Water Governance Assessment of the Green Roof Policy in Rotterdam

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Summary

Using the Water Governance Assessment method the green roof policy in Rotterdam is assessed, which is the most ambitious green roof policy of the Netherlands. From this, it has been concluded that, in general, the green roof policy is a legitimate policy. The knowledge about the water system and stakeholders is sufficient, and they have been involved in a participative and integrated way. Several tools are used, such as, a subsidy system, tax benefits, information provision and leading by example. The project's goal is to achieve 800,000 m^2 of green roofs by 2030. It is currently hard to assess whether they are on target or not due to the short existence. If the target turns out to be too high, there are several approaches Rotterdam can try to improve the effectiveness. Obliging green roofs on new buildings, introducing a different sewage tax which is dependent on the yearly precipitation discharge and providing housing corporations with the means to charge tenants for the construction of green roofs. Whether or not the goal is achieved, it is important that the actual macro-scale effects are properly monitored to see whether the green roofs function as intended.

Table of contents

Introduction

Water is a resource of paramount importance for life. It is of great societal, economical, and environmental value. However, water can also be responsible for loss of life and economic damages. Due to climate change, especially these adverse effects will become more common, and proper adaptation measures are indispensable. Because of this proper integrated water management is vital. A good way to start managing a resource is setting clear legal rules and making policies that deal with the resource. This has been done EU-wide with the introduction of the Water Framework Directive (WFD)[1], which forms the basis of water management in EU member states (van Rijswick & Havekes, 2012). Based on this framework, policies are being implemented to achieve the targets set in the WFD. A good policy design is key to achieving specific goals. However, such a policy design can be far from perfect. If it is based on unfair or wrong assumptions it might lead to not achieving all of the set goals.

In this paper, the policy on green roofs in Rotterdam is scrutinized by using the water governance assessment method tool (Brouwer et al., 2012; Municipality of Rotterdam et al., 2013). Green roofs are natural climate buffers that can store water, which helps the city deal with excess peak precipitation and, thereby, reducing water nuisance events (Rotterdam Climate Initiative, 2010; Municipality of Rotterdam et al., 2013). The municipality of Rotterdam has set targets for 2030 for the green roof policy, namely; a minimum of 800,000 m^2 green roofs in Rotterdam, and green roofs on at least 50 per cent of municipal buildings. Green roofs form a part of an integrative project for Rotterdam in which the goals are to be 100% Climate Proof before 2030 and have 50% less CO_2 combustion compared to the 1995 levels (Goedbloed, 2010).

The urban water challenges in Rotterdam relevant to green roofs are twofold: first, increasing pressures on the urban drainage system due to climate change. Presently, Rotterdam already has a 600,000 m^3 water storage deficit (Municipality of Rotterdam et al., 2013); second, the significant amount of impervious areas and high land prices hinder or fully prevent the creation of green areas (Ferguson, 1998; Mentens et al., 2005; Municipality of Rotterdam et al., 2013).

Using the water governance assessment method (Brouwer et al., 2012), the shortcomings and problems of this policy will be identified, and where necessary improvements for the policy will be shown. Hereby, the focus is on the legitimacy and effectiveness of the policy. In this paper legitimacy is defined as: “lawfulness by virtue of being authorized or in accordance with the law” (Princeton, sine anno). So legitimate policy is clear, credible and supported. This means that the authorized party making the policies is democratically elected and seen as the appropriate competent authority. It involves stakeholders and society requiring their support, always in accordance with the law. (definition constructed using Mees et al., 2013; and personal discussion). Effectiveness is defined as the degree to which the policy targets will be achieved. The main question is:

To what extend does the policy design on green roofs need improvements, and what are these improvements?

[1] Directive 2000/60/EC

Assessment method

The water governance assessment method is an interdisciplinary method to rate policy designs. As is shown in figure 1, it deals with several building blocks of water management and governance. This assessment method is very comprehensive, and can be applied in any water governance and policy topic.

In the following sections, first the necessary information about green roofs is given to enable the reader to understand the functioning of green roofs. Following this, all building blocks will be assessed by answering questions that are posed in several quickscans/questionnaires (Kok, 2012; Hellegers & Ansink, sine anno; van Rijswick et al., sine anno; Kuks et al., 2012; Edelenbos, sine anno). Only the relevant questions have been allocated to the specific building block that they relate to. The paper follows the setup of the assessment method, meaning that each building block will be discussed in a separate subchapter. The assessment of each building block will start with its assessment criterion posed by Brouwer et al. (2012). This will be followed by an analysis, and concluded with a statement whether the assessment criterion has been met. The chapter lay-out is clarified in figure 1:

