Scoping Document

LIVING LABS, WP4, D.T4.2.1

These are some of the innovations tested at the Green Village, which target a climate adaptive city: Blueblogs, SolidGreen, waterpasserende baggertegels, Rainroad, Buffer pavement.

Flood Proof Holland

Flood Proof Holland is a field lab on the TU Delft campus for semi-full scale temporary innovative modular and flexible flood defences. It enables testing and optimization of the innovation, while also increasing reliability. Flood proof Holland consists of various open-air basins, in which temporary, modular, and flexible flood defences can be built. In each basin floods can be simulated to test the strength of the flood defence. Obstacles can be placed to simulate urban situations. There is also a test dyke on which multiple experiments were done on for example piping and breach tests.

Flood Proof Holland is used by entrepreneurs, companies, government bodies and research institutes. The location is equipped with different innovations such as: De Box Barrier, Green Soil Bag, Watergate, deSLAMdam, Mobile Dikes (https://www.mobieledijken.nl/), the H-Wall and the Flexible Flood Barrier.

Figure 3: Overview of Innovations that were tested at Flood Proof Holland

Living Lab in Limburg

While the existing living and field labs of the TU Delft - Green Village and Flood Proof Holland - focus on innovations for flat polder areas, the foreseen living lab in Limburg will focus on innovations which are important for hilly landscapes. As characteristics such as slope, increased flow velocities, rapid water concentrations are unique to hilly and

mountainous regions and may change the suitability and reliability of innovations. The living lab will offer stakeholders the opportunity to experiment and test innovations in the actual water system and make this also available and visible to others.

Currently the Waterboard in Limburg has two pilot areas, with the objective to test new devices and monitor more densely. These areas are the 'Groote Molenbeek', a flat catchment in the north of the province of 180 km^2 and 32 km long and the Geul catchment, which is in the south of the province and has a size of 340 km^2. Moreover, there is an area called ‘de Groene Rivier, near the Roer, that could be suitable to test innovative flood defences. Within this project we explored how these areas can be further developed as field labs and what other potential locations are suitable locations.

The area near the Groene Rivier has been transformed into a field lab for innovative flood defences in which the TU Delft together with the Waterboard Limburg conducted many experiments and research projects. We also organised a stakeholder event at the field lab site in which we invited important stakeholders such as the municipalities of Meerssen and Bunde, but also the fire department and international partners part of the Interreg project. So in this work package, we even went beyond the scoping – we really developed a field lab together with the Waterboard Limburg.

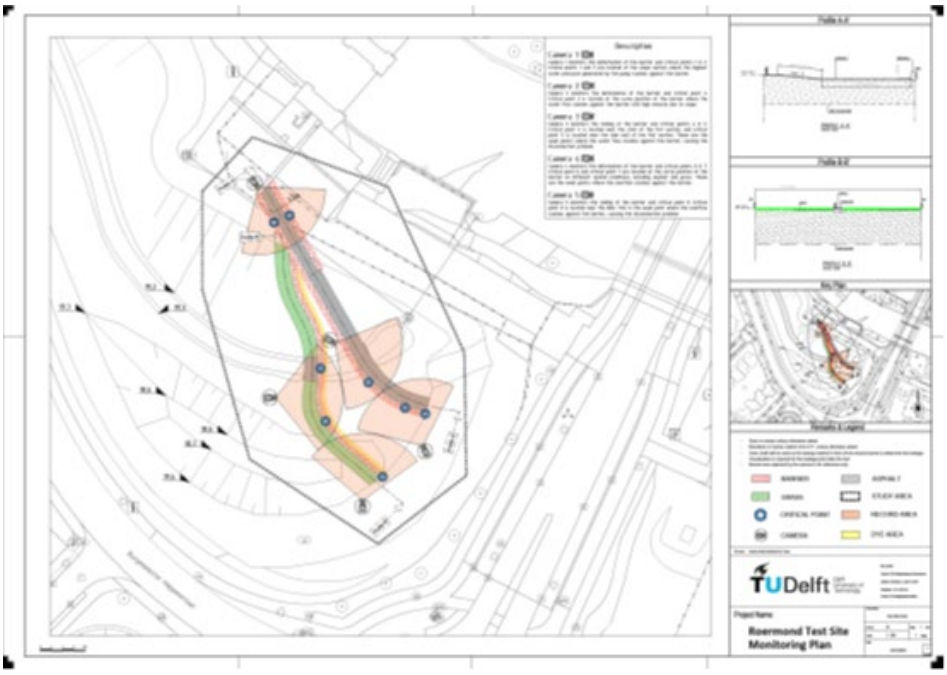


Figure 4 Initial design of the field lab de Groene Rivier

Objectives

The objectives of the Living Lab Limburg have been described in the project proposal and can be summarised as follows:

- Facilitate transdisciplinary learning
- Provide meeting points of science and practise, but also for community involvement
- Emphasize the high importance of monitoring and conducting physical experiments
- Showcase potential solutions and innovations that can address the challenges in Limburg
- Offer a space for students, researchers, entrepreneurs, and governments to test, experiment and validate potential solutions

It is already very promising for the long-term, that we achieved the above objectives at the site of the Groene Rivier. Also after the Interreg project, this site will be used for demonstration, research and training purposes in the field of innovative flood management.

