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Adaptive **D**ecision **S**upport **S**ystem (**ADSS**) for the Integration of Stormwater Source Control into Sustainable Urban Water Management Strategies

Ambition Reflection

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Glossary/ Definitions / Acronyms:

Glossary

Ambition Reflection	A component in the ADSS. The aim of this component is to challenge the user to reflect on its own attitude towards stormwater management.
Attractor	A special condition of a system. If the position (or condition) of a system finds itself in the vicinity of an attractor, it will undergo an evolution in the direction of that attractor. The distinguishing characteristic of complex adaptive systems is that there is a question of stable conditions far removed from static balance. Without the presence of external influences, they fall back to this state of static balance. The stable conditions are as far removed from the static balance as the static balance is from the attractors.
Basic water management:	Form of water management that aims at optimizing the water system on the basis of physical, chemical and economic criteria. A core concept in basic water management is control. Assumed is that damage can be prevented by good control of the physical and chemical processes in the system.
Complex adaptive system	A complex adaptive system displays the same fancifulness as the practice associated with integral projects. There is a question of non-linear dynamics, in which small changes can have large consequences. In this way, the behaviour of a complex adaptive system is often unpredictable, but even so, patterns are visible. These patterns in the system behaviour originate from the large quantity of known and unknown rules of behaviour that form the basis of a complex adaptive system. This sprouting of patterns is designated as the concept of emergence. This means that “the whole is more than the sum of the parts”.
Complexity (theory):	A theory in which the practice of complex projects is not idealized, but is described as a complex adaptive system.
Context:	The context includes the processes and interests of the existing inhabitants of both the spatial and social environments of the system, as well as the political processes and interests.
Contextual water management:	Form of stormwater management. Contextual water management is not so much aimed at the optimization of the water system, but at making a contribution to an optimum living environment in which the values of water are utilized as far as possible. The interaction between the system and the context is not neglected or reduced, but is used to create an optimum living environment. However, this results in

	increasing management complexity.
Decision making process:	All activities employed by a stormwater manager in order to achieve stormwater goals, such as prevention of flooding and pollution. By employing activities the stormwater manager tries to influence other stakeholders and to liberate means for achieving his goals.
Functional water management:	Just as for basic water management, functional water management is aimed at the prevention of damage by controlling the system. But for this consideration is given to the context and possibilities will be sought in which to fit water. Optimization of the water system means here that the system is attuned as well as possible to the different functions of the system.
System:	System is the natural and man-made water system and the water chain, including all infrastructural constructions.

1 Introduction

1.1 Why ambition reflection

The success of an urban stormwater project depends not only on the technical, legal and economic feasibility. As least as important is whether the water manager is able to connect stormwater issues to the urban context or, in other words, 'urban dynamics'. This report is about the managers' ability to implement successfully stormwater measures in the urban context. It is an introspection of the urban stormwater manager in order to reflect on its attitude (goals, philosophy, perception and position). This report contains a description of the Ambition Reflection component in the ADSS and background information on the ideas and concepts on which this component is based.

Before *Ambition Reflection*, this component was called *Ambition Filter*, referring to its filtering property[1]. The component served as a filter, filtering BMP's the stormwater manager could implement successfully and which he could not, based on his attitude towards urban dynamics. Although the attitude of the stormwater manager is a decisive factor of successful implementation, depicting linear connections between attitudes and BMP's would be too simple. The aim of this component is to challenge the user of the ADSS to reflect on its own attitude towards stormwater management in relation to urban dynamics. Therefore, there will be no ambitious filter.

Starting point of Ambition Reflection is that the user reflects, not the ADSS. The ADSS only offers a framework for reflection. In a same way as the ADSS does not have to 'know' the user's problem to give well-structured information to support the user in finding the answer. This is a very basic principle of the ADSS.

Compared with other components of the ADSS, Ambition Reflection is more theoretical and abstract. Therefore it may come across as being vague and less important. Our

[1] It has been changed into ambition reflection since the position of the component in the flowchart changed from the top to the bottom which made 'reflection' more appropriate.

goal is to cut out the theory as much as possible and to make it as concrete as possible. Therefore a lot of illustrative examples will be included in Hydropolis.

In the Ambition Reflection component the concept of three attitudes of the water manager plays a central role. These attitudes, elaborated in the following chapter are based on the field experiences of Tauw and on the analyses of the questionnaires filled in by the core end users (CEU's) of DayWater. In the description of the three attitudes use is made of the aspects theory which is presented in Deliverable 3.3 in more detail. Besides this, in this report use is made of concepts from the complexity theory (i.e. attractors, transition and adaptation), as coping with complexity is one of the basic characteristics of the archetypes.

1.2 Problems in four quadrants

The four quadrants model of Christensen (figure 1.1) helps to distinguish different ways the ADSS supports the user. The four quadrants represent four ways of dealing with uncertainty regarding the clarity of objectives and/or means. Referring this figure, the ADSS supports in two ways. First of all, it provides information to reduce uncertainty (i.e. means: long term effect of stormwater infiltration on porous pavement). This new information may lead to a shift from one quadrant (innovation) to another (modelling). However, this is not all! Some uncertainties cannot be reduced by information; these uncertainties have to be dealt with. The ADSS also provides information to the user *how* to deal with uncertainty in all four quadrants. This information is rather important, for engineers tend to solve all problems as if they are first quadrant problems (no uncertainties). This is what Christensen calls premature implementation and premature consensus. The four quadrants are just one way to categorise problems, as there are many more. The Ambition Reflection component supports in the second way; it helps the water manager to reflect on his attitude towards uncertainties regarding context or – more precise – regarding urban dynamics.

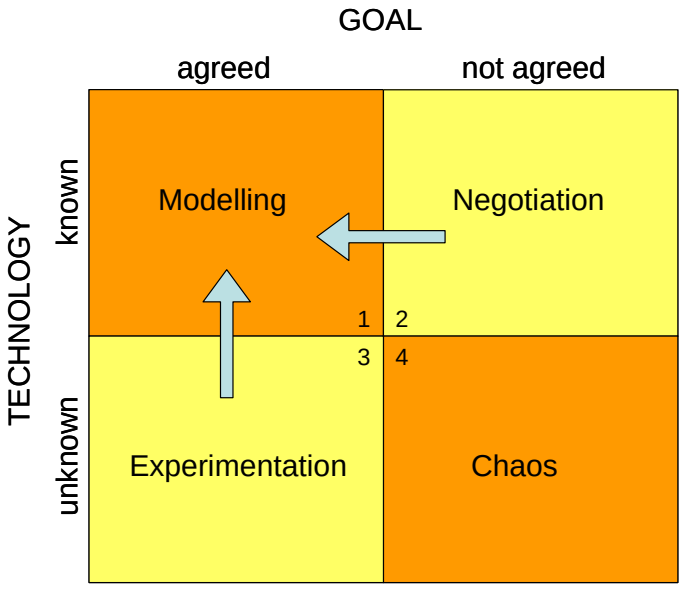


Figure 1.1 Problems in four quadrants from 'Coping with uncertainty in planning' by Christensen (1985).