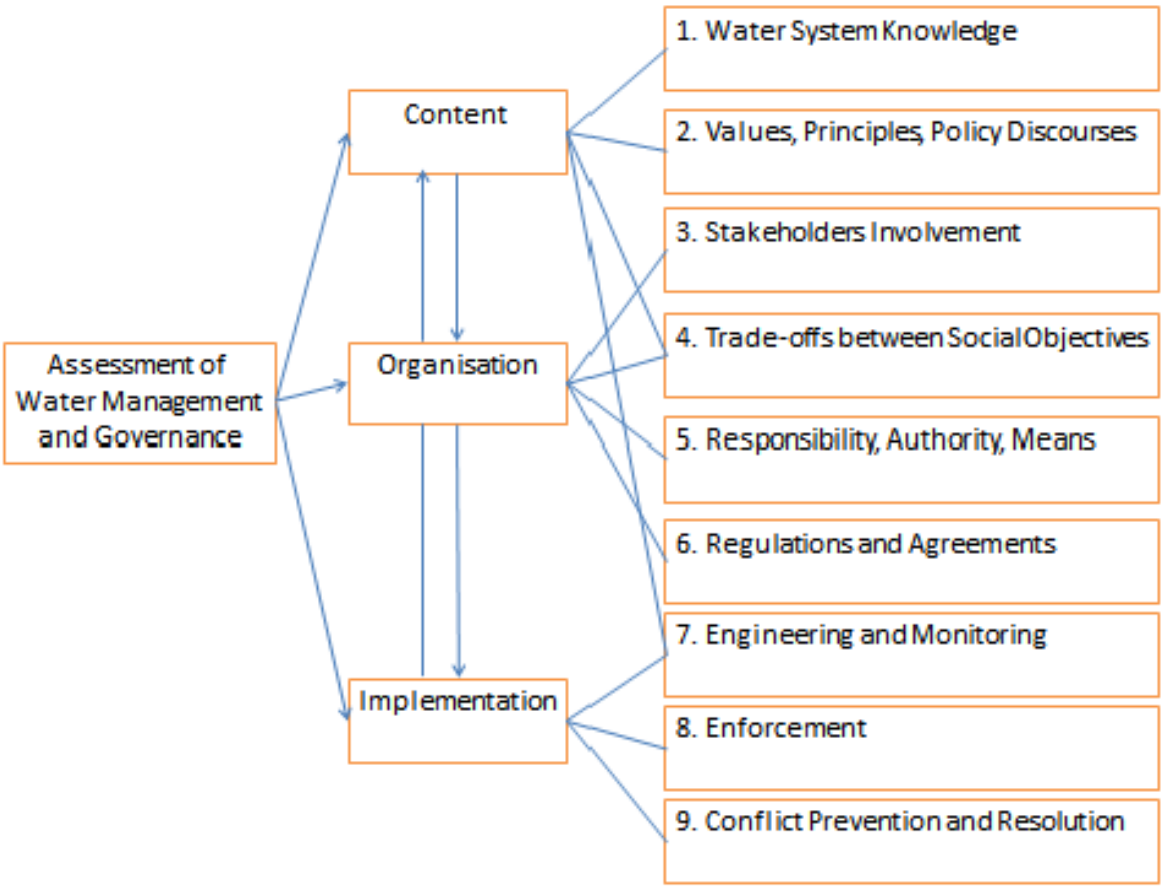

Figure 1: Scheme of the multiple dimensions of water governance and management (Brouwer et al., 2012).

Recommended knowledge about green roofs

It is important to have a basic understanding of green roofs. Green roofs are an attractive solution to create additional water storage because roofs make up 40 to 50% of the horizontal impermeable urban area (Dunnet & Kingsberry, 2004). The clear advantage is that green roofs do not compete with other functions, because they are constructed on previously unused space. However, green roofs alone cannot solve the storage problem entirely, but they can reduce the peak of a rainfall runoff event significantly. For best results, they have to be combined with runoff reducing measures such as urban green, pervious pavement, rainwater cisterns and runoff handling measures such as sewerage systems. The various water-related benefits of green roofs are (Getter & Rowe, 2006):

1. absorbing water in the green roof substrate and thereby delaying the initial time of runoff;
2. reducing the volume of total runoff by retaining part of the water;
3. spreading the runoff over a longer period of time by gradually releasing the excess water stored in the porous space of the substrate;
4. decreasing the flow velocity due to increase in roughness by vegetation, even when the substrate is saturated.

Green roof design

There are two types of green roofs: extensive and intensive. The choice one makes depends on the carrying capacity of the roof, available budget and personal preference. Extensive roofs are lighter, cheaper and can store less water than an intensive roof. Intensive roofs can additionally provide more aesthetic value or function as a park or garden (Dunnet & Kingsberry, 2004; Municipality of Rotterdam, sine anno). An impression is given in figure 2:

Figure 2: Extensive (left) and intensive (right) green roofs (IGRA, 2013).

Additional benefits

Besides water management green roofs provide several other benefits that can provide additional incentives for building owners to construct a green roof, which is important as the effectiveness depends on the participation of these parties:

- Reduction of energy demand for space conditioning can be reduced by up to 75% compared to conventional roofs (Liu & Baskaran, 2003). In summer the cooling costs are reduced and in winter the heating costs (Del Barrio, 1998; Liu & Baskaran, 2003);

- Reducing the urban heat island effect (Getter & Rowe, 2006);
- Improvement of roof longevity due to protection against solar radiation and cold (Liu & Baskaran, 2003);
- Improvement of air quality (Nowak et al., 2006);
- Improved sound insulation. The vegetation acts as an additional sound barrier (Dunnett & Kingsbury 2004);
- Fire resistance or retardation (Oberndorfer et al., 2007);
- Improved aesthetic value (Getter & Rowe, 2006);
- Increased urban biodiversity (Getter & Rowe, 2006).

Green roof policy so far

Since the start in 2008 until mid 2012, more than 100,000 m^2 of green roofs has been realized, with the greatest increase towards the end. The year 2011 was thus far the top year, with a subsidy request for 55,000 m^2 of green roofs (Stedebouw & Architectuur, 2012; BNR, 2012). Unfortunately, it is hard to state whether the policy is really on target as it has only been "active" for a little over five years, and the total project duration is thirty-two years. This extrapolation is made even harder by the bias present in the start-up phase, where the concept of green roofs is still highly unknown and stakeholders have to familiarize themselves with green roofs. Assuming that interest for the green roofs remains minimal and the average growth of roofs is the same as it was over the last four and a half years, the total amount of green roofs will end up being approximately 550,000 m^2 in 2030. However, if interests turns out to be more similar to the 2011 growth spurt the target of 800,000 m^2 will be overshot with 290,000 m^2. Once green roofs have become a more integral part of Rotterdam, within a few years, more grounded conclusions can be drawn as to the effectiveness of the green roof policy.

The geographical boundaries of the green roofs project are limited within the city of Rotterdam. The exact targeted location is shown in figure the targeted location in figure 3.

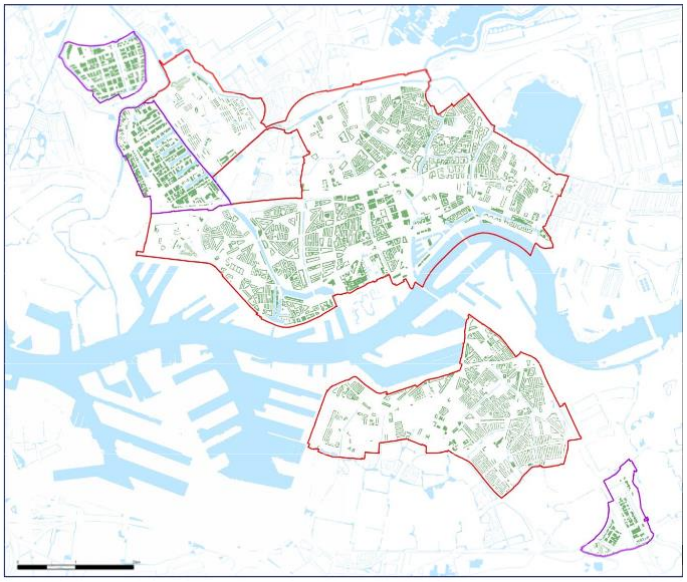

Figure 3: Geographical scope of green roofs project, Red is residential area, Purple is business area (Goedbloed, 2010).

Water System Knowledge

"Assessment criterion: Is there sufficient knowledge of the existing water system in order to deliver the required service level of societal functions; if not, what are the gaps; is sufficient knowledge available to assess the impact on the water system because of changes in environment and societal functions" (Brouwer et al., 2012).