Figure 5 Demonstration day at the Groene Rivier living lab with many stakeholders involved (October 2023)

Scoping of Innovations

Overview of innovation types and research possibilities
With input from the University of Liege and Waterboard Limburg, the TU Delft scoped for innovations that could be suitable for the challenges in the Euregion, related to water and climate adaptation. Some of these innovations are already tested at various sites in Limburg and were reviewed by University of Liege.

Innovation	Company	Type	Link	Comment
Box barrier	BoxBarrier	Temporary flood defence	BoxBarrier® Flood Barrier: Temporary Flood Defence System	Tested at Flood Proof Holland and The Groene Rivier Limburg
Mobile Dijken	Mobile Dijken	Temporary flood defence	Mobiele Dijken	Tested at Flood Proof Holland and The Groene Rivier Limburg
Green Soil Bag	Green Soil Bag	Temporary flood defence	Greensoilbag - Green Soil Bag	Tested at Flood Proof Holland
WaterGate	MegaSecur EUROPE	Temporary flood defence	Water-Gate© | Flood protection, Cofferdams, Pollution retention (megasecureurope.com)	Tested at Flood Proof Holland
SlamDam	SlamDam	Temporary flood defence	SLAMDAM® is the solution for creating a temporary dam quickly and efficiently | SLAMdam®	Tested at Flood Proof Holland and The Groene Rivier Limburg
Solid Green	SwaansUnfr a	Urban infiltration	SolidGreen - Swaans Infra	Tested at Green Village
Parkpositive	Innovative groen parkeren	Urban Water retention	Home - Park Positive	Tested at Green Village
Rainroad	Movares	Urban Water retention	Rainroad - Ingenieursbureau Movares - adviseurs en ingenieurs	Tested at Green Village
ZOAK	TileSystems	Urban Infiltration	ZOAK BESTRATING – TileSystems (tilesystemx.com)	Tested at Green Village
FlowSand	Aquaflow	Urban Water retention	Flowsand - The Green Village	Tested at Green Village
BlueBloqs	Field Factor	Urban Water Retention	BlueBloqs - Smart rainwater solutions — FieldFactors	Tested at Green Village

Buffertrottoir	Waste Works	Urban Water Retention	Buffertrottoir - The Green Village	Tested at Green Village
Drainline	Drainline	Urban Infiltration and water filtering	Drainline - The Green Village	Tested at Green Village
DSI Infiltration Well	O2dit	Urban Infiltration	DSI® infiltratietechniek (o2dit.nl)	Tested at Green Village
Watterpasser ende Baggertegels	Waterweg	Urban infiltration	Waterweg | Circulaire waterpasserende bestrating van baggerspecie | Rotterdam	Tested at Green Village
Drainmix®	Drainmix	Building material with good drainage	DrainMix® - The Green Village	Tested at Green Village
Watertable	Watertable	Urban Infiltration	WaterTable - The Green Village	Tested at Green Village
SPOGRO	SPOGRO	Increase water buffering capacity of soil	Spogro - The Green Village	Tested at Green Village
Bufferblock	Bufferblock	Water retention and drainage	Bufferblock – De Oplossing Voor Waterberging	Tested at Green Village
Discharge	Rainbow Sensing	Smart Measurem ent Systems	Rainbow Sensing – Local People, Local Devices, Open Knowledge	Tested at the side at Hommerich, Geul catchment
Monitoring of temporary flood barriers	ingenieursb ureau RINA	fiber optics/acou stics and sensing)		Tested at Flood Proof Holland
5G	Do IoT Fieldlab	Smart Measurem ent Systems for water crisis	Fieldlab (tudelft.nl)	Tested at the Groene Rivier
NoFloods Water Tube Barriers	AQWatt	Temporary flood defence	https://www.aqwatt.com /en/solutions/flooding-solutions/temporary-dams-and-flood-dykes	Product developed by a Danish company called Environment Solutions, but

				AQWatt is headquartered in Hasselt, Belgium
NoFloods Flex Wall	AQWatt	Temporary flood defence	https://www.aqwatt.com/en/solutions/flooding-solutions/flood-defence-wall-nofloods-flex-wall	Product developed by a Danish company called Environment Solutions, but AQWatt is headquartered in Hasselt, Belgium
Acquastop	Acquastop	Temporary flood defence	https://inondations.be/systemes-anti-inondations-acquastop/	Acquastop is an Italian company, but the product is also sold in Belgium in Namur
Velox	Aggeres	Temporary flood defence	https://www.aggeres.com/en/product/mobile-deployable-flood-barrier-that-unfold-itself/	Tested at The Groene Rivier
RAINBLOCK	Aggeres	Urban Water Retention	https://www.aggeres.com/en/product/smart-rainwater-harvesting-system-to-collect-and-retain-excess-rainwater/	Reviewed by University of Liege

Tabel 1: Overview of innovation types suitable for testing in a field lab in Limburg

As of December 2022, already several start-ups of the “Waterstraat” testing site in the Green Village have confirmed their interest in conducting experiments in Limburg to test the suitability of their innovations in a different landscape. Such as the Urban Water Buffer of Field Factors and the Bufferblocks and X-tiles. This was reflected in a joint proposal that was handed in at NWO. Also we tested some of the Flood Proof Holland innovations and temporary flood barriers at the Groene Rivier.