2 Three attitudes in USWM

2.1 System and context

Water management can be characterized on the basis of the difference between *system* and *context*, and by the manner in which it deals with the interaction between these two. All attitudes of water management are aimed at the system in the first instance. System is understood to mean the natural and man-made water system and the water chain, including all infrastructural constructions. It includes everything the urban stormwater manager is responsible for.

The context includes both the spatial environment as well as the social environment, including interests of inhabitants and political processes. Core concepts are environmental planning and society; both determining factors for the manner in which the system is designed. Both are also determining factors for the way in which water management is organised. The separation between system and context is somewhat arbitrary. In reality, the system is interwoven with its context; they are inseparably bound up with each other and there is a strong interaction between them.

The basic assumption of this report is that water management can be characterized by the way in which the complexity of the interaction between system and context is dealt with. The experiences of Tauw and analyses of the questionnaires have resulted in three attitudes towards USWM being distinguished, all three being characterized as attractors:

1. Basic water management;
2. Functional water management;
3. Contextual water management.

In Figure 2.1 the system is sketched with the context for the three attitudes of the water manager. For basic water management the water management is directed inward. An attempt is made to optimize the water system to minimize any inconvenience at the boundaries of the system being managed. In this attitude the interaction between system and context is minimized. Functional water management makes connections with the context by freezing the context in functions (such as ecology, nature and recreation). The aim of functional water management is to integrate the system as well as possible within the defined functions. There is a question of unilateral influencing of the system by the context. Contextual water management, on the other hand, really confronts the context. The context is not frozen in functions, but the continuous interaction between system and context plays a central role. And it is in this interaction that source control can be implemented successfully. In the following sections, these three archetypes are further worked out.

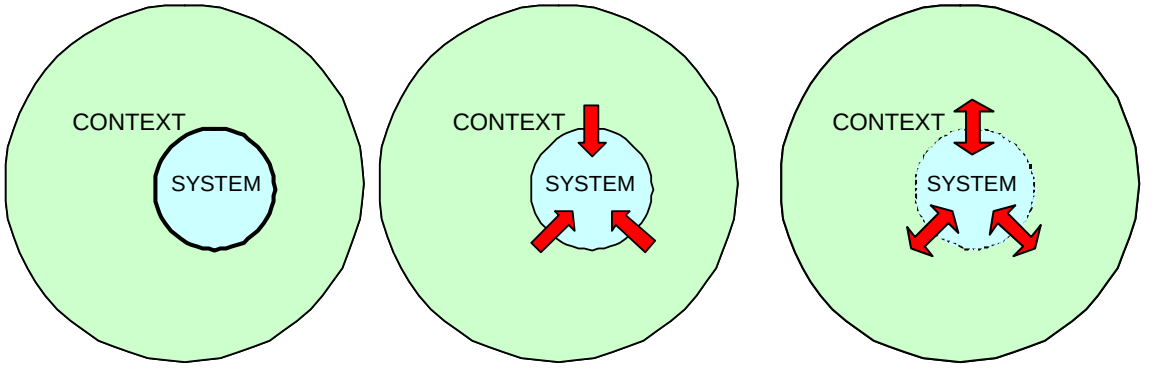


Figure 2.1 Interaction between the system consisting of water system and water chain and the context. Basic water management hardly experiences any interaction between system and context. For functional water management there is a question of one-way traffic and for contextual water management of actual interaction.

Different aspects of water receive recognition in the context, water has value for society. The values of water become visible not in the system, but in the interaction with the context. The quantitative values of water are therefore strongly linked together to the extent to which the water partners succeed in allocating a place in the water management to this interaction. In de following sections, fifteen aspects describe in more detail the three attitudes towards USWM.

2.2 Basic stormwater management

Basic water management aims at optimizing the water system on the basis of physical, chemical and economic criteria. The objective is the prevention of damage. A core concept in basic water management, therefore, is control. Damage can be prevented by good control of the physical and chemical processes in the system. The water system is seen as an independent system; there is hardly any consideration given to the interaction between the system and the context. The context is only that in which the water system is imbedded. The advantage of this way of thinking is that it results in relatively simple, normative water management. Optimization of the water system takes place on the basis of uniform standards. A disadvantage of this simplification is that alienation arises between the 'optimized' water system and its context. In the wider relationship, the optimum system can prove to be sub-optimal, in which values of water remain unutilized.

2.2.1 Aspects of basic water management

In Table 2.1 the characteristics of basic water management are described seen through fifteen aspects.

Table 2.1 Basic water management, seen through fifteen aspects.

Aspect	Characteristics
Pistic	There is a strong belief in the makability of the water system. With sufficient insight into the technological and chemical relationships, the water system can be checked and controlled.
Moral	The aim of the water partners is to optimize the water system. Water systems are approached as control systems that can be adjusted on the basis of design standards. The core concept is control. Water management is problem-driven, for which strong action is taken. The relationship between system and context is not taken into account.

Aspect	Characteristics
Legal	The regulations are based on standards and are aimed at preventing damage and dangerous situations. The water partners act in accordance with the legally determined responsibilities and authority. Tasks in water management are precisely divided.
Aesthetic	For urban water management the aesthetic aspect plays little or no role. This is left completely to the urban planner, with the proviso that the functionality of the water system will not be affected. For constructions sometimes an architect is involved in the design phase.
Economic	Attention is aimed primarily at the prevention of damage. In rural areas the main consideration is the minimizing of yield depressions. In municipal areas “water in the street” is prevented and water quality measures are taken when fish mortality occurs after an overflow from the sewers. The optimization of systems in terms of the cost plays an important role. In new housing development areas an attempt is made to produce a design with minimum dimensions for water flows, so that the available ground and the associated financial benefits can be maximized. The functions of water may be taken up in the margins.
Social	Generally, complaints initiate action. These can be complaints about smell, accessibility, water and damp nuisance, etc. Professionals communicate with professionals in the language of the civil engineer, with concepts such as levels, flow rates, field capacity, storage coefficient, pumping over-capacity, etc. Harmonization with other policy areas is achieved by means of agreements in policy plans.
Linguistic	The water system is described with the aid of quantitative variables and mathematical comparisons. The greatest possible objectivity is striven for, so that there is no ambiguity.
Historical	There is little historical consciousness. But - unconsciously - respect for values from the past, which results in resistance to change.
Logical	The treatment of the water partner is based on linear cause-effect relationships in the physical, chemical and biological processes. Insight into these relationships is obtained by analysing the water system.
Psychological	Nuisance, inconvenience and danger as input for water management.
Biotic	Inspection, control of plants - such as duckweed and water lilies - and animals - such as musk rats - by regular maintenance.
Physical	Inspection and control of flow rates, water levels and water quality.
Kinematic	Flow of water, ice, sediment and materials as important assessment values for water management.
Spatial	Storage of water within the existing water system, technical storage. Often juggling with space. Measures often have an end-of-pipe character. In new districts the ground to be released is maximized, in existing areas water management follows the environmental planning.
Arithmetic	Inspection and control of the system takes place on the basis of numbers, because of their assumed objectivity and unambiguousness. Water in, water out (m^3 and levels) and quantities of material.