For this green roof project, a Social Cost Benefit Analysis (SCBA) has been conducted. This SCBA was executed by having two scenarios; one reference scenario with no implementation (the 'zero' alternative), and one scenario with the implementation of the project (the 'project' alternative). The difference between the two scenarios is the effect the project would have on society as a whole. An urban climate adaptation model has been made for this SCBA (RCI, 2013). The SCBA attempts to strike a balance between both monetary and non-monetary costs and benefits. A monetary benefit for a green roof is, for instance, a reduced energy bill. Some non-monetary benefits and costs are biodiversity and water quality loss, respectively. Part of the SCBA is aimed at private parties without including societal effects, to assess whether a green roof is a personal beneficial investment. It has been stated in the SCBA that there is little hard knowledge available and the attributed benefits have been obtained primarily in controlled experiments (Arcadis, 2008).

In the SCBA the most conservative estimations have been used, which are based on empirical data for the expected benefits. The outcome showed that green roofs are primarily beneficial investments for the highly urbanized parts of Rotterdam. However, for private parties, although there were substantial benefits, the overall financial result was negative. Based on this, a subsidy of €30 per m^2 has been proposed (Arcadis, 2008), and implemented (RCI, sine anno f).

The SCBA appears to be based on conservative estimations resulting in a relatively negative impact. The small-scale empirical data used, might not be translatable to a large-scale system performance. In this regard monitoring will be very important (see 'engineering and monitoring'). The scientific verification in the report is poor, as the use of references is minimal. This results in little transparency of the report itself and where figures come from. Because the function of this report was not only to inform policy makers but also to create transparency it is a downside that this report is not openly available and can be obtained only via personal contact.

Related to the assessment criterion, it can be concluded that all the important variables have been addressed and assessed. It is questionable whether the information used in the SCBA is really the best available knowledge, as it is difficult to trace back the sources. Few knowledge gaps exist: the translation of the small-scale performance to the large-scale (actual) performance; the ideal plant species composition could be further researched (Oberndorfer et al., 2007) leading to even more effective green roofs; and, the inherent uncertainties related to predict climate change impacts. If the climate change impact is larger than expected, the policy target might need to be raised in order to become 100% climate proof.

Values, Principles, Policy Discourses

"Assessment criterion: Is there sufficient knowledge of shared or conflicting values, viewpoints and principles (represented by different policy discourse coalitions) for water issues and their consequences for facing water management issues?" (Brouwer et al., 2012).

In order to know what values, principles and policy discourses exist it is important to first identify what stakeholders and perspectives exist. In this section the focus is on the values of the different parties involved, while in the third building block their exact involvement in relation to green roofs is elaborated further. The first major stakeholder is the Rotterdam Climate Initiative (RCI). This initiative is a consortium of four major parties. Even though it is made up of several parties, it is still included as a separate stakeholder, because it has its own board and council (see 'stakeholder involvement') and as a whole, is the initiator of various large projects in Rotterdam, among which green roofs. Of the four parties, only two play a significant role in this project. Most important is the municipality of Rotterdam, which fulfils a leading role. The municipality values an economically healthy and attractive habitable city (RCI, sine anno a). The second relevant stakeholder is 'DCMR milieudienst Rijnmond', which values the environmental protection and sustainable initiatives which help improve the environmental standards (RCI, sine anno b). The other two minor stakeholders in the RCI are: Port of Rotterdam and Deltalinqs, because these play an insignificant role in the organisation of the green roofs project.

Other relevant stakeholders that can be identified are: Firstly, the water boards, which have a special role, as they are the main responsible water management authority in the region. What they value is that water is of sufficient quality, the people living within their jurisdiction are safe from flooding and waste water flows are properly treated (Waterschappen.nl, sine anno); secondly, the European Union (EU), which has taken a stand on climate adaptation strategies in Rotterdam. With the founding of the EU and the signing of the Treaty of Lisbon[2] the core values that have been stated are human dignity, freedom, democracy, equality, the rule of law and the respect for human rights. In these core values there seems to be no real link to the sustainable initiative of green roofs. However, this same treaty has one of the most explicit legal commitments to sustainable development anywhere in the world (Aldson, 2011), displaying that the EU strongly values sustainability; and lastly, housing associations and other businesses (RCI, sine anno c). It is assumed that these parties value an economically beneficial solution where the investing parties themselves benefits The benefits for public safety and sustainability should be viewed as a bonus, except for businesses that make a priority of being sustainable.

The above-mentioned stakeholders all have non-conflicting values, although not every actor might weigh these values in the same way. Companies want to make profit, while governments mainly want a liveable city. However, when looking at the various stakeholders, they all benefit from a climate proof city. The main values that are shared by all stakeholders are: safety and reduction of costs. These shared values increase the legitimacy of the green roof policy.

Apart from values, principles also play an important role. The most important ones are the precautionary (Mees et al., 2012), subsidiarity and solidarity principles. The precautionary principle is

[2]2007/C 306/01: Treaty of Lisbon - Amending the treaty on European Union and the treaty establishing the European community.

important because green roofs are natural climate buffers aimed at preventing possible future water nuisance. The principle of subsidiarity plays an important role, because the municipality and water boards (lower governments) make the climate policies, which are based on the national/EU policies. The principle of solidarity "is a fundamental principle based on sharing both the advantages, i.e. prosperity, and the burdens equally and justly among members" (Eurofound, 2011). Green roofs have benefits for several actors, e.g. decrease in peak discharge (task of water boards), decrease in fine particles (task of municipality), decrease of heat island effect (task of municipality), and decrease in energy costs and improvement of wellness (owners/users). It is therefore only fair that these all share in the costs.

This subsidy programme of the municipality falls under the economic and financial resources part of good governance. Good governance is defined as "the transparent and accountable management of human, natural, economic and financial resources for the purposes of equitable and sustainable development."[3] All these aspects are included in the municipality's plan to increase the number of green roofs.

In general, there is sufficient knowledge of values, viewpoints and principles. This is mainly due to a close cooperation of the stakeholders (e.g. as present in the RCI). However, a possible improvement could be to conduct a survey to investigate the viewpoints of private parties concerning mandatory green roofs on all new buildings. This could lead to a more effective policy (see enforcement).

Stakeholder involvement

"Assessment criterion: Are all relevant stakeholders involved? Are their interests, concerns and values sufficiently balanced considered in the problem analysis, solution search process and decision-making?" (Brouwer et al., 2012).