We also experimented with innovations in the field of monitoring in the Geul catchment. In these physical experiments, they teamed up with the start-up TAHMO and RainbowSensing in collaboration with the Waterboard Limburg.

Figure 6 A group of TU Delft students experimenting with different monitoring instruments in the Geul catchment

Stakeholder scoping report

For a living lab it is important that all stakeholders are included from the start of the project to achieve the co-created and integrated solution the living lab aims for. Therefore, it is important to actively invite public, private, civic and knowledge stakeholders to participate in the lab.

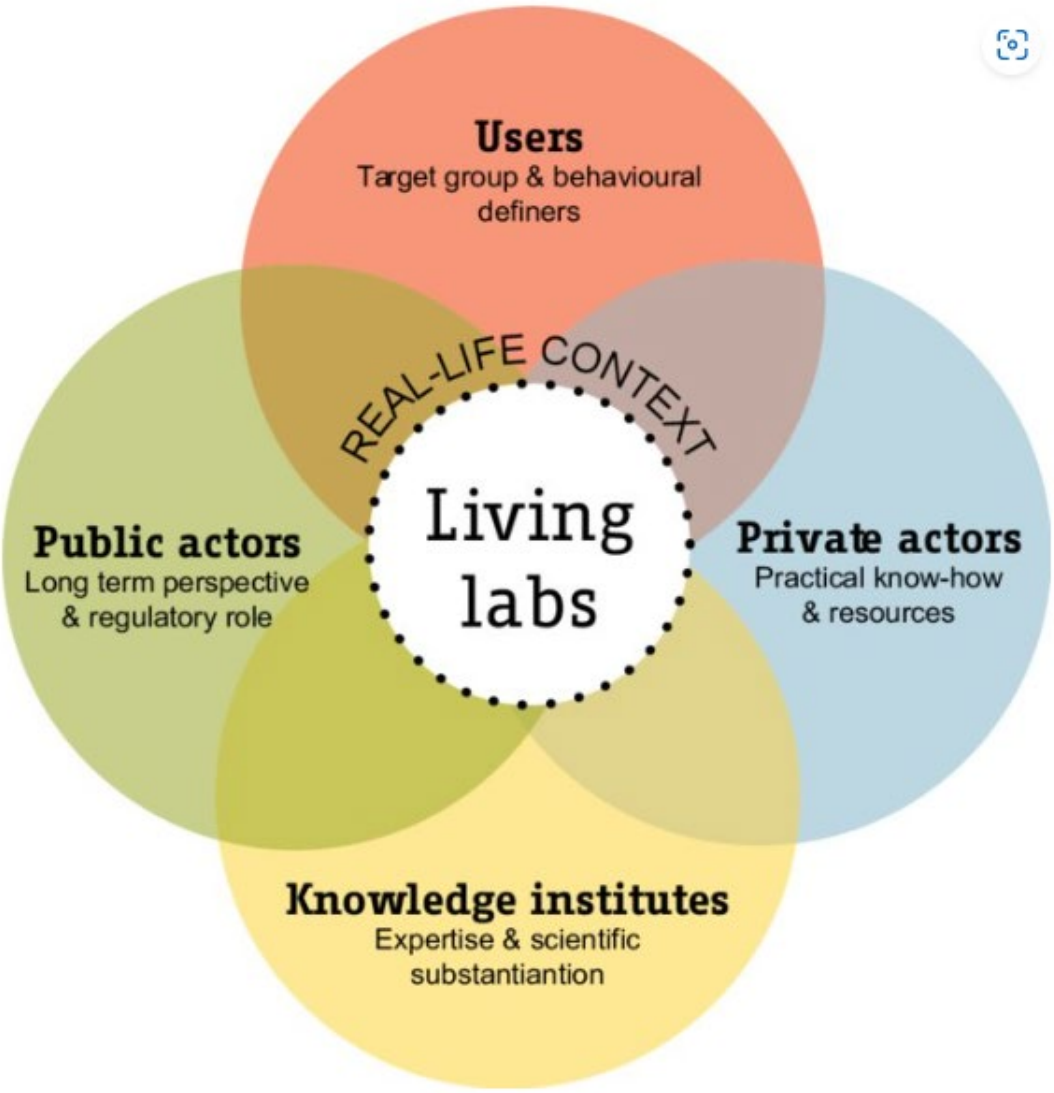


Figure 7: The Living Lab Stakeholders (Reference: (PDF) Urban Living Labs: A Living Lab Way of Working (researchgate.net)

Stakeholder Meetings

Several meetings have been taken place and the concept and the requirements of a living lab have been discussed with the Waterboard Limburg and various partners. For example, the municipalities that are at high risk (e.g. Valkenburg, Meerssen, Bunde) were consulted and involved in many of the experiments. But also partners like the Vlaamse Waterweg in Flanders and the Service Publique de Wallonia.