2.2.2 Characteristics of the process; static approach

The core concept within the management process of basic water management is *control*. This control is designed in a cyclic process in three steps and is shown schematically in Figure 4.2.

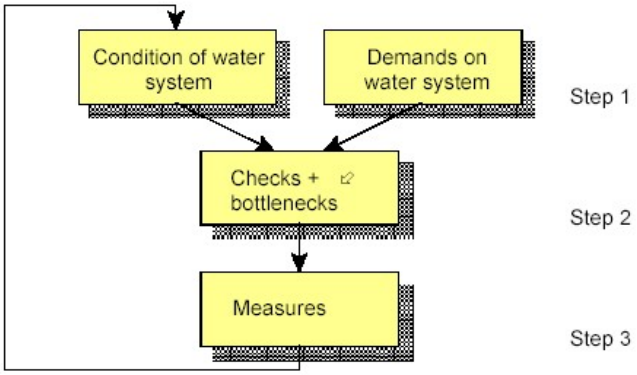


Figure 2.2 Schematic diagram of basic water management process.

The starting point of the process is assumption that the water system can be controlled by establishing requirements and checking the water system against these requirements. The first step is to picture the condition of the water system and the requirements which must be satisfied. In the second step, the condition of the water system is checked against the requirements for the water system. For this, computer models are used. Complex relationships in the water system are translated into calculation models with relatively simple linear relationships between variables, such as oxygen content and nutrient content. By checking the existing condition against the desired condition (the requirements), bottlenecks are revealed. The third step is a logical continuation. Measures must be taken to resolve the bottlenecks. Modifications to the water system are proposed or maintenance measures are taken. Packages of measures are subsequently optimized, mostly in terms of costs. After the third step the first step is repeated, and so on.

In practice it is found that in the management process the focus of the water system is displaced to the model, so that the water system is observed ‘at a distance’ and is greatly simplified in the process. The water system is changed into a mathematical comparison with variables, parameters and boundary conditions. For step two in the process, checking and the determination of bottlenecks, this displacement of attention leads to undesirable situations. Valkman (2001) shows that a similar normative and model-aimed approach leads, consciously or unconsciously, to manipulative action in order to optimize the model in instead of the actual water system. The consequences will be visible when the measures are implemented. In many cases these measures conflict with the complex social processes. As a result these measures do not in the least solve the problem within its context.

2.2.3 Attractor around basic measures and the prevention of damage

In describing the attractor, the financial aspect plays an important role. A characteristic mechanism of basic water management can be expressed in the form of a causal relationship diagram. This is shown in Figure 2.4. A causal relationship diagram consists of variables connected by arrows. A plus sign means that when the one variable increases, the other also increases. A minus sign means that when the one system variable increases, the other decreases. In the figure financial sources for water projects form the basis.

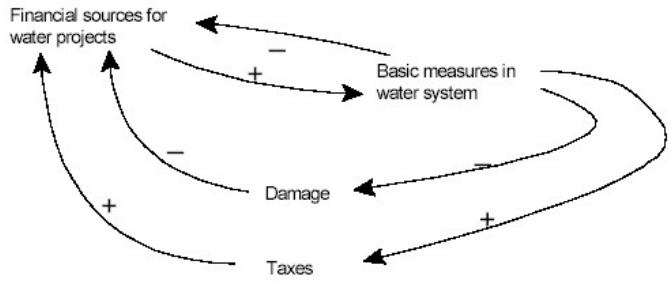


Figure 2.3 Causal-relationship diagram for the basic attractor.

The more financial sources available, the more measures can be taken. In the figure, reference is made to basic measures for water management (i.e. the construction of mills and weirs, the excavation of water courses, the installation of drainage, the construction of sewers and the building of a sewage water purification plant). The better the measures, the less damage will be done. The more damage, the more money will be expended on the repair of the damage. As a result fewer financial sources will be available for water measures.

2.3 Functional water management

As for basic water management, the subject of functional water management is damage prevention. However, consideration is given to the urban environment and how to fit in water. There is a question of one-sided influencing of the system by the context. In order to fit this context into the system, functions are derived. Optimization of the water system means here that the system is attuned as well as possible to the different functions of the system. The advantage of functional water management is that there is a question of attuning the water system to social needs. Functional water management also contains the principle of control. The various functions result in a more differentiated, but still normative, way of managing the water system.

2.3.1 Aspects of functional water management

Functional water management offers enrichment in comparison with basic water management. More attention is paid to what others – the non-water professionals – want to do with water. Water can be used for swimming and sailing, it provides conditions for plants and animals, and so on. The gap between the system and the context is bridged. Only, there still is a question of one-way traffic. In Table 2.2, the characteristics of functional water management are listed for each aspect.

Table 2.2 Functional water management seen through fifteen aspects

Aspect	Characteristics
Pistic	Although there is still a strong belief in the makability of the water system, there is more concern for complex relationships. The aim is optimization of the water system through better