As described before, the RCI is the major stakeholder within the green roofs project although they do consist of several separate organizations. The organizational lay-out of the RCI is shown in figure 4:

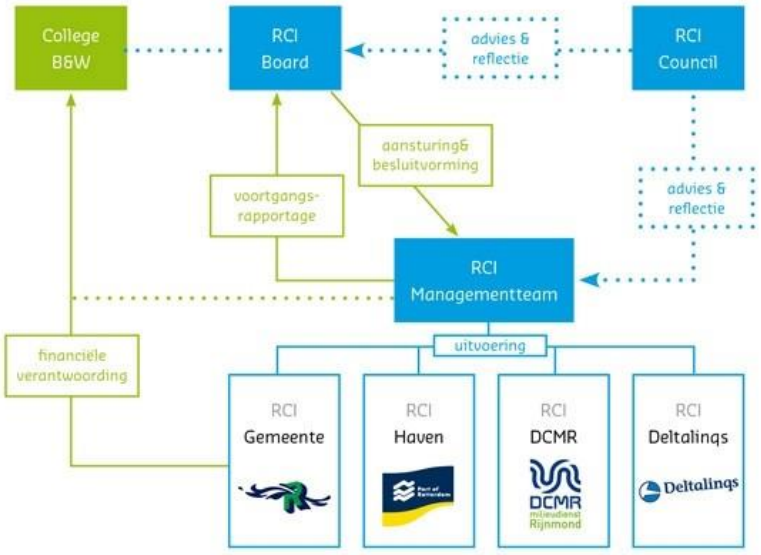

Figure 4: Organizational chart of the Rotterdam Climate Initiative consortium (RCI, sine anno d).

[3] The Cotonou Agreement, Article 9.3

Together these four stakeholders have the most ambitious goals for a city in the Netherlands (RCI, sine anno e). They are trying to achieve a reduction in CO_2 emissions of 50% compared to 1990 and make Rotterdam 100% climate proof by 2030, meaning that they are able to cope with any climatic event that may occur in the future, including influences of global climate change. The green roofs project is one of several projects that helps contribute to both goals (RCI, sine anno f).

Throughout all the stages of the project, the municipality has the leading role. It uses several tools to increase the attractiveness for private parties to be involved and participate. The first measure is by implementing green roofs on municipal buildings, thus leading by example. The second tool is the provision of information. It might be possible that private parties are interested in implementing green roofs, but not aware of the benefits, who to approach for the construction, or other information. The last and most important tool is the use of subsidies. Especially private parties often object to implement certain measures due to high financial investments. Only in the maintenance stage the municipality is not directly involved, since this is up to the property owners (Mees et al., 2012). Another RCI partner, namely the 'DCMR milieudienst Rijnmond' (environmental agency Rijnmond), mainly has a role in the enforcement of environmental laws and distribution of environmental licenses. Besides the executive function it is also involved in new environmental developments such as green roofs. It checks for the environmental (safety) related questions (RCI, sine anno b). The RCI itself is part of a greater consortium based around the provision and sharing of knowledge. This organization is named 'Atelier voor Interactieve DuurzaamheidsActiviteiten' (AIDA), and is made up of universities (Rotterdam, Leiden, Hogeschool Rotterdam), the RCI, the Province of South Holland and 'Ontwikkelingsbedrijf Rotterdam' (Development business Rotterdam) (AIDA, sine anno).

Several water boards are involved: 'Waterschap Hollandse Delta', 'Hoogheemraadschap van Delfland' and 'Hoogheemraadschap van Schieland en de Krimpenwaard' (RCI, sine anno f*).* The functions provided by green roofs greatly overlap with the responsibility of the water boards. They provide additional safety for the inhabitants of Rotterdam. Besides the technical overlap also a part of the financing comes from the water boards (RCI, sine anno c).

Besides the municipality and water boards, governmental involvement also takes place on higher scales. Next, these involvements are discussed from small to large. Starting with the involvement of the Province of South Holland. They work closely together with the municipality of Rotterdam when it comes to sustainability. Making the city climate proof is part of this (Province of South Holland, 2013). On a slightly larger scale there is the national government, specifically the ministry of economic affairs. They have special tax regulations for green roofs (RCI, sine anno f; Agentschap NL, 2013a). On the supranational scale there is the EU, which has declared the city an example of climate adaptation. By doing this, they put more focus on the green roofs policy, and thereby promoting it. Also, this project has received EU-funding by INTERREG IVB. This is a financial instrument of the EU's Cohesion Policy that helps fund CO_2-reducing measures (Rotterdam, 2013; NWEurope, 2009). It appears that all involved parties are properly identified and have been involved in the project from early stages. This allowed all the parties that really participate in the management on this project to be included in the decision making process. Private parties were less involved in the first development stages of the project, but were approached after the first policies had been set up. It is easier to develop a policy and request participation in later stages by small parties with benefits still clearly present for these parties. Participation is always voluntary.

Tradeoffs between social objectives

"Assessment criterion: Are agreed service level decisions based on trade-offs of costs, benefits and distributional effects of various alternatives" (Brouwer et al., 2012).

There are only a few tradeoffs to be made when constructing green roofs, which is mainly due to the fact that green roofs are considered 'no-regret measures' with multiple advantages (Mees et al., 2013).

Public tradeoffs

The main reason to construct green roofs is to increase storm water retention capacity. However, a possible side effect is a decrease in water quality, due to leaching of nutrients (Oberndorfer et al., 2007). This is especially the case with intensive roofs, where one might use fertilizers. Thus, this is a tradeoff between water quantity and quality.

Also, not all people benefit from green roofs to the same extend, but everyone pays for the subsidy (tax money). This is a tradeoff with respect to the fairness principle.

Private tradeoffs

Green roofs are investments, which have certain return periods. The benefits of green roofs apply immediately after construction, such as heat reduction. However, translating this into purely financial benefits (i.e. reduction of energy costs) can result in a longer return period.

Then there is the tradeoff between intensive and extensive roofs. Intenstive roofs are not financially attractive, and require more carrying capacity of the roof, but they store more water and have more aesthetic value. For a lot of people this tradeoff is not really an issue. However, for bigger buildings, this can be a valid tradeoff.

Lastly, there is a possible tradeoff between green roofs and solar panels. However, this is only valid for intensive roofs. Extensive roofs and solar panels go hand in hand, an even increases the efficiency of photovoltaic panels, due to the cooling effect (Municipality of Rotterdam, sine anno).

The assessment criterion is met, because according to the SCBA the benefits outweigh the costs on a macro scale. Individual owners might decide for themselves whether the tradeoffs are favourable or not. In general not a lot of tradeoffs have to be made.

Responsibility, authority and means

"Assessment criterion: are the authorities, responsibilities and means well-organized to deal with water issues at the appropriate administrative scale(s) in a participative and integrative way" (Brouwer et al., 2012).