Figure 8 In October 2023 as part of the project a stakeholder test day was organised with participation of a wide variety of stakeholders (e.g. TU Delft, Vlaamse Waterweg, Service Publique de Wallonia and waterboards from The Netherlands)

We also organised a stakeholder meeting in Delft on the 30th of April 2023 at the fieldlab The Green Village. During this meeting, representatives of the Waterboard, Province and various municipalities in the Euregion were present such as Beek, Sittard-Geleen, Landgraaf, Parkstad, Roermond, Beesel, Vaals, Horst aan de Maas, Valkenburg, Voerendaal and Peel en Maas.

Figure 9 Stakholder meeting at the Green Village with the Province of Limburg and a large representation of municipalities in the Euregion (April 2023)

Partner exploration

TU Delft, Waterboard Limburg and the University of Liege explore potential partners together through these meetings and drafted a potential list of suitable stakeholders for the foreseen living lab. In the past years, already many of these partners have been consulted and actively involved in the various living labs.

Public Actors

- Municipalities
- Provinces
- Veiligheidsregio (Brandweer)
- Military
- Waterboards
- Staatsbosbeheer

Private Actors

- Limburgs landschap
- ARK
- Entrepreneurs active in the field of climate adaptation (see list of scoped innovations)

- Users

- Waterboard
- Public
- Municipalities
- Companies

Knowledge institutes

- Technical University of Delft
- Hogeschool Venlo
- Maastricht University
- (Liege University)
- (Aachen University)
- Vocational Education

All of the mentioned stakeholders have been involved in this work package in the form of stakeholders consultations, research activities, demonstrations and experiments in the field of water/climate adaptation. Especially the physical events and experiments in the field or at the living labs have been instrumental in gaining insight into the potential of a permanent living lab in Limburg. It is very promising to have seen the transformation of the Groene Rivier site into a functional living lab through interaction, joint research projects and joint experiments/demonstrations.

Capability Assessment

The living labs will need a lead partner and other partners, which are responsible for running the living lab on a day-to-day basis. This requires continuous investment into the living labs in terms of money, time and employees.

A capability assessment was performed to identify suitable project partners. The questionnaire included topics such as:

- Goals, ambitions, and interests
- What can the stakeholder offer?
  - Financials
  - Effort / time investment
  - Network
- How can the project help the stakeholder?
- What role does the stakeholder envision?
- Risks and Points for attention?

The result of this assessment was that a large role will be for the Waterboard Limburg itself, with support of the TU Delft. To ensure the institutionalisation and sustainability of the living lab, the Waterboard Limburg hired a recent TU Delft graduate who is from Limburg and graduated on flood-risk management for Meerssen. He has a large network in the TU Delft, knows the Waterboard Limburg and some of its municipalities, so we believe he will play an important role in the future for further research projects and experiments.

Implementation Plan for the living labs Limburg

After scoping the potential partners and capabilities of the interested partners that were already involved in the developments, we defined our objectives of the living lab and brainstormed about how we could go about implementation. We decided not to write a detailed plan, but start with the actual transformation of one of the most promising sites (de Groene Rivier) and the conducting of field experiments at the other identified sites (Hommerich/Geul). By implementing these activities, we learned where additional tasks or partners need to be found and what are the potential risks. A clear insight is that there should be a local owner of a living lab. In the case of the Groene Rivier, it was clear that the main role for implementation was with the Waterboard Limburg. They are responsible for the site and for inviting other stakeholders to make use of the site. We also learned that for the Waterboard to maintain good relations with relevant knowledge partners in the area (such as University of Liege or Hogeschool Zuyd, but also TU Delft) it should be institutionalised with one of the departments in the Waterboard (for example the innovation & strategy department). We had various discussions with the waterboard and other partners and finally the waterboard decided to open up a position for a new employee that will work on this aspect. This person will be responsible for the further implementation of the living labs and the translation/institutionalisation of the various research projects and experiments into policy for the Euregion. Through this function, we also ensure that the scoping and start of the living lab idea will get a follow-up in the future.

Field Experiments

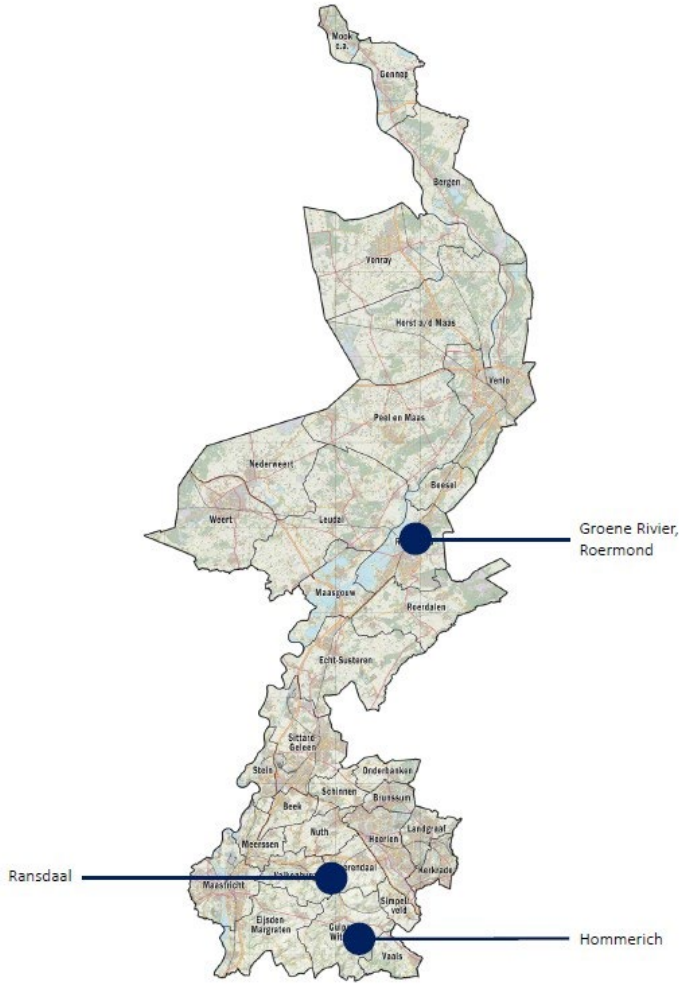
The project aimed to facilitate 5 – 10 physical real-life experiments in the region. The experiments can be related to:

