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Implementation of a different approach to sewer management

Développement d'une approche différente de la gestion des réseaux

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RESUME

Waternet est la première entreprise aux Pays-Bas à avoir incorporé l'ensemble des services concernant l'eau au sein d'une seule et unique société. Waternet a en effet en charge la gestion et la garantie de l'eau potable, du traitement des eaux usées, des eaux souterraines, des eaux de surface ainsi que la protection contre les inondations dans une vaste zone comprenant Amsterdam et sa région. Waternet est également responsable du système d'égouts d'Amsterdam intramuros (3800 km de longueur).

Durant les dernières années, Waternet a développé une nouvelle approche de gestion des égouts. Cette nouvelle approche distingue trois niveaux de contrôle : au niveau de la ville, au niveau des systèmes d'égouts et au niveau des canalisations. Une approche qui permet une meilleure stratégie pour la gestion des égouts à Amsterdam et qui permet de réagir rapidement aux nouveaux développements ruraux. Cette étude de cas montre les premiers résultats obtenus grâce à cette nouvelle approche ainsi que les défis de sa mise en œuvre.

ABSTRACT

Waternet is the first organisation in the Netherlands that is responsible for the management of the sewer system, drinking water, waste water treatment, groundwater, surface water as well as flood protection. The service area of Waternet covers for the majority of services a wide area in and around Amsterdam; the management of the sewer system is limited to the city of Amsterdam.

To improve efficiency, Waternet developed a new approach to sewer management. To develop a better management strategy, three levels of assessment were distinguished: the city level, the sewer systems level and the object level. Having a coherent strategy on all three levels enables the sewer manager, for example, to quickly react to new urban developments. This paper describes the first experiences with the implementation of this three level approach in a case study area.

KEYWORDS

Assessment, failure mechanism, sewer management, system levels, urban drainage

In what aspects does this case study:

Integrate stormwater?

The case study shows a method for assessing sewer systems. The functioning of the systems during stormwaters is one of the items within the assessment.

Has a sustainable approach?

The method of the article will be the guideline for sewer management for the next years.

Has a multi-actor approach?

Not relevant.

Is innovative?

The three level approach describes a new innovative method for assessment of sewer systems.

Is exemplary?

The case study is exemplary for the Amsterdam situation.

Is applicable to other projects?

The three level approach is primary developed for Amsterdam, but will be applicable for other municipalities.

Introduction

Waternet is the first organisation in the Netherlands that is responsible for the management of the sewer system, drinking water, waste water treatment, groundwater, surface water as well as flood protection. The service area of Waternet covers for the majority of services a wide area in and around Amsterdam; the management of the sewer system is limited to the city of Amsterdam.

To improve efficiency, Waternet developed a new approach to sewer management. To develop a better management strategy, three levels of assessment were distinguished: the city level, the sewer systems level and the object level. Having a coherent strategy on all three levels enables the sewer manager, for example, to quickly react to new urban developments. This paper describes the first experiences with the implementation of this three level approach in a case study area.

The three level approach

In the past 15-20 years Amsterdam has applied the integrated sewer system management as described in NEN EN 752. According to this standard, at a regular interval sewers are cleaned and inspected. Based on the sewer inspection results decisions are made which sewers need structural rehabilitation. In addition to that, sewer inspection results are also used for the prediction of the long term rehabilitation needs. This forecast showed that it is likely that sewer replacement will double in the next ten years.

Benchmarking among sewer system managers in the Netherlands made clear that Waternet puts much more effort in investigation (inspection). Nevertheless, other managers including Amsterdam claim to have a good understanding of the condition of the sewers. On top of that, a study into failure mechanisms concluded that sewer inspection is probably not the most effective investigation technique as settlement is the predominant failure mechanism. Investigating ground settlement and the functioning of the system would therefore be more effective than the assessment of the structural condition of objects.

As a result, the following questions raised within the Waternet organisation:

- Should Waternet continue collecting inspection data as this technique does not provide the necessary information?
- Will another approach be more effective and efficient?

To answer these questions, Waternet returned to the basic question of sewer management: "*What do we need to know to determine which sewers have to be repaired, renovated or replaced and what information is therefore required?*" Answering these questions led to the three level approach for sewer management.