The owner of the green roof is responsible for its maintenance (see engineering and monitoring), which is clearly defined by the municipality of Amsterdam (Municipality of Amsterdam, 2012). However, it is not very clear as to where this is specified for Rotterdam. In Rotterdam, the maintenance was, up until now, always outsourced to the suppliers of green roofs (Mees et al., 2012).

The actor that is responsible for the prevention of water nuisance on public ground is the municipality. This responsibility is clearly assigned to the municipalities in the Water Act[4] (Mees et al., 2012), which is why the municipality plays a leading role in the green roof project. There are no private instruments in the green roofs project. For instance, rental corporations cannot charge tenants for a green roof on their building block, from which the tenants profit through a reduced energy bill (Bos & Mees, 2012). This is a potential bottleneck. There are two public financial instruments to promote the use of green roofs. Public financing of the project is applied through taxes, which the municipality and water boards use to pay for green roofs on their own buildings and finance the subsidies of €30/m^2 (€25/m^2 and €5/m^2, respectively) (RCI, sine anno g). In case of private financing, most of the costs are still borne by the owner. The average costs are about €45/m^2 for extensive roofs, and €120/m^2 and up for intensive roofs (Arcadis, 2008). Thus, the financing is both central and decentralized.

The coordination of the aforementioned subsidies is in the hands of the municipality of Rotterdam and the water boards. The consumer has to apply for this subsidy via an application form, which has to be handed to the municipality where it will be processed. The green roof has to meet certain requirements such as a minimum area of 10 m^2, a water storage capacity of 15 liter per m^2 and certain components such as substrate and a drainage layer need to be present (RCI, sine anno h). Green roofs fall under the Environmental Investment deductibility tax[5] (RCI, sine anno f; Agentschap NL, 2013a), which is the highest form of tax deductibility (36%). To apply, one needs to fill in a form on the website of the Agentschap NL (Agentschap NL, 2013b). Another benefit can be gained because the construction of a green roof can help improve the ecolabel of a house. This can improve the value of the house, but can also lower the property transfer tax. For houses with energy label A this tax is 2%, compared to 6% for G label (DGBC, sine anno). The choice for a green roof voluntary thus holds no binding obligation, before a subsidy is granted. Therefore, the instruments do not have the status that they can fulfill a water task. They only aid in fulfilling of these tasks by providing incentives to third parties.

The municipality has clearly stated its goal. Since the involvement of the public is needed to reach this goal, the municipality uses complementary instruments alongside the subsidy and tax benefit system, such as leading by example and informing the public.

Since the goal is a long-term target (2030), it is not known as of now whether the public instruments are sufficient to reach this target. However, information and communication can always be intensified. Also, the municipality can decide to install more green roofs on its property or the subsidies can be increased. The instruments are not static because of the long time frame and due to political changes.

It can be concluded that the authorities, responsibilities and means are well-organized at the appropriate administrative scales (subsidiarity principle). Also, all stakeholders are involved in a participative and integrative way, as is visible in e.g. the RCI.

[4] Waterwet, Artikel 3.5
[5] code: F 7070

Regulations and agreements

"Assessment criterion: are regulations and agreements legitimate and adaptive, and if not, what are the main problems with regard to the above mentioned legitimacy aspects?" (Brouwer et al., 2012).

Both the municipality and the water boards have the competence for setting up green roof regulations. The municipality has set up guidelines for subsidies and requirements for green roofs in cooperation with the water boards (RCI, sine anno h).

Installing green roofs is on a voluntary basis. Therefore the parties agree on normative grounds. Moreover, the voluntary basis ensures the use is equitable and fair, since there is no forcing behind the decision. This voluntary basis disappears the moment an interested party engages in an agreement with the municipality that they are to install green roofs. Otherwise, it would be a breach of contract, i.e. subsidy agreement[6].

Rotterdam exceeded various European standards with respect to air quality in 2006 (Municipality of Rotterdam, 2006) and will likely continue to do so in 2015 (Province of South Holland, 2013). Green roofs help improve the air quality, to meet the air quality regulations set by the EU and adopted in the Dutch Environmental Management Act[7].

It is important to note, that the goals that have been set by the RCI are not legally binding, and therefore, no agreements or regulations.

The criterion for this building block is fulfilled as the democratically elected municipality involves all the parties and does not force partners to participate. Overall, this results in the regulations being legitimate. The subsidy regulation is, however, subject to change due to, e.g. subsidy limit being reached[8], changes in the political landscape or economic crisis. This was the case for the people living under the jurisdiction of *Hoogheemraadschap van Delfland*, who are now only eligible for €25 as the water board no longer funds their part (RCI, sine anno i). This reduces the clarity and thus legitimacy of the regulation, as people are not entirely certain if they will still get their subsidy.

Engineering and Monitoring

"Assessment criteria: Are SLAs sufficient available (implicit or explicit) in order to redesign the existing infrastructure? Are design and consequences of different alternatives sufficient available? Is there sufficient monitoring of the system and are the data analysed?" (Brouwer et al., 2012).

Before implementation of a green roof a certified engineer has to check whether the roof can handle the extra weight (Hop, 2010). Improvements in the existing infrastructure are not strictly necessary, unless one desires an intensive green roof and the loading capacity of the existing roof does not meet the requirements. In general, it is safe to say that sufficient design and engineering knowledge is available.

[6]Municipality of Rotterdam (2008) *Nadere regels subsidie aanleg groene daken*. Gemeenteblad 2008.
[7]VROM-publicatie (2010) *Wet Milieubeheer*. Staatsblad 2010
[8] Article 4 - Municipality of Rotterdam (2008) *Nadere regels subsidie aanleg groene daken*. Gemeenteblad 2008.

Maintenance of green roofs depends on whether you are dealing with an extensive or intensive roof (Oberndorfer et al., 2007). These maintenance targets are not clearly defined, but rather stay quite general. However, it is mentioned that extensive green roofs require no maintenance, except for a biannual inspection for unwanted growth and cleaning of the rainwater drains. Intensive green roofs, on the other hand, require quite some maintenance, comparable to the work required by an ordinary garden (RCI, sine anno j). But specific activities are not explicitly taken into account or further elaborated upon.

The development of the green roofs project is monitored reasonably well, the amount of added storage and green roof area are known to the municipality (RCI, 2011). Monitoring of the large-scale effects is important to reflect whether known the small-scale effects are translated correctly to the actual green roofs behaviour. Thus can, in turn, strengthen the green roof policy and increase its legitimacy. This has been stressed in the SCBA (Arcadis, 2008), because practical knowledge about the exact benefits of green roofs on a large scale like this is not abundant. Acquiring this knowledge through monitoring also improves the quality of the financial assessment of green roofs.

