenance until 2015. HELCOM Recommendation 23/5 (2002) calls for preventing or at least minimize rainwater runoff pollution by harmful substances in order to assist the Baltic Sea – one of the most vulnerable seas – ecological state rehabilitation.

Ambition of better life quality now and in the future – that is the strategic plan for sustainable development vision for the second decade of the 21<sup>st</sup> century.

## **The Development of Vilnius' Municipal Rainwater Runoff System**

Economic objectives, the social development and environmental protection are being adjusted with each other and also complement each other – this is the understanding of sustainable development (fig. 1). Particularly important is the ratio of city and natural environment. Enterprises that operate rainwater runoff in major cities currently are facing considerable challenge – to implement sustainable development program for urban growth.

On behalf of Vilnius municipality Private Limited Company 'Grinda' operates rainwater runoff in the capital of Lithuania. The company was founded in 1932 as the Vilnius city road maintenance company and in 1955 was reorganized into Private Limited Company 'Grinda'. Vilnius City Municipality owns 100% of the shares. The company's authorized capital is 2 mln. EUR, the turnover of 2012 is 8 mln. EUR. The main areas of activity: building streets and roads, repairing pavements, streets' maintenance, the

localization of emergency situations on the streets and also operating Vilnius City rainwater runoff.

Vilnius is located on the confluence of the rivers Neris and Vilnia. Historically it did happen that the city expands horizontally. Urban development like this complicates the installation of communications – makes it more expensive. Currently, the total length of storm water network in Vilnius city is 1500 km. There are 720 km of main networks. The development of Lithuanian capital rainwater runoff system in the last decade is shown in figures 2-3.

### **The Problems of Vilnius' Municipal Rainwater Runoff System**

Unfortunately, today Vilnius' municipal rainwater runoff no longer meets the increased needs of the city (fig. 4). In many areas of the city existing runoff networks are overloaded. The pipeline which has too small diameter does not manage to receive high rainfall yield. When we have a heavy rainfall the streets and basements of buildings get flooded, traffic stops and that causes big financial and material losses.

Hydraulic throughput calculations are very important for incorporating newly developed areas into the city's storm water system, but they are not carried out systematically.

Big part of the capital's storm water pipeline was built in the beginning of 20<sup>th</sup> century. So now about 17% of Vilnius municipal rainwater runoff system is in emergency condition (fig. 5), that about 200 km of pipeline, rainwater collection wells and collectors. This situation constantly makes endangers that may occur subsidences in traffic areas, business areas and residential backyards.

Rainwater runoff enters the city's river through 94 rainoffs. Unfortunately, only 10% of stormwater runoff is treated in four municipal treatment facilities. Present four treatment devices are overloaded and they do not clean stormwater to the required standards. Currently, including companies' treatment equipment, there is only 8-10% of stormwater cleaned. The remainders of untreated water are discharged into open urban water banks. Stormwater management infrastructure is very poorly developed, that is why a large part of it enters the banks untreated and negatively affects the condition of water banks.

Presently the Vilnius City's special stormwater management plan is still under development. Proper stormwater management planning, development of the infrastructure and problems' systemic solution are impossible without this plan.

Part of the stormwater networks are not inventoried and legally registered. Part of it belongs to Vilnius' Municipality and the other one is left on her own. There are no procedures, how the network will be transfer to operating company. Also funding for renovation and reconstruction is not unforeseen. Even current needs of the network are not funded enough.

### Some Possible Solutions of the Problems

Quite difficult economic situation in Europe and in the country also rebounds on Vilnius municipal budget. Despite the economic difficulties life in the capital continues, therefore it is necessary to ensure public safety and comfort. It is noticed more and more rainfall in recent years in Lithuania, also more frequent spring-summer-autumn downpours. In order to ensure continuity of public transport traffic in the city, municipal company 'Grinda' has taken preventive measures. To achieve this goal, specialists of the company identified 50 rainfall accumulation sites in Vilnius, which appear because of the overload of stormwater pipeline. They were classified into three groups according to the hazard level. 14 urban areas were attributed to the highest risk group, 22 areas of Vilnius - to medium-risk group and 12 areas to prevention group. The current state of Vilnius city individual districts' rainwater runoff is presented in table 1 and figure 6.