- Smart ways of monitoring
- Temporary flood barriers
- Tracer tests
- Water infiltration in urban areas or in other climate adaptation measures

Students and staff from the Waterboard Limburg and TU Delft were involved in these experiments.

Field Experiments Overview

- Map indicating the location of the different field experiments side



Smart monitoring at Hommerich Station

Rainbow Sensing together with TAHMO, Delft University of Technology and the water board Limburg established an experimental site for testing a camera-based flow monitoring software (OpenRiverCam) at the site of the Hommerich water level station.
The camera was installed on March 30, 2021. After the flood event in July 2021, the electricity at the site was damaged and renewed and the site was taken back into use in 2022.

Figure 10: Installation and surveying on 30 March 2021

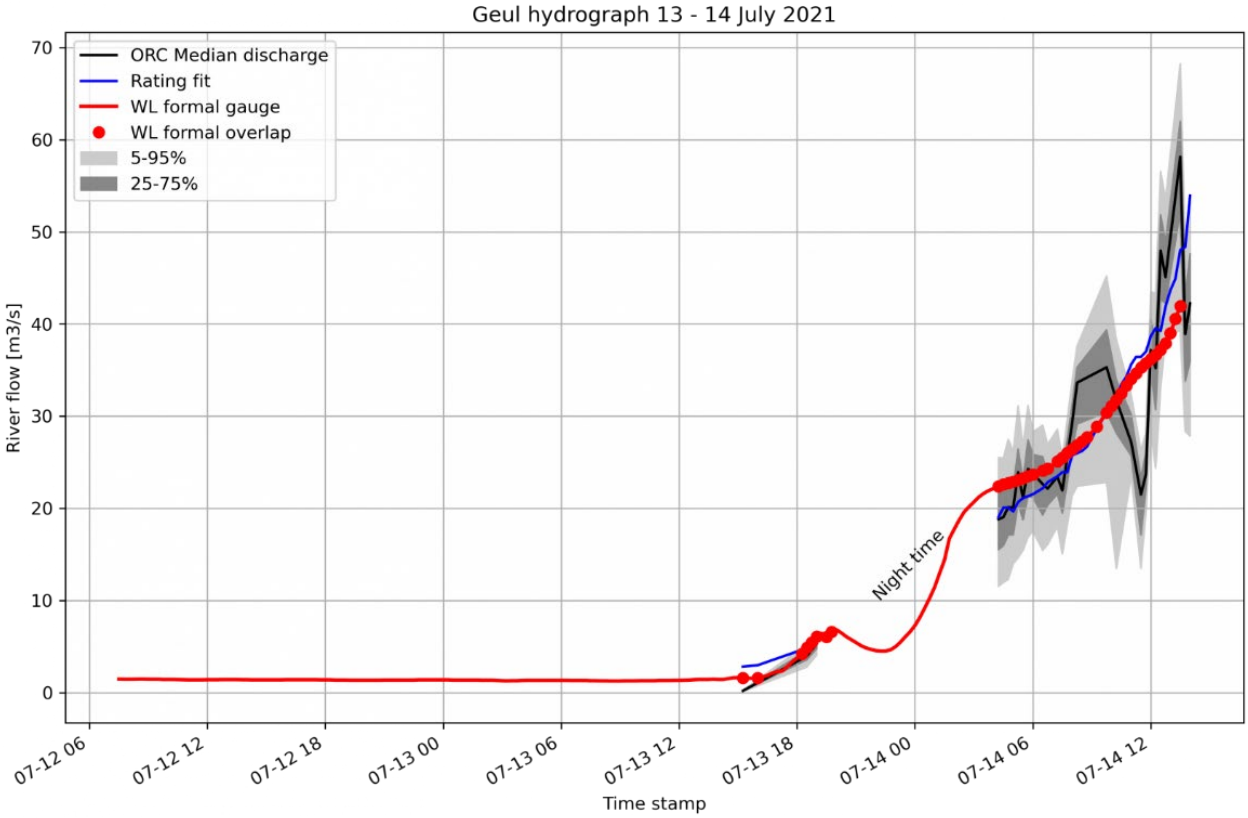


Figure 11: Hydrograph at Hommerich for the Flood Event in July 2021. In black, dark grey and light grey respectively, ORC results (50% quantile, and 25-50 and 5-95% quantile bands respectively, in red: River flows at station Hommerich

Flood Barrier Tests in the Groene Rivier living lab

Performed Tests in 2022

On April 6th, 2022, a test of four different flood barrier system have been taken place at the Groene Rivier living lab in Roermond. These tests have been conducted with support of the TU Delft and the Waterboard Limburg. The flood barriers tested were BoxBarrier, Geodesign Barrier, Mobiele Dijk and Slamdam. Three of these barriers were tested before at Flood Proof Holland.