Engineering and monitoring seems to be in order, since SLAs are present and the monitoring of the functioning and implementation of the roofs is in order. Whether the large scale monitoring of the actual effects is done or not is less communicated.

Enforcement

“Assessment criterion: are regulations and agreements enforceable by public and/or private parties, and are there appropriate remedies available?” (Brouwer et al., 2012).

The subsidy agreement is enforceable after both parties agree on the amount. The subsidy will only be given if a green roof is actually constructed, so if one applies for a subsidy one obligates him or herself to construct a green roof that meets the requirements. This is also the case with the tax money deduction. The subsidies from the municipality and water boards come from an enforceable instrument, tax money.

In our opinion the green roof policy could use more enforcement to increase the legitimacy and effectiveness. In Basel and Stuttgart – after meetings with private parties – the municipality has set up a policy through which project developers are obliged to build green roofs on new buildings. The private parties involved were not opposed to this obligation, because now it was clear what was expected of them (Bos & Mees, 2012). A level playing field and clarity on what is expected increases legitimacy (Mees et al., 2013). Even though the legitimacy slightly decreases due to forcing people (Mees et al., 2012), the net result is expected to be positive.

A subsidy agreement can be temporary, vary per municipality and bring a lot of bureaucracy with it. Moreover, it has been argued that the lack of enforceable means for private parties is a weakness in Rotterdam. For instance, housing corporations cannot charge their tenants for constructing a green roof, an investment from which the tenants benefit through a lower energy bill so which will earn itself back for them. Now the rental corporation has to bear the costs (Bos & Mees, 2012).

Conflict prevention and resolution

"Assessment criterion: Are there sufficient conflict prevention and resolution mechanisms in place?" (Brouwer et al., 2012).

Conflict management is a minor issue at this moment for green roofs. This is mainly due to the fact that it is all on a voluntary basis and a 'no-regret' measure. There are two kinds of possible conflicts that might arise however. One is related to an economical competition for space, the other concerns possible resistance from civilians.

Roofs are predominantly unused space with one exception: photovoltaic panels (see 'tradeoffs between social objectives). Even if this leads to a conflict, it will only be an internal conflict of potential clients. This is no legal conflict, as everybody can choose what he or she prefers. Because of this voluntary basis, no civil or political rights are violated. Rotterdam promotes the construction of green roofs by providing subsidies. This might lead to conflicts concerning an unfair market advantage for green roofs. In case of a conflict it will be up to the court to resolve. There is no need for a special conflict management policy plan.

It is also possible that civilian resistance arises with the implementation of green roofs; the so called NIMBY ('Not In My Back Yard') principle. Seemingly perfect solutions can still cause friction with civilians, even more so in densely populated areas where a lot of people are affected. People do not necessarily have to be against the implemented measure, as long as it is not in their 'back yard'. This can be illustration with an example from San Francisco. The owner of a one-storey ranch desired to add a green roof on his garage. The surrounding neighbours in their three storey houses requested a blocking by the Planning Commission by way of a Discretionary Review. Their arguments were related to the adverse effect on the historic structure, incompatibility with the neighbourhood character and the invasion of non-native species. Later their arguments were declared unfounded and their complaints did not make it to the Commission (Socketsite, 2013).

General arguments that might be expected are related to the aesthetics of the green roofs which might not be to everyone's liking or fear of possible roof collapse or leakages. These resistances can be expected concerning any green roof. For intensive green roofs specifically, additional resistance can be expected such as unwelcome wildlife such as birds, insects or rodents, pesticide/fertilizer leaching, irrigation requirements or the invasion of non-native species if these are used (Greenroofs.com, sine anno).

In case one wants to object to a green roof on a municipal building, one can file a complaint towards the city council (Municipality of Rotterdam, sine anno), which will be taken into consideration. If that person is still not satisfied, or the dispute concerns a non-municipal building, he/she can go to court. Since there are only minor conflicts addressed in this policy, and there are means to settle possible disputes, there are enough conflict prevention and resolution mechanisms in place.

Transparency of decision making can reduce conflicts and increases legitimacy. Therefore, information about decision making by the municipality of Rotterdam has been made publicly available (RIS Rotterdam, 2013)

Conclusion

In this paper the policy on green roofs in Rotterdam has been scrutinized. The conclusions for each building block will be briefly recapped followed by answering the research question.

Policy analysis

With respect to water system knowledge, there are a few gaps, but overall, there is sufficient knowledge available. Due to close cooperation between stakeholders from the early stages, the values are well known and are not contradictory. The most important principles are the precautionary, subsidiarity and solidarity principle. No obstructing tradeoffs exist and the (social) benefits outweigh the costs. All stakeholders are involved in a participative and integrated way, and the responsibilities, authorities and means are well-organized. Overall, the regulations are legitimate, but due to possible changes in political composition, economic crisis and subsidy limit, the legal certainty can be jeopardized which decreases the legitimacy. Required engineering knowhow is sufficient and individual roof performance is monitored, but large-scale monitoring is not explicitly included in the policy. Enforcement is a weak side of the policy, due to its voluntary basis. Major conflicts are not expected, with the possible exception of the NIMBY principle.

To what extend does the policy design on green roofs need improvements, and what are these improvements?

In general, it can be concluded that no major redesign of the policy is required. The green roof policy is considered legitimate because the municipality is a democratic body, public participation is actively promoted and rewarded. In addition, overall transparency is reasonable, with exception of the (availability) of the SCBA.

It is somewhat uncertain whether the policy is effective enough at this point. The municipality makes a continuous effort to reach participants. Once green roofs have become a more integral part of Rotterdam, within a few years, more grounded conclusions can be drawn as to whether the goal can be realized. The possible improvements to increase the likelihood of reaching the target are discussed in the recommendations below.

Recommendations

The green roofs policy of Rotterdam is an ambitious undertaking, with quite far-reaching goals. However, one could wonder whether it is the most effective way of reaching these goals. In this chapter several recommendation will be made, as to how the policy could be improved.

The success of the policy is largely dependent on the willingness of the people to cooperate. Comparisons with cities like Stuttgart and Basel show that the effectiveness of the policy could be greatly increased by obliging the construction of green roofs on new buildings. It would be an improvement to the effective of the policy plan, as it would result in a larger area of green roofs and a lower price because of higher abundance.