**Table 1. The state of Vilnius districts rainwater runoff system**

<b>1</b>	Vilnius district	1	2	3	4	5	6	7	8
<b>2</b>	The year of rwrws exploitation start	2006	2005	1978	2004	1985	1985	2007	1967
<b>3</b>	Length, km		14,8	45,1	20,8	118,3	43,1	1,4	106,8
<b>4</b>	Quality*	9	9	6	9	7	6	9	4

<b>1</b>	9	10	11	12	13	14	15	16	17	18	19
<b>2</b>	1965	2007	1982	1975	1980	2000	2007	2007	1960	2007	1989
<b>3</b>	27		61,8	25,9	75,3	8,2	10,7	20,9	50	9,2	31
<b>4</b>	5	9	6	5	6	8	9	8	3	9	7

<b>1</b>	20	21	22	23	24	25	26	27	28	29	30
<b>2</b>	2004	2008	2008	1975	1975	1967	1980	2005	1970	1974	1970
<b>3</b>	7,1	3,4	6,4	51,1	60,3	47	26,5	1,5	13	7,6	23,3
<b>4</b>	9	9	9	6	5	3	4	9	4	5	3

<b>1</b>	31	32	33	34	35	36	37	38	39	40	41
<b>2</b>	1958	1958	2007	1938	1930	1982	1980	1960	2008	1969	2007
<b>3</b>	12	11,3	5,1	7,7	32,6	12,5	8,5	83,8	14		
<b>4</b>	2	2	9	3	3	5	5	2	9	4	9

<b>1</b>	42	43	44	45	46
<b>2</b>	2008	2008	2007	2005	2004
<b>3</b>					5,1
<b>4</b>	9	9	8	8	9

\* Points in 10 points system



The special plan of city's stormwater management is already being prepared in the City Development Department of Vilnius municipality. This plan provides for the financing of rainwater runoff development, reconstruction and renovation until 2020. The plan, for the first time, includes the hydraulic calculations of stormwater network, which so far have not been properly archived in Lithuania. The plan also provides for the installation of an integrated runoff treatment system in the city.

We hope that a new term of the Lithuanian Parliament will approve the new law of drinking water supply and runoff management. The legal documents that accompany this law provides for a new stormwater management regulation, planning, organization, financing, pricing, individuals' rights and duties and runoff users' settlement policy.

Upon the support receipt from European structural funds we hope to install an automated monitoring and accounting system of the Vilnius City's stormwater, which enables not only a reliable stormwater pollution control, but also its prevention.

## **Conclusions**

Vilnius municipality with its subordinate municipal enterprises in difficult economic conditions are trying to realize the principals of sustainable development plan of the capital of Lithuania. It is not an easy task to harmonize historically valuable city old town's life which chaotically increased in pre-crisis period and now is stricken by big demographic problems. Severe difficulties arise in stormwater management in the city. At this obligation the municipal company 'Grinda', its further practical actions in stormwater management relates with the change of drinking water supply and run-off management law, also other post-legislative standard acts.

The creation of a new legal framework requires the preparation of Vilnius City stormwater management action plan and schedule.

It is important to continue to operate in the municipal level while waiting for the actions of a new term of Lithuanian Parliament. The capital of Lithuania Vilnius is the largest city in the country, therefore rainwater runoff system in Vilnius is the largest. So the capital's rainwater runoff operating company must lead in preparation and approval of the rules of stormwater management in the Vilnius City Council meeting,

In parallel it is necessary to prepare applications to the European Union structural funds for support. It would make it possible to install fully automated the Vilnius City's stormwater monitoring and accounting system.

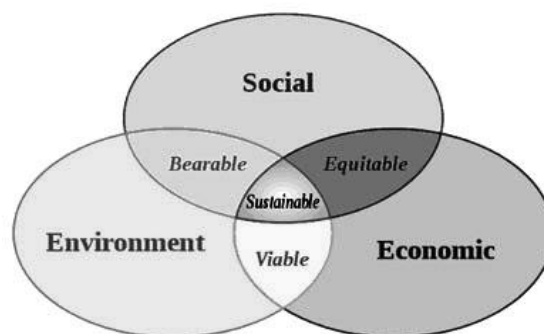
## **References**

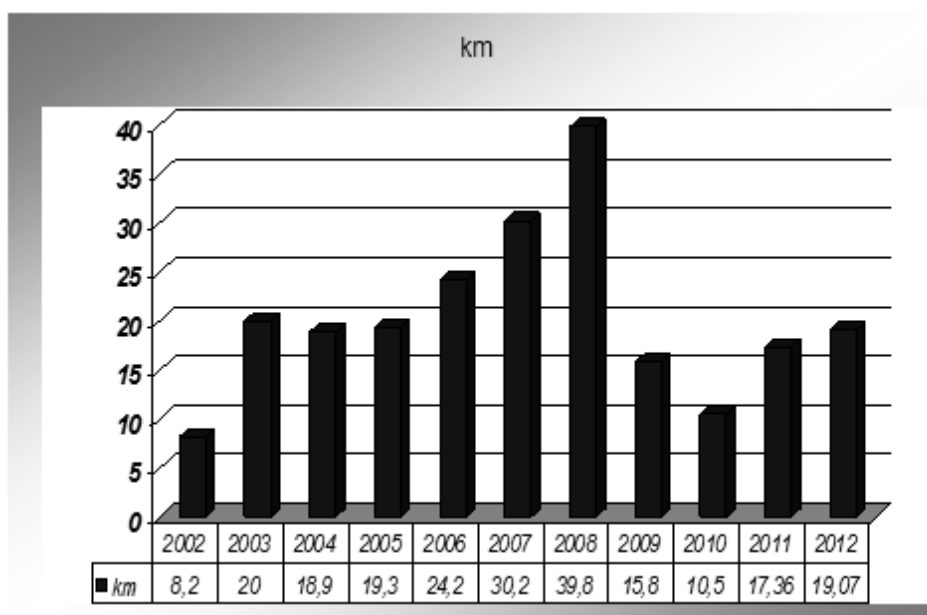
Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water