Figure 12: Temporary Flood barrier testing April 6th, 2022, at the Groene Rivier Site in Roermond

Test at Flood Proof Holland of the monitoring set up for the temporary flood barrier test in Roermond in May 2023

On February 15, 2023, a test of the developed monitoring set up was performed at Flood Proof Holland. This test had the objective to test the assumptions, tools, and measurements of the monitoring program.

Two trials have been performed:

1. Testing with the box barrier
2. Testing with the H-wall

The first test was aimed to check if deformation of the barrier can be detected, the second test was aimed to check that leakage (through a uranium tracer) can be detected.
Both tests were successful regarding the monitoring. There is another pre-test planned at the location in Roermond (around March) to test the set up at the location. Prior to that tests, the measurements of the cameras need to be translated to the performance ranges given in the tender by the waterboard.
Participants during the test day in Delft:
Waterboard Limburg: Juus Teensma, Maurice Daemen and Bart Janissen
5G Internet of things start-up AccessHub: Maxime and Menno Stijl
TU Delft: Dr. Roelof Moll, Dr. Martine Rutten, Lindsey Schwidder, Dr. Davide Wuethrich and three TU Delft students: Kou Wai Chan, Angela Klein and Seppe Smeijers.

Impressions

Trial 1: Box barrier

Trial 2: H-wall