Another recommendation can be gained by looking at Germany. Where in the Netherlands one pays sewerage tax independent from the amount of (covered) surface, in Germany one pays according to the amount of covered surface. In Munster, for instance, the taxes on yearly precipitation discharge is €0.44 per m^2. Construction of a green roof can reduce this to €0.04 per m^2, but this is dependent on the storage capacity of the roof (RIVM, 2012). A clear tax benefit such as this would also in the Netherlands improve the incentive to construct green roofs, but require changes in the current Dutch nationwide policy.

These improvements to the policy could improve the legitimacy, because it gives legal certainty and equality. Subsidies can be altered, or stopped altogether, while a law cannot be changed that easily. This could also prove beneficial to private parties, as it is better known what is expected of them. Also the effectiveness of the policy would be greatly improved. It might, however, lead to lawsuits filed by parties who think an obligation might be unreasonable. This could be prevented by first gauging people's opinion about this. A positive attitude could result in the implementation of obligation of green roofs on new buildings.

Providing private parties, such as housing corporations, with the means to charge tenants for the construction of green roofs can result in increased effectiveness. The tenants profit from the investment by a reduced energy bill, but the housing corporation has to bear the costs (Bos & Mees, 2012). Since housing corporations are on a tight budget already, it can be expected that they will be hesitant of making such an investment when they cannot gain from the investment.

A last recommendation is related to the conducted SCBA. Monitoring should be applied to find out if the large scale effects in fact correspond to the small scale predications and it should be made publicly available to increase the knowledge of the costs and benefits of the public, increasing transparency, resulting in better "good governance".

References

- Agentschap NL (2013a) *Over de regeling (MIA\Vamil)* [Online] http://www.agentschapnl.nl/programmas-regelingen/over-de-regeling-miavamil [Cited 10 June 2013]
- Agentschap NL (2013b) *Aanvragen MIA\Vamil* [Online] http://www.agentschapnl.nl/programmas-regelingen/aanvragen-miavamil [Cited 30 June 2013]
- AIDA (sine anno) *AIDA* [Online] http://www.aidarotterdam.nl/duurzamedaken/dod/aida.html [Cited 14 June 2013]
- Aldson, F. (2011) *EU law and sustainability in focus: will the Lisbon Treaty lead to 'the sustainable development of Europe'?* [Online] http://www.academia.edu/525231/EU_Law_and_Sustainability_in_Focus_Will_the_Lisbon_Treaty_Lead_to_The_Sustainable_Development_of_Europe [Cited 13 June 2013]
- Arcadis (2008) *Groene Daken Rotterdam - Maatschappelijke Kosten-Baten Analyse.* Report number: 110643/WA8/050/000894
- BNR (2013) *Aantal groene daken door het dak.* [Online] http://www.bnr.nl/radio/bnr-duurzaam/286524-1206/aantal-groene-daken-door-het-dak [Cited 27 June 2013]
- Bos, A. & Mees, H.L.P. (2012) *Effectief beleid voor groene daken. Wat kunnen we leren van het buitenland?* Dak & Gevel Groen, pp. 14-17
- Brouwer, R., Edelenbos, J., Hellegers, P. Kok, M., Kuks, S. & van Rijswick, M. (2012) *An Integrated Method to Assess the Governance of Water.*
- Del Barrio, E.P. (1998) *Analysis of the green roofs cooling potential in buildings.* Energy and Buildings, Vol. 27, pp. 179–193
- DGBC Dutch Green Building Council (sine anno) *Green Deal – Fiscale vergroening voor energiebesparing gebouwde omgeving* [Online] http://www.dgbc.nl/losse_paginas/voorstel_green_deal_fiscale_vergroening_voor_energiebesparing_gebouwde_omge [Cited 21 June 2013]
- Dunnett, N.P. & Kingsbury, N. (2004) *Planting Green Roofs and Living Walls.* Portland (OR): Timber Press.
- Edelenbos, J. (sine anno) *Notitie verdere uitwerking methodisch deel Bestuurskundige Procesanalyse als onderdeel van de assessment Tool Water Govenance.*
- Eurofond (2011) *Solidarity Principle.* [Online] http://www.eurofound.europa.eu/areas/industrialrelations/dictionary/definitions/solidarityprinciple.htm [Cited 10 June 2013]
- Ferguson, B.K. (1998) *Introduction to Stormwater: Concept, Purpose and Design*. New York: Wiley
- Getter, K.L. & Rowe, D.B. (2006) *The role of green roofs in sustainable development.* HortScience, Vol. 41, pp. 1276–1286.
- Goedbloed, D. (2010) *Groene Daken Rotterdam*. Presentation [Online] http://www.stowa.nl/Upload/agenda/11%20Daniel%20Goedbloed.pdf [Cited 16 June 2013]
- Greenroofs.com (sine anno) *Issues* [Online] http://www.greenroofs.com/Greenroofs101/issues.htm [Cited 16 June]
- Hellegers & Ansink (sine anno) *Quickscan Economic Capacity: Methodology, Applications, and Pitfalls.*

- Hop, M.E.C.M. (2010) *Dak en Gevel Groen* [Online] http://edepot.wur.nl/156202 [Cited 23 June 2013]
- IGRA (2013) *Green Roof Types.* [Online] http://www.igra-world.com/types_of_green_roofs/ [Cited 27 June 2013]
- KNMI (2006) *Klimaat in de 21e eeuw - vier scenario's voor Nederland.* [Online] http://www.knmi.nl/klimaatscenarios/knmi_nl_lr.pdf [Cited 24 June 2013]
- Kok, M. (2012) *Quickscan "System Design" Capacity.*
- Kuks, S., Bressers, H., de Boer, C., Vinke, J. & Özerol, G. (2012) *Governance assessment tool – Institutional capacity.*
- Liu K. & Baskaran, B. (2003) *Thermal Performance of Green roofs through Field Evaluation—Ottawa*. Ottawa (Canada): National Research Council Canada, Institute for Research in Construction. Report number: NRCC-46412.
- Mees, H.L.P., Driessen, P.P.J. & Runhaar H.A.C. (2012) *Exploring the Scope of Public and Private Responsibilities for Climate Adaptation*. Journal of Environmental Policy & Planning, Vol. 14, No. 3, pp. 305-330
- Mees, H.L.P., Driessen, P.P.J., Runhaar, H.A.C. & Stamatelos, J. (2013) *Who governs climate adaptation? Getting green roofs for stormwater retention off the ground.* Journal of Environmental Planning and Management, Vol. 56, No 6, pp. 802-825
- Mentens, J., Raes, D. & Hermy, M. (2005) *Green roofs as a tool for solving the rainwater runoff problem in the urbanized 21st century?* Landscape and Urban Planning, Vol. 77, pp. 217-226
- Municipality of Amsterdam - Stadsdeel Oost (2012) *Toelichting subsidieregeling groene daken en gevels stadsdeel Oost.* [Online] http://www.oost.amsterdam.nl/actueel/zoeken-0/2012/week-5/vaststelling/ [Cited 27 May 2013]
- Municipality of Rotterdam (sine anno) *Rotterdam Groen van Boven – Toepassing van groene daken in Rotterdam*. [Online] http://www.milieuzorgoverheden.nl/downloads/rotterdam_groen_van_boven.pdf [Cited 13 June 2013]
- Municipality of Rotterdam (2010) *25.000 m2 extra groene daken in Rotterdam* [Online] http://www.rotterdam.nl/25_000m2_extra_groene_daken_in_rotterdam [Cited 27 June 2013]
- Municipality of Rotterdam, Hollandse Delta Water Board, Water Board of Schieland and Krimpenerwaard & Water Board of Delfland (2013) *Waterplan Rotterdam 2 – Working on water for an attractive city.* [Online] http://www.rotterdam.nl/waterplan_2_en_deelgemeentelijke_waterplannen [Cited 11 June 2013]
- North-West Europe (2009) *165F MUSIC Mitigation in Urban areas: Solutions for Innovative Cities* [Online] http://www.nweurope.eu/index.php?act=project_detail&id=5351 [Cited 14 June 2013]
- Nowak, D.J., Crane, D.E. & Stevens, J.C. (2006) *Air pollution removal by urban trees and shrubs in the United States.* Urban Forestry & Urban Greening, Vol. 4, pp. 115-123
- Oberndorfer, E., Lunholm, J., Bass, B., Coffman, R.R., Doshi, H., Dunnet, N., Gaffin, S., Köhler, M., Liu, K.K.Y. & Rowe, B. (2007) *Green Roofs as Urban Ecosystems: Ecological Structures, Functions, and Services.* BioScience, Vol. 57, No 10, pp. 823-833

