LIFE+ AERFIT LITHUANIA

aerfit
ADAPTATION EXTREME RAINFALL

Kaunas, Lithuania

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Contents

1. Introduction 3

2. Aerfit project 3

3. Preparation 4

4. Technology 5

5. Location 5

6. Implementation 6

7. Results 6

Annex 1. Workplan 7

Annex 2. Location 10

Annex 3. Photos of the project and work 11

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1. Introduction

In 2018 a LIFE+ subsidized project started in The Netherlands: Aerfit. The aim of the project was to demonstrate the working of the so-called FHVI technology, Fast High Volume Infiltration, in the urban environment. FHVI is developed as a reaction to climate change. One of the consequences of climate change is unpredictable high volumes of rainfall during the year. The existing sewer systems are not designed to cope with this problem. FHVI can, in many situations, solve the problem of overflooding sewer systems and stagnant water, sometimes diluted waste water, on the streets. FHVI is able to infiltrate the water very rapidly into the underground. The technology infiltrates the water into deeper permeable soil layers. This way, a higher capacity can be reached than with infiltration that uses only gravity as the driving force.

2. Aerfit project

The Aerfit project started in 2018. The idea was to demonstrate the FHVI technology for the problem of abundant rainwater in urban areas. The FHVI technology was already proven in other applications. The municipality of Apeldoorn became partner in the project. The demonstration includes 150 infiltration wells in different parts of the municipality. Besides an infiltration facility, also a pre-treatment method is developed. This resulted in the infiltration of rather clean (rain)water.

The overall goal of the project is the demonstration of FHVI as a climate adaptation solution that can be used throughout large parts of the EU. For that reason, there was already a demonstration in Germany included. An interesting opportunity arises by a demonstration in Lithuania. Parts of Lithuania can be compared with The Netherlands, with respect to the ground structure. That was the main reason to start the demonstration.

3. Preparation

Lithuania is reasonably comparable with the Netherlands. In many parts it has the same underground. Lithuania borders on the Baltic Sea. However, the (legal) environmental situations are different from the Dutch situation. Infiltration in the underground is not used yet. An important reason is that many people use groundwater as their drinking water supply. The authorities don't want any possible pollution in the underground water layers. For that reason, the regulations regarding water quality are very strict. In the Netherlands there are no strict quality rules for infiltration water. These rules will probably come in the future, but not up till now.

Nevertheless, there is a pretreatment step developed in the Aerfit project. This was to protect the infiltration facilities. Research shows that the quality of the infiltration water is very high as a result of the pretreatment. During the project in Lithuania, it has to be proven what quality can be obtained, and if that quality is good enough to apply. Perhaps the quality has to be upgraded. In that case also the projects in the Netherlands will benefit from that.

On April 27, 2023, Henk van Tongeren Water & Techniek (HvT) and Foundation O2Dit (O2Dit) were present on the annual meeting of the Hydrological society of Lithuania. A presentation was given about FHVI. The conclusion was that there was little doubt about the functioning of the technology, but a lot of concern about the quality of the water infiltrated into the underground. This is because many households in Lithuania withdraw water from the underground for their daily water supply. A pre-treatment is therefore a requirement.

On September 12-13, 2023, a mission was carried out by HvT and O2Dit to see if a pilot project in Lithuania was feasible. There were meetings with the Municipalities of Vilnius and Kaunas, and relevant institutes have been visited. The mission is concluded with site visits to possible locations. Overall, it could be stated that the possible clients were positive and were willing to give this technology a chance.

4. Technology

For the pilot plant in Lithuania the most up to date configuration of FHVI is chosen. So, the best practices have been taken from the Aerfit project. This includes the latest version of the pre-treatment facility.

5. Location

The project is realized at Domeikava Library (Kaunas, Lithuania) (see photo on the left). For this first project the choice is to solve the problem of abundant rainwater that flows from the roof. This will give a good idea of the functioning of the technology without disturbances of pollution of the street.

At the site of the Domeikava Library four FHVI wells with two pre-treatment facilities are realized.