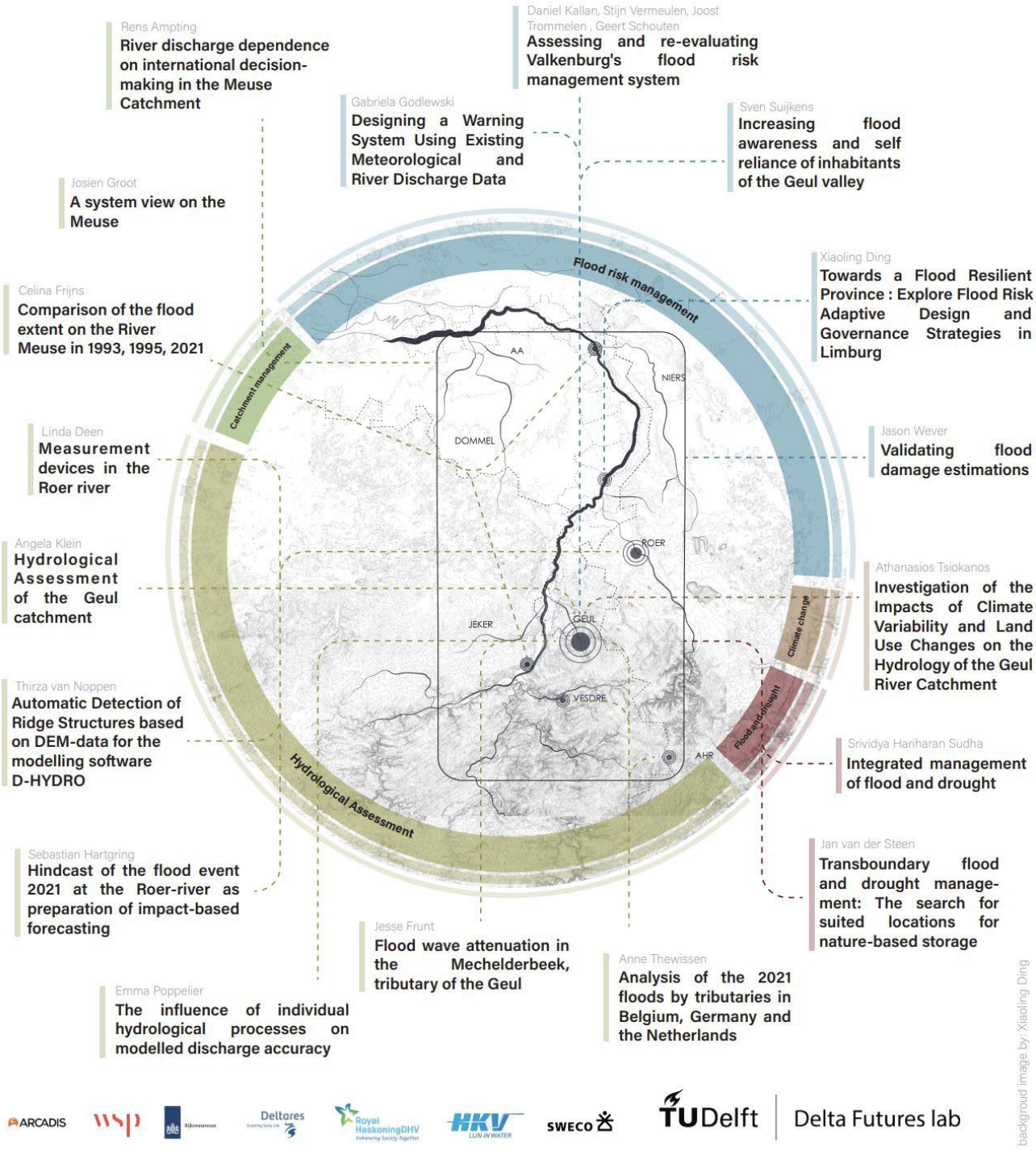


Figure 13 Overview of a variety of research projects that were done, in collaboration with many other partners

The Groene Rivier field lab has been redesigned by staff and students of the TU Delft for the upcoming tests in May 2023 and October 2023. During these tests, we tested different types of temporary flood barriers, based on the criteria set by the Waterboard Limburg and its stakeholders (e.g. fire department, municipalities and communities).

Figure 14 Experiments in October 2023

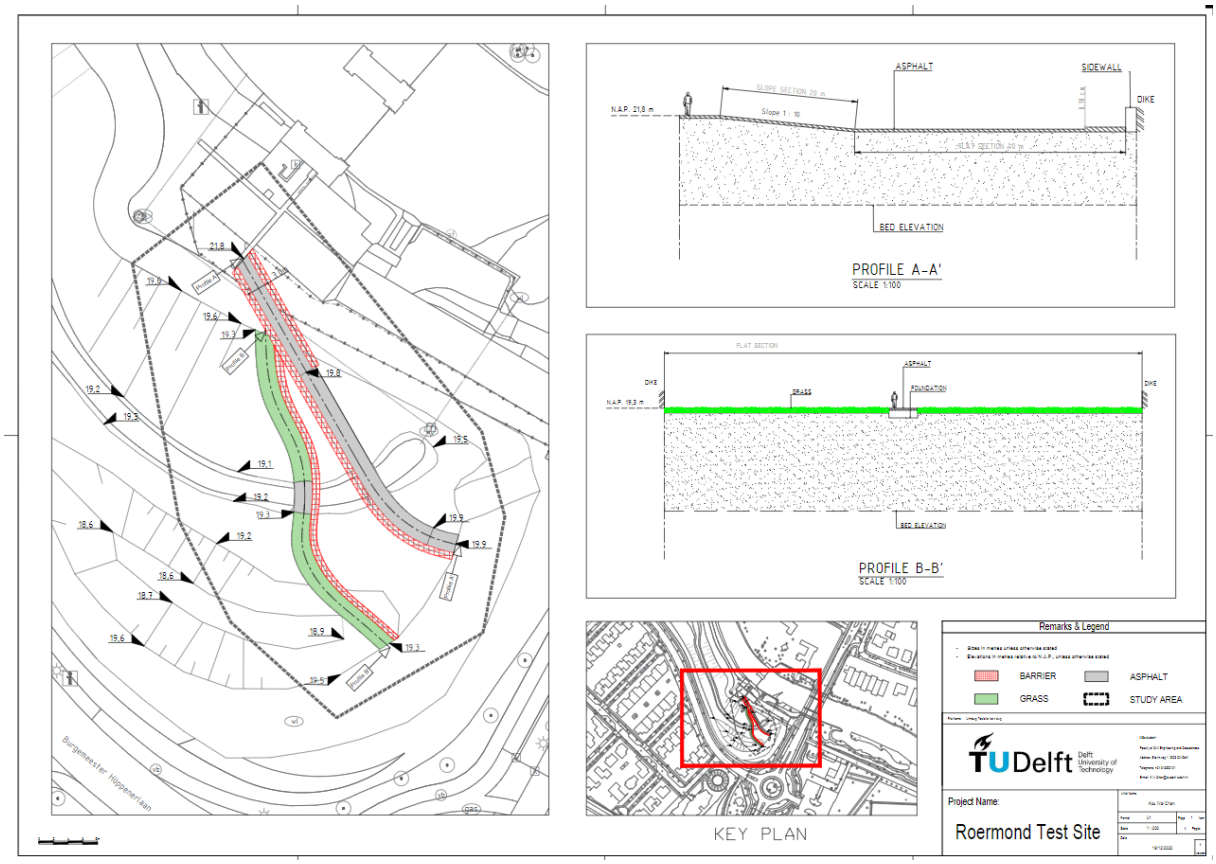


Figure 15: Design for the temporary flood barrier tests in May 2023

Various tests were carried out, for example:

1. Testing on water-steering capacity regarding longitudinal flow on hard or distant ground;
2. Testing for water resistance on natural substrate (Stability).

Additionally, the temporary flood barrier systems which have already been purchased by the Waterboard were tested and monitored:

- Waterschot: Waterschot.nl | Houdt het water tegen met dit waterschot
- Mobile Dijk: Mobiele Dijken

The successfully tested temporary flood barrier systems were purchased after the tests in May and will be used in flood situations in the city of Bunde and Meerssen. To train the other stakeholders on how these barriers must be set-up and used, another demonstration and test day was organised in October 2023.