- Princeton (sine anno), *Wordnet search 3.1* [Online] http://wordnetweb.princeton.edu/perl/webwn?s=legitimacy [Cited 24 June 2013]
- Province of South Holland (2013) *Beleidsvisie Duurzaamheid en Milieu 2013-2017* [Online] http://www.zuid-holland.nl/overzicht_alle_themas/thema_milieu.htm [Cited 2 June 2013]
- RCI (sine anno a) *Gemeente Rotterdam* [Online] http://www.rotterdamclimateinitiative.nl/nl/rotterdam_climate_initiative/over_rci/partners/gemeente_rotterdam [Cited 24 June 2013]
- RCI (sine anno b) *DCMR Milieudienst Rijnmond* [Online] http://www.rotterdamclimateinitiative.nl/nl/rotterdam_climate_initiative/over_rci/partners/dcmr [Cited 24 June 2013]
- RCI (sine anno c) *Gemeentelijk programma groene daken* [Online] http://www.rotterdamclimateinitiative.nl/100_klimaatbestendig/groene_daken/gemeentelijk_programma [Cited 24 June 2013]
- RCI (sine anno d) *Organisatiestructuur* [Online] http://www.rotterdamclimateinitiative.nl/nl/rotterdam_climate_initiative/over_rci/rotterdam_climate_initiative [Cited 23 June 2013]
- RCI (sine anno e) *Rotterdam Climate Initiative* [Online] http://www.rotterdamclimateinitiative.nl/nl/rotterdam_climate_initiative/over_rci/rotterdam_climate_initiative [Cited 10 June 2013]
- RCI (sine anno f) *Groene daken in Rotterdam* [Online] http://www.rotterdamclimateinitiative.nl/nl/100_klimaatbestendig/projecten/groene_daken_in_rotterdam?portfolio_id=23 [Cited 1 June 2013]
- RCI (sine anno g) *Gemeentelijk programma groene daken* [Online] http://www.rotterdamclimateinitiative.nl/100_klimaatbestendig/groene_daken/gemeentelijk_programma [Cited 24 June 2013]
- RCI (sine anno h) *Voorwaarden* [Online] http://www.rotterdamclimateinitiative.nl/NL/100_klimaatbestendig/groene_daken/voorwaarden [Cited 24 June 2013]
- RCI (sine anno i) *Aanvragen subsidie* [Online] http://www.rotterdamclimateinitiative.nl/100_klimaatbestendig/groene_daken/aanvragen_subsidie [Cited 24 June 2013]
- RCI (sine anno j) *Veelgestelde vragen* [Online] http://www.rotterdamclimateinitiative.nl/nl/100_klimaatbestendig/groene_daken/veelgestelde_vragen#HoezithetmethetonderhoudWatzijndekosten [Cited 24 June 2013]
- RCI (2011) *Investing in sustainable growth. Rotterdam Sustainability Monitor 2011.* Sustainable 2010-2014 Programme Agency, Rotterdam.
- RCI (2013) *Social cost-benefit analyses* [Online] http://www.rotterdamclimateinitiative.nl/en/100_climate_proof/projects/?portfolio_id=93 [Cited 24 June 2013]
- van Rijswick, H.F.M.W. & Havekes, H.J.M. (2012) *European and Dutch Water Law*. Europa Law Publishing, Groningen 2012
- RIS Rotterdam (2013) *Raadsinformatiesysteem Rotterdam* [Online] http://www.ris.rotterdam.nl/cgi-bin/homepage.cgi [Cited 28 June 2013]

- RIVM (2012) *Bodem als draagvlak voor een klimaatbestendige en gezonde stad* [Online] http://www.rivm.nl/Bibliotheek/Wetenschappelijk/Rapporten/2012/mei/Bodem_als_draagvlak_voor_een_klimaatbestendige_en_gezonde_stad [Cited 24 June 2013]
- Rotterdam (2013) *Bezoek het groene infodak* [Online] http://www.rotterdam.nl/bezoekhetgroeneinfodak [Cited 14 June 2013]
- Socketsite (2013) *A Rather Unbelievable New NIMBY And Anti-Green Roof Argument* [Online] http://www.socketsite.com/archives/2013/04/the_newest_nimby_and_rather_unbelievable_antigreen_roof.html [Cited 16 June 2013]
- Stedebouw & Architectuur (2012) *Forse groei groene daken in Rotterdam.* [Online] http://www.stedebouwarchitectuur.nl/nieuws/nieuws/forse-groei-groene-daken-in-rotterdam.106231.lynkx?utm_campaign=10juli2012&utm_content=Nieuws&utm_medium=email&utm_source=ezineSenA [Cited 27 June 2013]
- Waterschappen.nl (sine anno) *Ontdek de waterschappen. Informatie over waterschappen* [Online] http://www.waterschappen.nl/wat-doet-een-waterschap.html [Cited 24 June 2013]