Aspect	Characteristics
	harmonization with requirements and boundary conditions from the physical and social context
Moral	The prevailing ethics are those of utilitarianism (minimize pain, maximize enjoyment). Water systems must be functional. Integralness gains substance with the aid of multi-criteria analyses. Water system is optimized mainly to achieve hydrological objectives. Uncertainties are minimized.
Legal	In regulations, account is taken of various user functions of water, resulting in diversity in standards. On the basis of the functions, various requirements are determined with respect to depth, flow, water quality, linked surfaces, etc.
Aesthetic	Water as municipal soft furnishings, however now having more relationship with design. Designers have much influence. Design must fit with function (form follows function).
Economic	Economic considerations are central to considerations (costs and benefits are carefully set out against each other). Economic equilibrium. Customer is always right. Proceeds from fishing, sailing, recreation, experience, increased house prices, professional pace, etc. also count. Also, natural values are appreciated. Management is more complicated and more expensive.
Social	Different social actors represent different social interests. Actors have needs and set requirements and boundary conditions. Water and society are bound up with each other on a functional basis. Inhabitants are more sharply in focus. Effort is deployed on changes in use, not on changes in behaviour. However, changes in behaviour do occur. Interdisciplinary collaboration, whereby persons with different professions understand each other's language to an increasing degree. In discussion with other actors, the professionals determine the boundaries for the discussion.
Linguistic	Functions related to water accommodate a large diversity of social interests and needs. When the interests and needs of society are translated into functions, the water partner speaks in his mother tongue: in standards.
Historical	There is little historical understanding. When things are being considered, the starting point is today and tomorrow. Measures are taken on a rational basis. Historical values play a part if they are actually introduced as a real concern (for example by urban archaeologists).
Logical	The actions of the water partner are based on the allocation of functions in accordance with an analysis of the desires of society.
Psychological	Control will be exercised on the basis of both positive and negative stimuli (characteristic of utilitarianism). Positive appreciation, such as “walking beside water brings happiness” is taken into account. Attractive water is also appreciated.
Biotic	Attention for bank zones and the influence of groundwater levels on animal life. The intrinsic value of plants and animals is recognized. Vulnerable functions, such as natural function and drinking water function are coupled.
Physical	Checking and controlling flow rates, water levels and water quality on the basis of functional requirements.
Kinematic	Flow of water, sediment and materials as important assessment values for water management. At the same time, Dynamics in the numbers of plants and animals and in economic developments are considered.
Spatial	Water not only follows environmental planning, but there are also requirements determined for spatial development on the basis of water considerations.
Arithmetic	Inspection and control of the system takes place on the basis of numbers, because of their assumed objectivity and unambiguousness.

2.3.2 Characteristics of the process; Frozen dynamism

Essential for the process of functional water management is the involvement of a large number of actors for the realization of water plans or reconstruction plans, in which water plays an important role. Many people may take part in a discussion concerning what the water system should look like. The requirements placed on the water system do not any more come exclusively from handbooks, but are derived from functions that society ascribes to the water.

A characteristic process in functional water management is shown globally in Figure 2.6. The structure of basic water management can still be clearly recognised. However,

something has been added. In an interactive process, the water partners establish the functions of the water system (step 1). The degree of interaction can thus differ considerably. Sometimes an intensive process with inhabitants will be organised, sometimes the interaction remains limited to harmonization with other plans and the possibility for third parties to have a say.

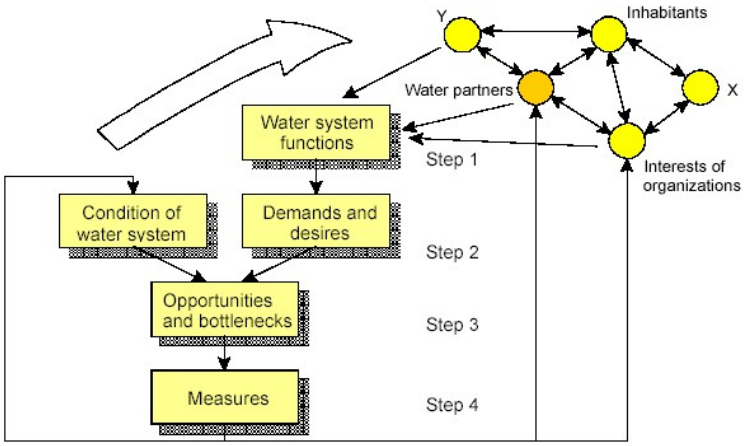


Figure 2.4 Schematic diagram of functional water management process.

The requirements for the water system are established on the basis of the functions (step 2). If the function ‘water for swimming’ is allocated to a part of the surface water, then that demands a high water quality. At the same time, users may formulate desires, for example concerning the layout of the banks.

For what follows, functional water management is very much like basic water management, with this difference, that consideration is given not only to bottlenecks but also to opportunities. The need for water offers the water partners possibilities to get their own ideas for water placed higher on the political agenda. Also, the way in which feedback takes place is more extensive. The measures taken are fed back to the actors involved in the process. These then observe the condition of the water system for themselves.

Characteristic of functional water management is that the actors involved may certainly be involved in discussions concerning what needs to be done. However, the discussion is limited to water issues. In residential areas, where residents and companies are involved, that comes across as being very bureaucratic and people often cannot say what they feel they need to say. It is possible that many times in a year inhabitants are invited to participate in a discussion about one specific subject, as each discussion is organised by different compartments of a municipality. In the case of functional water management it seems to be difficult to make a connection. However, compared with basic water management, the communication is much richer (more aspects are addressed).

2.3.3 Functional Management Attractor

The attractor associated with functional water management includes an important expansion of the basic attractor. The water infrastructure is now not only equipped to prevent damage but now also has value, for example, for nature and recreation, see Figure 2.7.

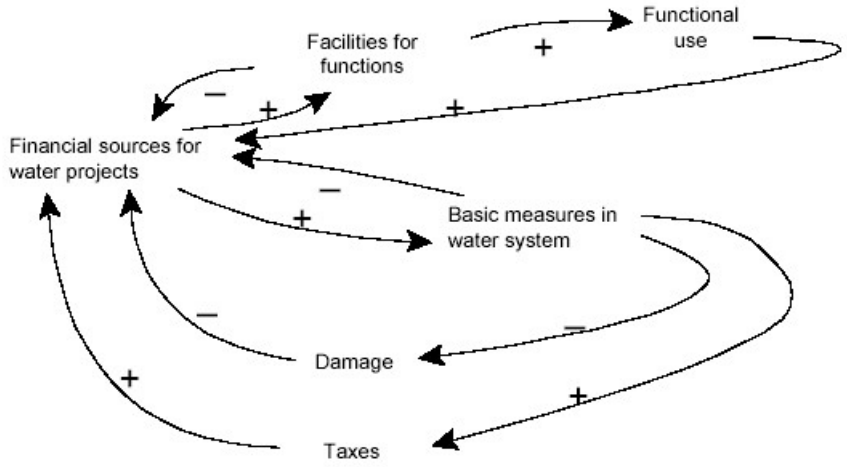


Figure 2.5 Causal relationship diagram for the functional water management attractor.

Money is withdrawn from this attractor for the purposes of realizing facilities, so that good functional use is possible. For this it can, among other things, be used to improve the quality of the water so that it can be used for swimming, to construct nature-friendly banks and fishing places, the construction of landing places and dredging deeper than is strictly necessary for the drainage of water. The better the facilities, the more the functional use. Through functional use, new possibilities for financing are created. It happens more frequently that water-related projects are financed by a large group of actors, including waterboard, municipality, private individuals, foundations, the leisure industry, the housing association, etc.