policy. <http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0060:EN:HTML>

- HELCOM Recommendation 23/5 (2002) Reduction of Discharges from Urban areas by the Proper management of Storm water Systems.
- Makepeace, D.-K., Smith, D.-W., Stanley, S.-J. (1995). 'Urban stormwater quality:summary of contaminant data.' *Critical Reviews in Environmental Science and Technology* 25: 93-139.
- Novotny, V., Barnwell, T., Donigian, A., Huber, W., Olem, H., Roesner, L., Salomons, W., Shanahan, P., Somlyody, L., Stol, B. (1995). *Nonpoint pollution and urban stormwater management*. Lancaster: Technomic Publishing.
- Davis, A.-P., Shokouhian, M., Ni, S.-B. (2001). 'Loading estimates of lead, copper, cadmium and zinc in urban runoff from specific sources.' *Chemosphere* 44(5): 997-1009.
- Ericsson, E., Baun, A., Mikkelsen, P.-S., Ledin, A. (2005). 'Chemical hazard identification and assessment tool for evaluation of stormwaterpriority pollutants.' *Water Science and Technology* 51: 47-55.
- Marsalek, J., Rochfort, Q., Mayer, T., Servos, M., Dutka, B., Brownlee, B. (1999). 'Toxicity testing for controlling urban wet-weather pollution: advantages and limitations'. *Urban Water* 1: 91-103.
- Herrmann, T., Schmida, U. (2000). 'Rainwater utilization in Germany: efficiency, dimensioning, hydraulic and environmental aspects'. *Urban Water* 1(4): 307-316.
- Robson, M., Spence, K., Beech, L. (2006). 'Stream quality in a small urbanised catchment'. *Science of the Total Environment* 357: 194-207.
- Nolde, E. (2007). 'Possibilities of rainwater utilisation in densely populated areas including precipitation runoffs from traffic surfaces'. *Desalination* 215(1-3): 1-11.
- Zhang, M., Chen, H., Wang, J., Pan, G. (2010). 'Rainwater utilization and storm pollution control based on urban runoff characterization'. *Journal of Environmental Sciences* 22(1): 40-46.
- Xue, B., Kang, X. (2012). 'Study on the pollution control and resource recovery of urban street rainwater'. *Energy Procedia* 16(A): 2-7.