6. Implementation

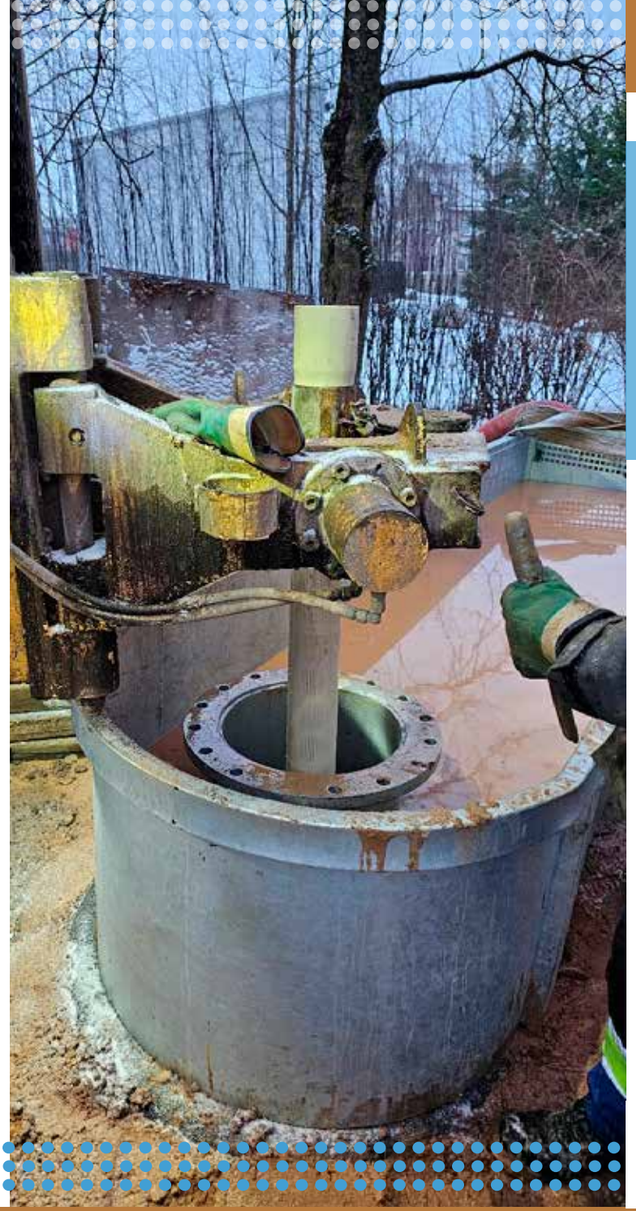
The project is a joint effort of the Aerfit team and the drilling company UAB Hidrogeologija (Kaunas, Lithuania). The knowledge transfer and the assistance during the execution were given by Henk van Tongeren Water & Techniek. Putting the FHVI technology in practice in Lithuania is entirely similar to the latest Dutch practices. In the Dutch LIFE+ project a pretreatment facility was developed. It took at least a year, and many prototypes, before a satisfying result could be booked. In Lithuania, the team was able to skip these efforts.

The project has been executed following a Workplan. The Workplan is taken in this report as annex 1. During the realisation many photos have been taken. In annex 2 a selection of the photos has been placed. So, it is easy to follow the steps of drilling, installation of FHVI parts and the testing.

7. Results

The FHVI wells have been tested following the Aerfit protocol. This means that we know exactly the capacity of the wells at the start of the project. In the period after installing the wells, there has been rain at the project site. Visual judgment showed that the wells were functioning according the original plan. Due to the early winter conditions, it was not possible to do any objective measurements. These measurements are planned for the coming months (spring 2024).

The quality of the infiltration water is an important issue in Lithuania. Any progress on this point, for instance more sophisticated pre-treatment, will have a positive impact on future projects in the Netherlands.



Annex 1. Workplan

Project:	Workplan FHVI System Domeikava Kaunas Lithuania
Our reference:	38201
Date:	3 October 2023
Drafted by:	ing. Bas Davies
Verified by:	Roel Dibbelink

Introduction

A pilot project will be launched in Kaunas Lithuania by Henk van Tongeren Water & Techniek and UAB Hidrogeologija. The aim of this project is to install Fast High Volume Infiltration (FHVI) systems at a pilot project site. This workplan describes how the key processes are implemented.

In the foreseeable future, 2 FHVI system will be constructed on site. This system consists of a 2 FHVI wells, pre-filter pit, road gullies, connecting pipework and monitoring. The knowledge on the method of construction and installation will be transferred to UAB hidrogeologija by Henk van Tongeren Water & Techniek. The Aerfit Lithuania project will be the first FHVI project in this country. A FHVI system can consist of more than one infiltration wells.

This workplan describes the following aspects:

- FHVI-well installation
- Developing FHVI-well
- Infiltration test (IBC-tanks)
- Gravel mixture pre-filterpit

FHVI-well installation

This section describes installing the infiltration well in the appropriate aquifer. During the drilling process, the filter trajectory will be carefully measured on absorption. To carry out this process, the following supplies are required, which include:

Equipment

The equipment that is necessary for carrying out this process is noted below:

- Smartphone with timer or stopwatch
- Flowmeter(s)

Preconditions

- The water that will be used in the drilling process should be clear and clean.
- No additives should be added to the working water used during the drilling process.