2.4 Contextual water management

For contextual water management, the interaction between the system and the context are central. In this, the water partners play a social game in order to make the best possible use of the opportunities and possibilities of water. Contextual water management is not so much aimed at the optimization of the water system, but at making a contribution to optimise the living environment in which the values of water are utilized as far as possible. The interaction between the system and the context is not neglected or reduced, but is used to optimise the urban environment. However, this results in increasing management complexity. With the involvement of other municipal issues, uncertainty is introduced. These uncertainties are not only to be considered negative, they also offer the possibility to develop new creative solutions and to generate wide enthusiasm. In order to cope with this complexity and uncertainty in a good way, the management process of contextual water management is equipped in

accordance with the principle of Interactive Implementation. Deliverable 3.3 describes the concept of Interactive Implementation. This report addresses the bottlenecks mentioned above (and others) and how to deal with these issues.

2.4.1 Aspects of contextual water management

In Table 2.3, the different characteristics of contextual water management are described for each aspect. In this form of water management, an attempt is made to achieve maximum utilization of the values of water by unlocking all aspects.

Table 2.3 Contextual water management, seen through fifteen aspects

Aspect	Characteristics
Pistic	Processes in water management comply with the laws of non-linear dynamism and demand a management strategy other than that based on the makability principle.
Moral	In addition to utilitarianism, there is also space for other ideas concerning ethics. More pluriformity, accepting that different persons can have different views. The core concept is interaction and thus there is more space for uncertainty.
Legal	Regulations which lead to a stimulating operation in instead of restricting operation. Legal possibilities are provided to build bridges between policy areas and to make collaboration over authorities possible.
Aesthetic	More collaboration between designers and managers, resulting in a unique design that fits in the surroundings.
Economic	Economic considerations are still of considerable importance for consideration (costs and benefits are carefully set out against each other). In addition to financial benefits, other values are actively taken into account in the decision-making process. Proceeds from fishing, sailing, recreation, experience, increased house prices, professional pace, etc. also count. Natural values are also appreciated. Maintenance receives a lot of attention. Less economic equilibrium, now also looking at macro-economic principles, such as: aura from the town, pride of the residents, the value of culture, the value of traffic cunning, etc. More costs, but also more financial domains.
Social	Different social actors still continue to represent different social interests, however there is less control based on interests and more on what various actors have to offer each other. Control is based on trust and mutual dependence. Concepts such as joint responsibility and involvement are important. Much attention is paid to education. In addition to interdisciplinary collaboration, there is also trans-disciplinary collaboration (connection between science and practice). People with different professions understand each other's language. In addition, water partners are able to contact inhabitants and companies
Linguistic	The wide recognition of all aspects of water demands a redefinition of concepts such as *water quality* etc. Language and communication are revived.
Historical	Historical values play an important role. Values of water are anchored as firmly as possible in culture (rituals, heroes and symbols).
Logical	The actions of the water manager are based on non-linear dynamics in the relationship between the system and the context.
Psychological	Control is exercised on the basis of both positive and negative stimuli (characteristic of utilitarianism). Positive appreciation, such as “walking beside water brings happiness” is taken into account. Much consideration for the diversity and identity of the living environment as a whole, in which water is built-in.
Biotic	Functional orientation continues to be important. The resilience of ecological systems is now of considerable importance. Attention is paid to spontaneity and self-organization. The town as a whole is an ecosystem.
Physical	Complex non-linear dynamics is the starting point for taking measures in relation to the water system.
Kinematic	Flow of water, sediment and materials as important assessment values for water management. At the same time have an eye for dynamics in the numbers of plants and animals, in social systems and in ideas and opinions is considered. Panta Rhei, the right moment.
Spatial	Space for other ideas, space for water, space for resilience. More consciousness of different scale levels and the operation of time.
Arithmetic	Water in, water out (m^3 and levels) and quantities of material. At the same time, numbers of

Aspect	Characteristics
	plants and animals. Attention for the numbers of actors and the numbers of opinions.

2.4.2 Characteristics of the process

Integral plans are – relatively – simple to make. Carrying out integral plans is more inconvenient. Not only finding financial resources, but also the possible resistances that remained outside the picture during plan formation can be a problem. Particularly for subjects such as combating diffuse sources demands the – voluntary – cooperation of many actors. This cooperation does not occur as a matter of course!

In practice, employees of water boards have the experience that it is difficult to fully maintain the water paragraph in new housing development and renewal plans. Water can be brought in successful in the early phases of the plan formation, however it often happens that surface water within the plan is scrapped or minimized when the plan is further developed: “Water is too expensive”.

All these observations make it necessary to unlock the aspects of water over the full spectrum and make use of the values of water. In order to reach this, there must be a place in water management for the interaction between the system and the context. After all, this is where the unlocking of the aspects takes place. However, the interaction with society is complex. Unpredictable behaviour and uncertainties make their entry into water management. Contextual water management, in the form of Interactive Implementation, provides building blocks that make it possible to cope with this complexity and uncertainty in water management.

2.4.3 Attractor of contextual water management

The third attractor is again an expansion. The basic measures for water management and functional use remain in existence. A mechanism has been added.

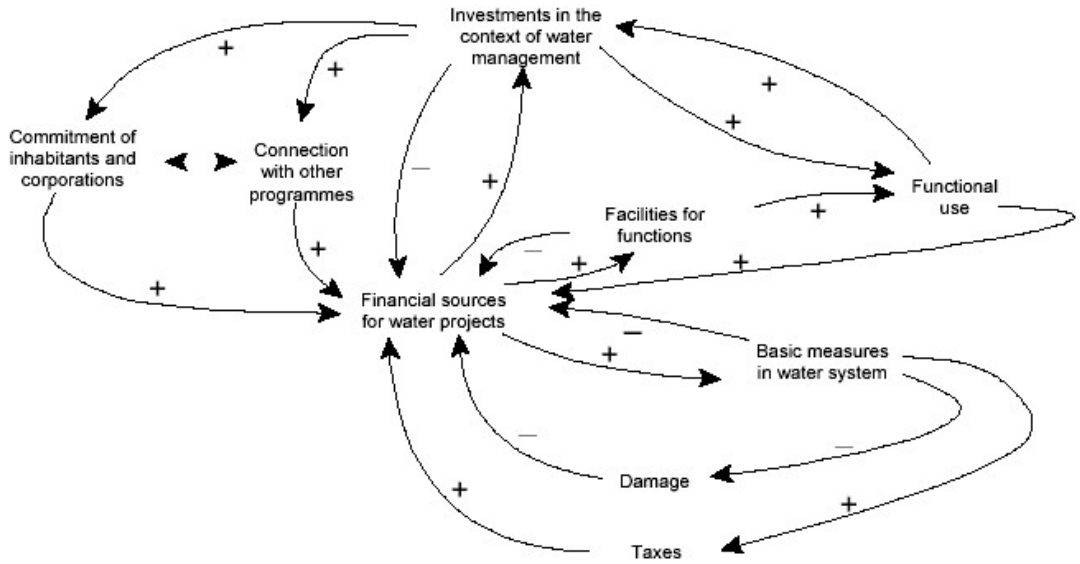


Figure 2.6 Causal-relationship diagram for the contextual water management attractor