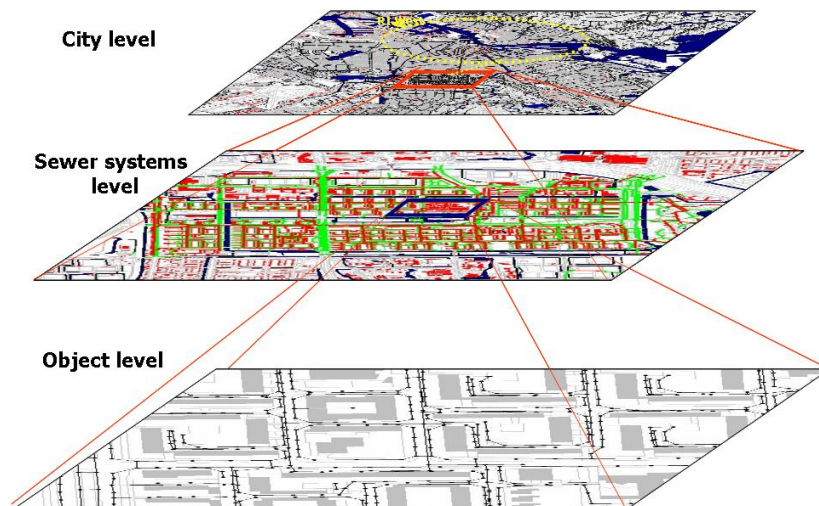


Figure 1: Three levels of assessment

Figure 1 gives a schematic representation of the tree levels of the approach. The three level approach is top-down and starts with a survey on city level (Baars et al. 2008).

1. City level:

Assessment on city level starts with a survey of the waste- and rainwater flows on the scale of the whole city. The focus of the city level assessment lies on the *interaction* of the sewer system with the water system:

- Where is wastewater produced and what is the best location for treatment?
- Is the treatment of rainwater in every situation necessary? Or is direct discharge to surface receiving water more efficient and effective?
- Does the transport and treatment of waste- and rainwater remain acceptable in relation to future developments considering the receiving surface water (environmental issues) and the capacity of the waste water treatment plant?

2. Sewer systems level:

For assessment on sewer systems level the *functional requirements* should be evaluated:

- Can the functional requirements (CSO spill frequency, street inundation, environmental impact of overflows) during rainfall be met?
- Is the transport of the baseflow guaranteed?
- Is the transport of wastewater to a treatment plant guaranteed?

3. Object level:

On the object level the *structural condition* is assessed:

- Is the water tightness of the object guaranteed?
- Is the structural integrity of the object acceptable?

The assessment on the three different levels must follow this order and can not be done separately as each lower level should fit within the framework of a higher level. An advantage of the three level approach is that when on a higher level the system does not meet the requirements, performance on a lower level does not need assessment. For example, when sewer pipes need to be enlarged in order to meet the requirements on systems level, these sewer pipes do not need to be assessed on object level.

Implementation of the three level approach

As described, the first step of the three level approach is the assessment on city level. This has been done recently and resulted in the redirection of all Amsterdam wastewater to a new waste water treatment plant in an industrial area outside of Amsterdam.

For assessment on the sewer systems level further implementation was required. Therefore a project was started, in which two sewer systems were selected as case studies. Central question was: *What aspects of the sewer system need to be analysed in order to check if the system functions properly?* For each of the functional requirements the following actions were done to answer this question:

1. Define the ideal (design) situation
2. Define the current situation
3. Determine the differences between the ideal and the current situation
4. Value the differences

This resulted in a list of aspects that needs assessment in order to verify if the functional requirements are met. After choosing a logical order, a detailed framework of steps to use for assessment of sewer systems in Amsterdam was created. Ultimately this framework can be used to determine which sewers need rehabilitation.

To show the added value of the three level approach, the first steps of the assessment on systems level will be described for a case study area. In line with the actions listed previously the ideal situation is defined first.

Figure 2 shows a map of the case study area. In this figure the borders of the area in the ideal situation are shown in purple. The ideal borders should fit logically within the geography, natural (surface water) and artificial (highway) borders, historic structure and future developments. Figure 2 also shows the most efficient location of the pumping station (middle of the area) and the main transport routes for the waste water are indicated. For this design the following considerations were taken into account:

- Are the water flows handled within the borders of the area?
- Are the transport routes as short as possible?
- Is the rainwater discharged to surface water with the least environmental impact and sufficient receiving capacity?

Next step is the description of the current situation. This situation is shown in figure 3. As can be seen, the pumping station is located at the north western corner of the area. To cross the canal in the south of the system siphons are used.