Filter installation step by step:

The process is as follows:

1. Drilling up to the expected aquifer and filter trajectory.
2. Within the right aquifer, 1 meter will be drilled.
3. Pump the borehole clean.
4. Fill the drilling container to reference point with water[1].
5. Wait and measure how much water is taken up within 5 or 10 minutes.

6. Fill the drilling container to reference point with water.
7. Write down the amount of water added as indicated in annex 1 of this workplan.
8. Continue drilling for 1 meter.
9. Repeat point 2 till 7 throughout the whole aquifer.

[1]During this process it is important to carefully record the amount of water (m3) added. The amount of added water to the containers needs to be written down to examine the location of the filter within the aquifer. An example of is given in annex 1 of this workplan.

Developing FHVI-well

Development of the FHVI well will be carried out with pumps. When water levels allow, the well may be pumped above ground. If the water level is deeper than 7 meters - ground level, the well should be developed using an underwater pump.

Equipment

The equipment that is necessary for carrying out this process is noted below:

- Suction pump or underwater pump which fits in a 110 mm pipe.

Preconditions

- It is important to extract until clean and clear water is extracted from the well.
- Permits required for discharging groundwater into sewers or surface water should be obtained from relevant authorities.

Process

The process of developing a FHVI-well is the same as developing a normal well.

Infiltration test (IBC-tanks)

This section describes testing of the infiltration capacity after construction of the FHVI-well using the IBC tanks.

Equipment

The equipment that is necessary for carrying out this process is noted below:

- Smartphone with timer or stopwatch.
- IBC-tanks filled with clean water.

Preconditions infiltration test

1. Start testing infiltration well after FHVI-well is constructed.
2. The IBC tanks should be filled with clean water.
3. During testing, the water level should be kept stable just below the edge of the well.

Infiltration process step by step

The process is as follows:

1. The IBC tanks are both filled with clean water.
2. Put out end of hose into the FHVI-well and turn on the valve.
3. Start stopwatch when opening the valve.
4. Note time every 25% emptying of IBC-containers, as in annex 2 of this workplan.
5. Continue until both IBC-containers are empty.
6. Stop timer/stopwatch and note total emptying time, as in annex 2 of this workplan.
7. Repeat points 1 to 5 if necessary.

Gravel mixture pre-filterpit (pretreatment).

This section describes adding the gravel mixture to the pre-filterpit.

Equipment

The equipment that is necessary for carrying out this process is noted below:

- Big bag (1,5 ton) with gravel mixture.
- Equipment that can carry the big bag with the gravel mixture.

Preconditions

1. The gravel mixture has a fraction of 2 mm to 8 mm.
2. The gravel mixture should consist of washed gravel.
3. Pre-filter pit must be installed in the ground. The gravel mixture cannot be installed in the pit when it is not yet installed in the ground, due to maximum lifting load.

Dumping gravel mixture into prefilter pit step by step

The process is as follows:

1. The gravel mixture can be applied from above the ground through the manhole cover.
2. The gravel mixture should be applied on top of the drain up to approx. 10 cm below inlet.
3. Repeat points 1 and 2 when installing the gravel mixture in a new pre filter pit.

Annex 1

For example

	Trajectory (m-gl)	Amount of water (m^3)
1	-12 to -13	1
2	-12 to -13	1
3	-12 to -13	3
4	-12 to -13	1
5	-12 to -13	1
	And so on throughout the aquifer.	

This means that the middle filter of the FHVI-well should be placed in the -14 to -15 m aquifer.

Annex 2

For example

Percentage (%)	Cubic metres (m^3)	Time (min)
100	2	0
75	1,5	1,5
50	1	3
25	0,5	4,5
0	0	6

This means that 2 m^3 of water is absorbed by the well in 6 minutes.

Annex 2. Location Domeikava Project

Annex 3. Photos Domeikava Project

1

First drilling of the FHVI well

2

Search for the best infiltration point

3

Preparation for the placing of the pre-treatment facility

4

Deck of the pre-treatment facility

5

Pre-treatment facility is completed.

6

Testing of the capacity of the FHVI well

8

FHVI well and pre-treatment facility are completed

9

Construction work to finish the work

10

The final keystone

About the LIFE AERFIT-project

TheLIFE AERFIT-project is an initiative of the municipality of Apeldoorn, Henk van Tongeren Water & Techniek, Stichting 02DIT, STOWA-Stichting RIONED and Hölscher Wasserbau.

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