In the contextual water management attractor a connection is made between water and other themes in the living environment, such as social safety, parking problems, noise pollution and street litter. The water partner plays the game with other actors and has, as an important trump card, control of the water. The values that water has for other policy fields may result in extra financial sources for water projects. Beside this, the involvement of inhabitants and companies make politicians eager to invest in water projects.

Table 2.4 Characteristics of three forms of water management

Characterization	**Basic water management**	**Functional water management**	**Contextual water management**
Objectives	- Aimed at optimizing the water system on the basis of physical, chemical and economic criteria - Primarily aimed at preventing damage	- Aimed at optimizing the water system on the basis of the functions defined by the context - Aimed at preventing damage and making use of the possibilities and opportunities for water	- Aimed at optimizing the living environment by making use, as far as possible, of the values of water in both the system and the context - Aimed at preventing damage and making use of possibilities and opportunities for both water and other areas
Relationship system/context	- No interaction between system and context. Water managers take no account of the context	- Unilateral influencing of the system by the context. Water partners are 'sensitive' to the context	- Interaction between system and context. Water partners are interested in the context
Dealing with complexity	- Neglect of complexity	- Reduction of complexity	- Employment of complexity
Characterization of the management process	- Normative management	- Standard management, but standardization differentiated by various functions	- Adaptive management with Interactive Implementation as the management process
Position of water partner in society	- Autonomous water manager	- Water partners are driven by the Province, which also determines the functions	- Water manager as a party in the social play
Water partner involved in other policy areas (RO, traffic, environment)	- Water partners have a compliant attitude	- Water partners are reactive	- Water partners are pro-active and anticipate issues in the living environment
Advantages	- Management process is relatively simple - Easy communication between colleagues - Clear organizational structure - Normative character makes good legal anchoring possible	- Internal integration results in more coherence between the various aspects within the water system - Things are attuned to the social need - The water partners receive more social recognition	- Unlocking a wide spectrum of values, whereby not only the costs but also the proceeds are brought into the picture - Society is involved in water management and vice versa - Water manager obtains more diversified and more pleasurable work and a wider social recognition - More opportunities and possibilities for water projects. Water plans do not disappear into the cupboard, but are carried out - More profit from water projects for both the water system and the living environment - Enthusiasm for water measures originates in the interaction with practice
Disadvantages	- Not very stimulating - Water partner stands on the sidelines of the social discussion - The gap between water and society - Limits of the possible come in sight - The gap from the technician	- Neither fish nor fowl - Top down approach - Many plans are made, but only a few plans are actually carried out. - Coherence on paper appears often not to result in the achievement of integral solutions in practice - Tackling diffuse sources is difficult to get off the ground	- Greater uncertainty - Basic water management threatens to disappear from sight because to much attention is paid to carrying out 'attractive' projects

3 Strategy and transition

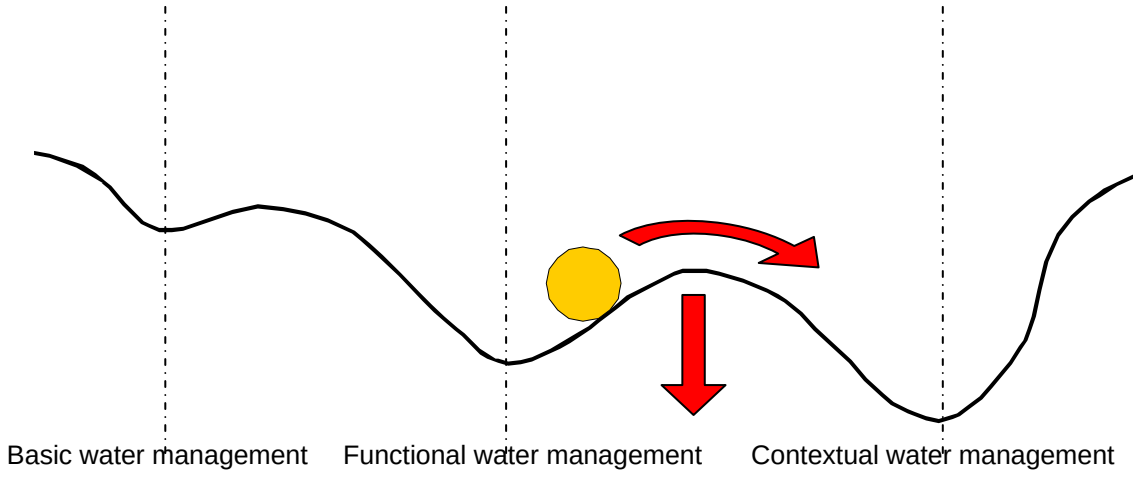
3.1 Ambition of the urban stormwater manager

For every water project the values of water can be identified, for example by using of the aspects introduced in D3.3. However, they only 'come to life' when they are brought into the right process. For that, it is important that the water partners reflect on the system and the context in relation to each other 'at a distance' and determine where they stand and where they wish to go. With functional water management, fewer values can be utilized than for contextual water management, although it requires an effort to make the transition. For this it also means that a development in the direction of contextual water management does not merely have advantages. In Table 2.4, several characteristics of the three forms of water management are shown, including advantages and disadvantages.

The values that are utilized and the form of water management chosen characterize the ambition of the water partners. It is good to reflect on the current position and if transition is needed and desired this section offers handles how to organise such a process.

3.2 Transition and changing attractors

The three archetypes of water management are attractors. In Europe, water management mostly find themselves in the field of attraction of functional water management (Deliverable 3.1). This results in problems in water management being dealt with mainly on the basis of the function of the water objectives, which are formulated in such a way as to end up with optimum packages of measures. The values of the third attractor are then still hardly utilized and the involvement of the inhabitants in their own living environment, in many cases, crumbles away. The need for an extra budget for maintenance and management in Dutch local authorities is increasing, while available budgets for this are decreasing.



Figuur 3.1 A fold diagram in which three attractors represent three archetypes in water management. A transition is needed to take the hump to another attractor.