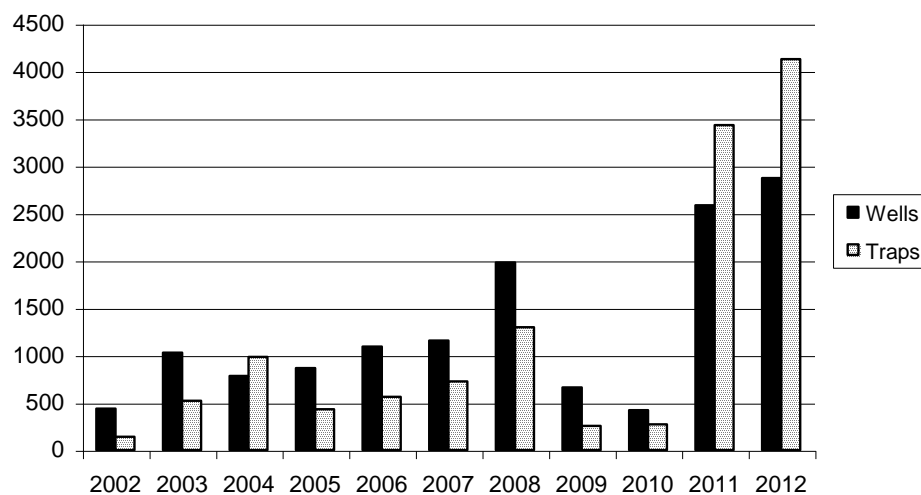
**Figure 1. Sustainable development**





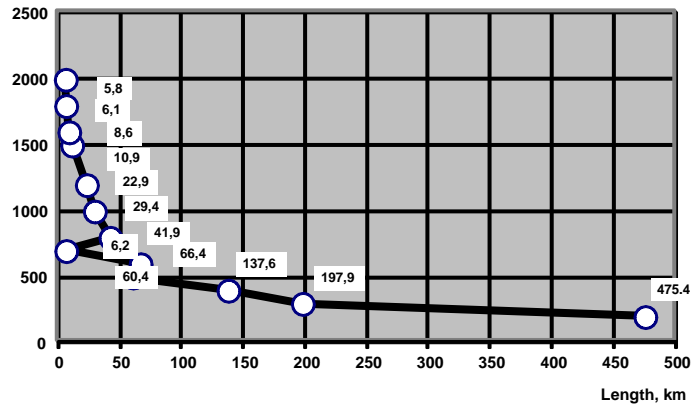
**Figure 2. The development of Vilnius' rainwater runoff system in 2002-2012**

**Figure 3. The dynamics of the exploitation of rainwater runoff wells and traps in Vilnius**



Diameter, mm

**Figure 4. The main characteristics of Vilnius' rainwater runoff system: diameter (mm), length (km)**



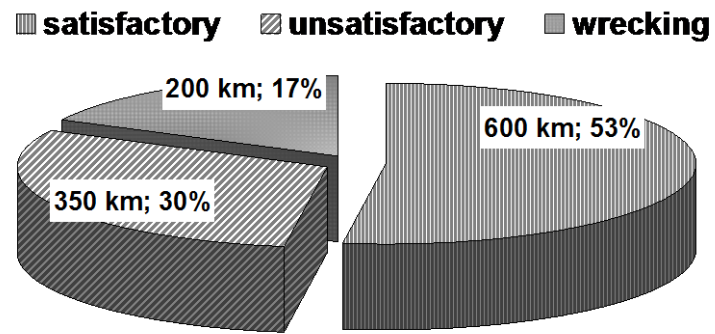
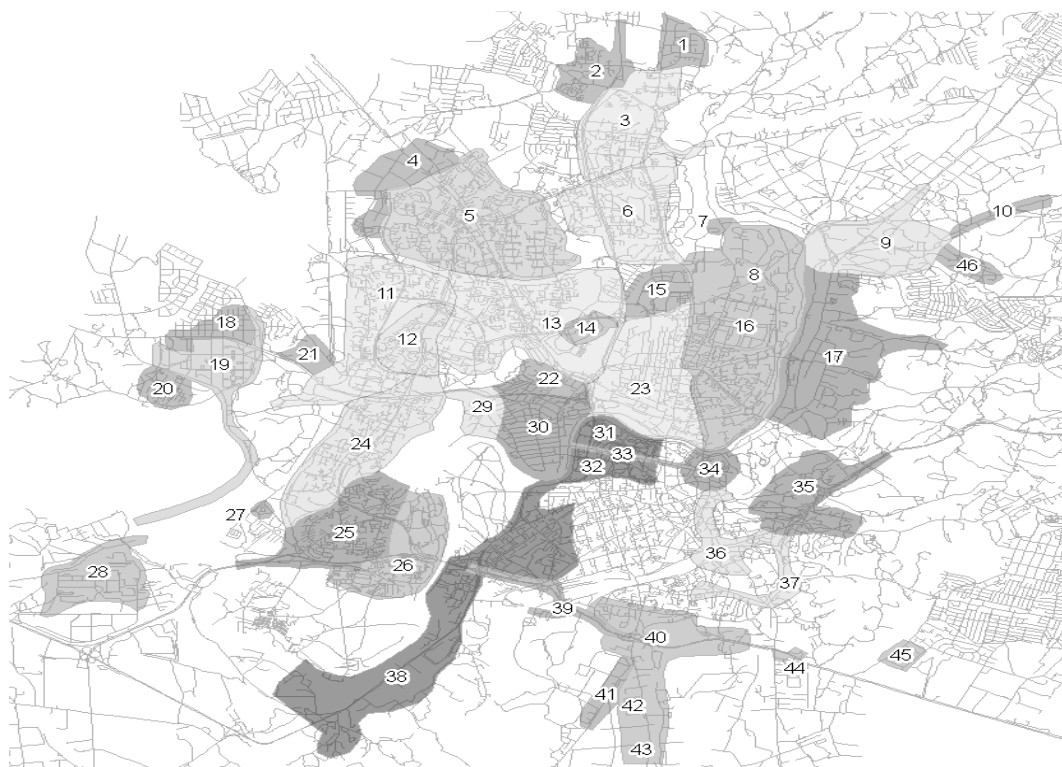


Figure 5. The quality of Vilnius' municipal rainwater runoff system



**Figure 6. The quality situation of municipal rainwater runoff system in Vilnius districts**