When comparing both figures a remarkable difference in the catchment area can be seen. The optimal catchment area of figure 2 is naturally bordered by surface water, whereas in figure 3 a border is present in the middle of a neighbourhood. Another difference between the two systems is the location of the pumping station and the length of the main transport sewers.

Because analysis of the functioning of the system indicated that the system does not function properly it was decided that the management strategy of this system should focus on the transition of the current system towards a more centralized design. Assessment of the objects in the system is postponed until it is decided which sewers also fit within the new design.

In comparison to the old method: sewer inspection defines rehabilitation needs, the three level

approach gives the opportunity to improve functioning on the long term.

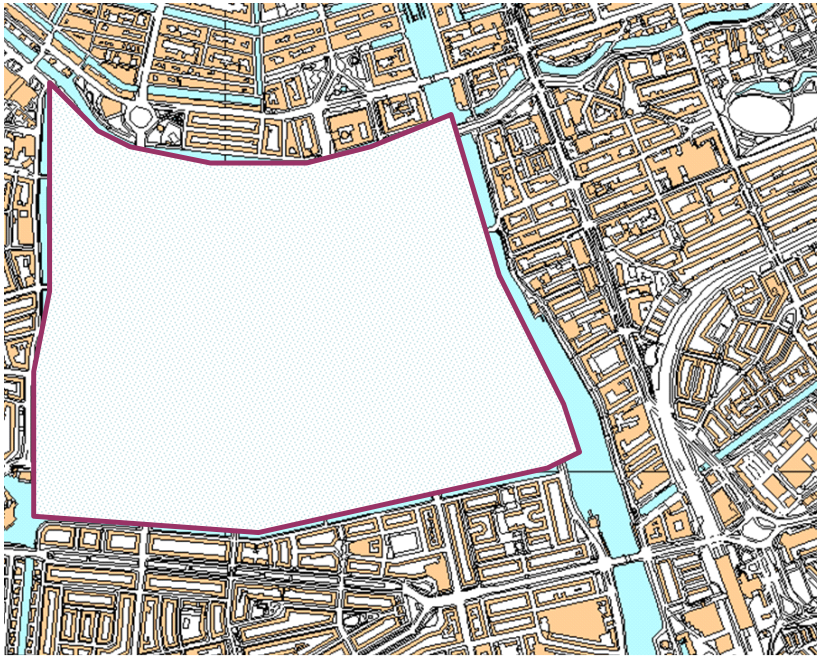


Figure 2: Logic catchment area and layout sewer system

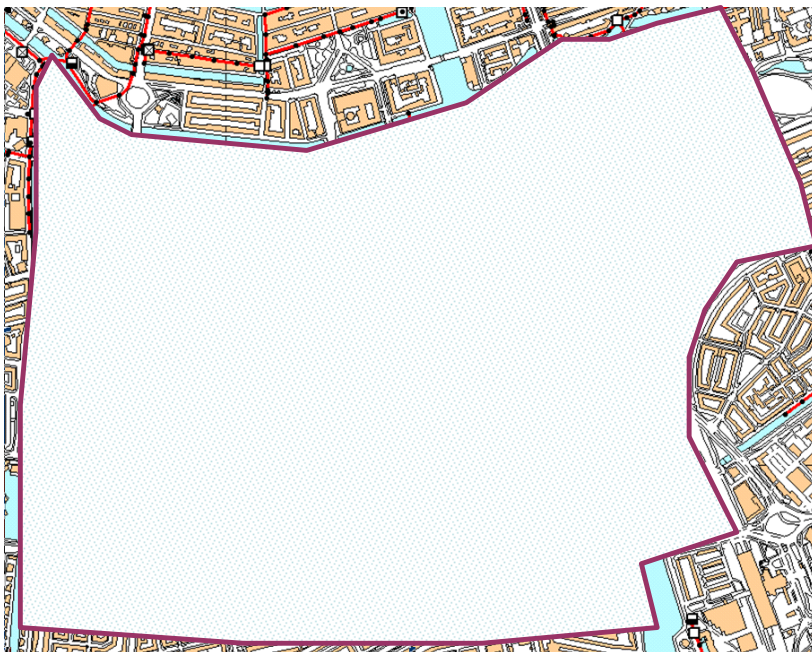


Figure 3: Current catchment area and layout sewer system

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