The operation of attractors and the translation processes can be represented in a fold diagram. In order to get from one attractor to the other, a hump must be taken. The position of the ball in Figure 3.1 indicates possible positions of water management. In some countries activities are taking place that actually touch on the ideas behind contextual water management. However the hump has not yet been overcome, but the ball is moving. For attractor changing, a lot of energy is required. If measures in the direction of a new attractor do not have the *critical mass* that is necessary to get over the hump, then the ball can roll back to the original position. However, luckily the folded landscape is not a static landscape. The form varies.

How can the ball get over the second hump in the folded landscape? The answer is Interactive Implementation (see D3.3). The working method that is characteristic of contextual water management also offers the building blocks for getting through the process of change. By doing, the ball gains speed. However, Interactive Implementation gives the ball not only speed, but also simultaneously contributes to these changes in the context by, for example, good – fair – communication. In this way the hump will be smaller. In addition, there are measures that are aimed solely at changing the context, such as financial stimulus, adjustment of regulations, emphasis on the interaction between technology and society in water training courses, etc. However, with Interactive Implementation transition is not a matter of course. Characteristic for a transition process remains the birth of resistances, also for Interactive Implementation. These resistances characterize a healthy process; it therefore is important to recognize the resistances and to deal with them.

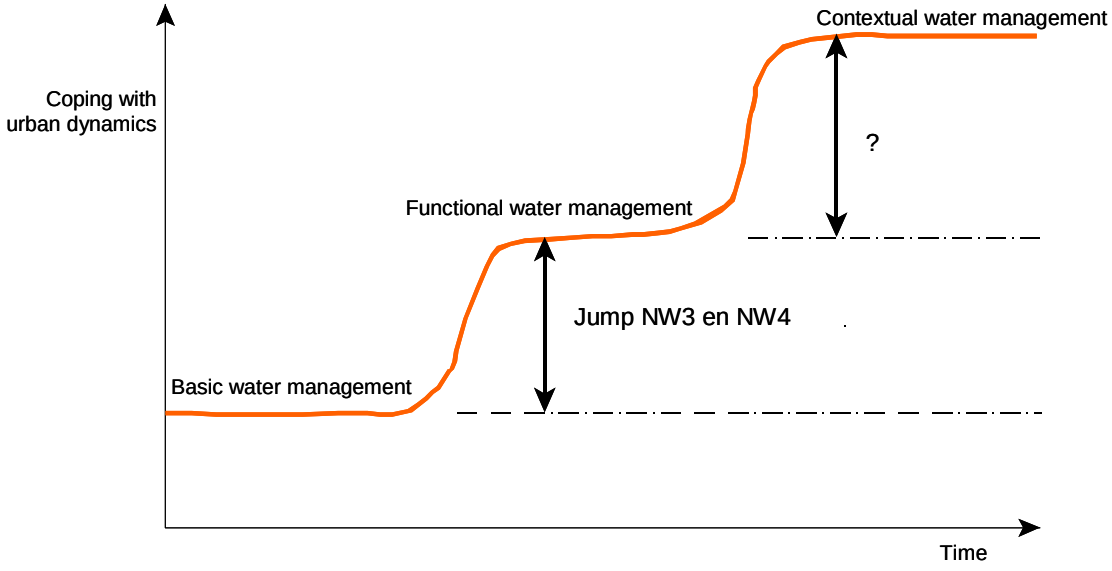
Going through a process of change is not simple. If the ball comes to a stop, it can roll back. Constant pressure must be maintained. In practice this means that choices must be made.

A final indication for the transition is aimed at the complexity of integral environment projects. In a good transition process the complexity of integral urban projects is not disputed, but is made manageable. For this, more attention is paid to the problem; not to reduce, but to extend. Water is not seen as a separate field but as a component of the living environment, in which people pay particular attention to subjects such as floating debris, social danger, traffic obstacles and young people hanging about. The process of utilizing complexity includes, among other things, the following four characteristics. (1) No attempt is made to find solutions that can be applied generically, but a search is made for the differences between areas and opportunities that arise because of these differences. “Dare to be inconsistent”, say Tops and Weterings (1999). (2) Conflicts are not avoided, but partly sought out. Running round like a scalded cat frustrates a design process, while “fighting out” a conflict clears the air. In better words: Through a process of negotiation, the feasible and the acceptable can be united with each other. (3) The study will not be continued until all uncertainties are resolved, but construction will be started as quickly as possible. Experimental projects are carried out based on the principle of “learning by doing”. Complex projects are characterized by many structural uncertainties. These can only be resolved in practice. (4) More consideration is given to timing. In new housing projects it is possible to set up tight planning. In an existing urban area, where many processes take place at the same time, that is usually not possible. Success is achieved by acting at the right moment.

Dutch transition in jumps

Developments seldom take place gradually in the time. This also applies to water management. Sometimes practically no changes take place during a long period, while there are also periods in which change after change occurs in a turbulent manner. That has to do with the operation of attractors. Attractors ensure that complex systems, such as the whole combination of water system, water cycle and society, exhibit stable behaviour. A system will oppose change. That is a healthy characteristic, because otherwise there would be a question of continuous instability. At the moment that people develop “foreign system” thoughts concerning how water management in the Netherlands could be better designed, resistance arises. Because of this, many good and bad ideas never come to fruition. Only ideas that retain their force and thus exert an increasing influence in spite of resistance have a chance of actually being converted into action. In this way it is possible that this results in a chain reaction of activities, by means of which the developments suddenly go quickly. However, that need not happen.

Attractors are not consciously created, but organize themselves in a spontaneous manner (emergence). The effect of this is, however, considerable and therefore it is better to take account of it. A development in the history of water management is discernible, as shown in Figure 3.2. In these developments, the three forms of water management are discernible as attractors.



In this, the first attractor of basic water management represents the stable condition around water in the period up to the publication of the third Policy Document for water management (NW3), in which the concept of integral water management was formally laid down as a policy. In the attraction area of the basic attractor, the organization of water management is aimed primarily at the control of water, so that no damage occurs. The number of aspects of water that were taken into consideration were still limited in extent.

The second attractor - functional water management - represents the stable period after NW3 until now, for which more coherence has arrived between surface water and ground water and between water quality and water quantity. The functions that water must have and the measures that must be taken are being considered in order realize these functions in practice. In this way, water is particularly of service. Events that occurred in the second half of the 90s resulted in the attractor of functional use being shifted. After periods of extreme precipitation and high removal, water partners began to act more pro-actively. The concept “space for water” has taken over a valuable spot in the fifth Policy Document concerning Environmental Planning. The number of aspects that have been opened up within this attractor is considerably larger than for the basic attractor.

4 Ambition reflection in Hydropolis

4.1 Fingerprint of the urban stormwater manager

The goal of the fingerprint and ambition reflection in general is increasing the awareness of the stormwater manager that the attitude is a key factor in successfully implement stormwater measures. Implementation of source control measures demands a 'context sensitive' attitude, as source control find place in the capillary ends of the water system that are interwoven in the urban context. The fingerprint offers the opportunity to reflect on the user's attitude towards urban stormwater management by using the three archetypes of urban stormwater management, introduced in section 2. Subjects of reflection are goals, philosophy, attitude, perception and position of the urban stormwater manager.

The fingerprint is a tool that gives the user the opportunity to find out his attitude towards USWM related to urban dynamics.

Table 4.1 Questionnaire

	Basic USWM	**Functional USWM**	**Contextual USWM**
Objectives of USWM	USWM aims at optimizing the water system on the basis of physical, chemical and economic criteria. It primarily aims at preventing damage.	USWM aims at optimizing the water system on the basis of the functions defined by society (nature, recreation, etc.). It aims at preventing damage and making use of the possibilities and opportunities of water.	USWM aims at optimizing the living environment by making use of the water system. It aims at preventing damage and makes use of possibilities and opportunities for both water and other fields of policy.
Dealing with uncertainty	In order to implement measures successfully the uncertainties have to be minimized by modelling technical and physical aspects of the water system. Uncertainties related to other aspects are less relevant and not taken into account. Uncertainties block the implementation of new measures	Uncertainty can be minimized by modelling technical and physical aspects. Uncertainties related to other aspects are minimized by assigning well-defined functions to the water system. In order to implement measures the uncertainties have to be minimized. Uncertainties aggregate the implementation of alternative measures	It is impossible to reduce uncertainty and therefore has to be dealt with. Uncertainties do not thwart the implementation of alternative measures.
Communication with citizens	USWM is about optimising the water system.	Good information service is an important aspect of USWM in order to create public support.	Source control demands interaction with the living environment including citizens. Therefore public involvement is essential. However, public involvement is more than good information services only.
Willingness to negotiate	USWM has always been underexposed. There is minimal negotiation with other space demanding functions.	There are negotiations on functions assigned to the water system.	The USWM negotiates with other fields of policies in order to come up with solutions that are supported by many.
Involvement of other policy	The water system is	There is a strong	There is a strong

fields	already complex without the involvement of other fields of policy. Therefore USWM should focus on stormwater.	relationship between the water system and other policy fields. By allocating functions to the water system this relationship is formalized. Involvement of other policy fields is restricted to the definition and allocation of these functions to the water system.	relationship between the water system and other fields of policy. Continues interaction between USWM and other policy fields creates new possibilities and opportunities for both USWM as for other policy fields.
Philosophy of USWM	The core concept of USWM is control over the water system, damage can be prevented by good control of the physical and chemical processes in the water system.	The core concept of USWM is control over the water system. Optimization of the water system means that it meets as well as possible the different functions society has imposed on the water system.	The core concept of USWM is control of the water system with respect to its urban context. USWM not so much aims at optimizing the water system, but at making a contribution to an optimum living environment.
Attitude towards regulations and legislation	USWM should be based on clear and uniform standards to simplify uphold of regulations.	USWM should be based on clear standards, derived from the allocated functions.	USWM should be based on differentiated standards, which may cause complex uphold of regulations
Attitude towards source control	Source control is surrounded with uncertainties on legal, chemical and ecological aspects. These uncertainties have to be reduced in order to become a real alternative for traditional stormwater measures.	Source control measures offer new ways to deal with stormwater. Besides important advantages, source control also introduces side effects such as complex interaction with private stakeholders.	Source control measures offer new opportunity to restore the relationship between the water system and society.

4.2 Ambition reflection and other components

Ambition Reflection is not a ‘stand alone’ component in Hydropolis; it has a strong relation with the other components. The attitude of the urban water manager affects the choice of BMP’s, the way he deals i.e. with risks, uncertainty, regulations and urban dynamics. Everywhere he comes, he leaves behind his fingerprint. This section describes the way ambition reflection is related to other component in Hydropolis. On base of these connections the popups will be formulated and implemented.

4.3 Ambition reflection and popups

4.3.1 Popups in Hydropolis

Within Hydropolis the free mode stands for browsing through all functionalities without defining a project and without the tracking function. Within Hydropolis the guided mode guides the user through Hydropolis. In this mode the user can define a project and save some alternatives. In this mode, his actions are recorded. Recorded action may be visited pages, selected indicators, project definition (which is obvious), answers to questions, the time the user visited Hydropolis, the pages the user has not visited, etc. By means of popups and smart links the user is guided through Hydropolis. Both popups and smart links are not integrated in the backbone structure of the ADSS. Once the components of Hydropolis are ready and one can visit Hydropolis, the smart links

and popups can be implemented. However, this section describes some of the popups related to Ambition reflection. Popups contribute to a large extent in making Hydropolis user-friendly and – very important! – fun to use.

In general three types of popups can be distinguished in Hydropolis:

1. popups with advice without a direct cause;
2. popups with noncommittal advice provoked by one or more actions;
3. popups with steering advice provoked by one or more actions;

Table 4.2 Users' actions recorded in the ADSS

WP related	**Action**
General	Pages visited
	Pages not visited
	Duration of visit (specific page or Hydropolis)
	Viewed examples
	Q/A
	Project definition before entering Hydropolis
Ambition Reflection	Fingerprint of user
BMP database	Selected BMP's
Source and flux	??
Decision making process	??
Risk assessment	??

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Adaptive **D**ecision **S**upport **S**ystem (**ADSS**) for the Integration of Stormwater Source Control into Sustainable Urban Water Management Strategies

Table ??, Example popups database

	time1	time2	time3	Attitude USWM	Viewed Aspects	Viewed examples	Selected BMP	# visitors	New visitor	…	Popuptext
Popup1				Basic or functional			Infiltration on private area				The BMP you have selected demands public participation. Read more about public participation in Urban Dynamics (hyperlink)
Popup2			20								Screensaver
Popup3									x		A new visitor has entered Hydropolis!
Popup4	>60				0	0					Have a look in the Aspects of USWM, where you also can find a large number of examples
…											
…											

time1 = Duration of visit Hydropolis [minutes]

time2 = Duration of visit specific page [minutes]

time3 = Duration of no action [minutes]

Attitude USWM = Fingerprint of user [contextual, functional, basic]

Viewed aspects = Visited aspect page [0..10]

Selected BMP's = [Chosen categories of BMP's]

visitors = Number of visitors online [#]

New visitor = New visitor enters Hydropolis [# visitors + 1]