Figure 16 TU Delft team at the Groene Rivier fieldlab in October 2023

Smart monitoring experiments at the Groene Rivier

To evaluate the performance of the temporary flood barriers, we planned to monitor water levels and water velocities during the tests. For monitoring five cameras which are able to communicate with each other were installed. The footage was used to assess the performance of the different solutions. The monitoring will be done with 5G technology through the involvement of the start-up AccessHub. To test the capability of the system upfront a test run took place at Flood Proof Holland, during which the Waterboard of Limburg was present as well.

Figure 17 Trial run of the 5G cameras at Flood Proof Holland and discussions with the Waterboard Limburg

More information on 5G Solutions can be found here:
https://doiotfieldlab.tudelftcampus.nl/fast-and-secure-5g-data-platform/

During the actual field tests, the cameras were used to monitor the performance of the barriers and to enable us to detect breaches, potential sliding/overtopping and other variables.

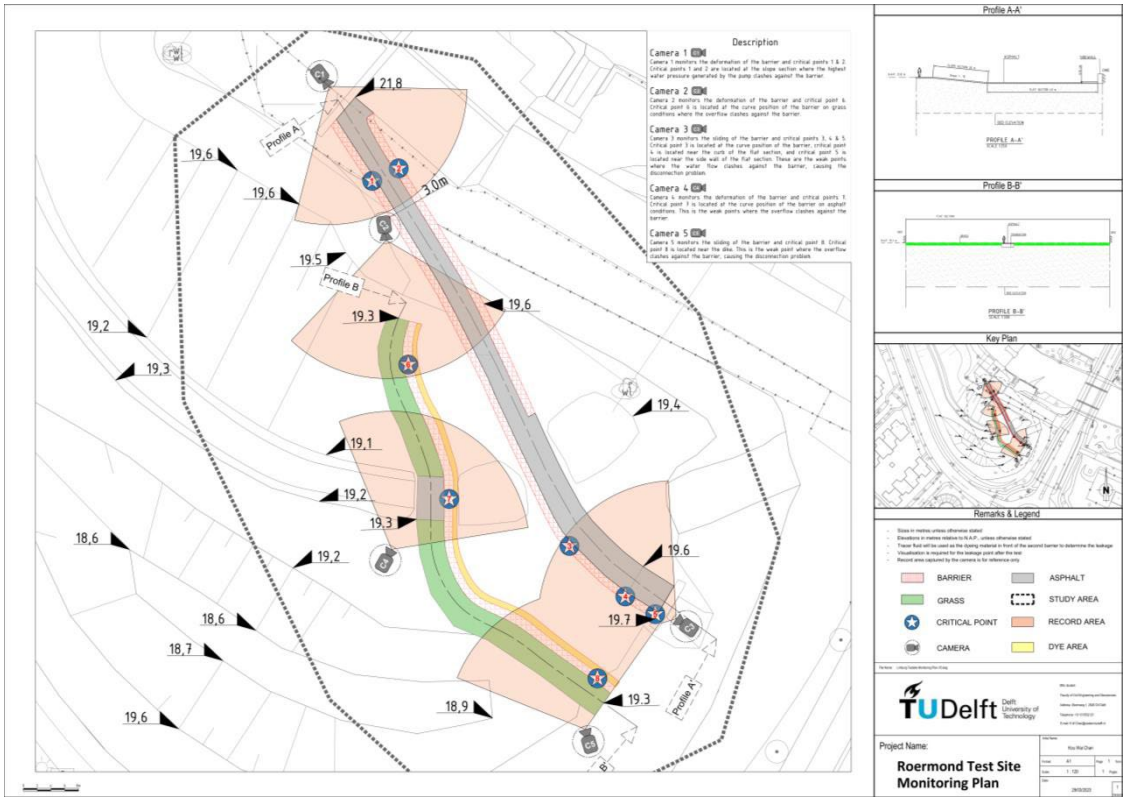


Figure 18 Design of the monitoring and positioning of the cameras

Figure 19 The cameras were set-up at various places to monitor the performance of barriers

Tracer tests at the field labs in TU Delft and in the Euregion

The temporary flood barriers must perform their functions with limited leakage under the barrier, as otherwise in worst case the barrier becomes unstable and fails, however it is challenging to quantify how much leakage has happened in a test situation. To better quantify the amount of leakage it we tested the use a tracer fluid at Flood Proof Holland, before using in the Euregion.

Figure 20 Test with tracer fluid at Flood Proof Holland together with the Waterboard Limburg

Tracer tests in the Geul catchment (Hommerich station)

After the successful tests at Flood Proof Holland, the same tracer fluid was used in the Geul catchment to track the flow velocity and circulation. This was part of an experiment of TU Delft students, in collaboration with the Waterboard Limburg. It is foreseen that the Geul catchment is an interesting site for physical experiments and research activities and we foresee that also in the future it will function as a living lab.

Figure 21 Tracer experiment in the Geul catchment by TU Delft students

Mapping potential physical sites

Finally, the living lab needs to have a location. An important characteristic of the living lab is the setting of its activities in a real-life context. In this case an important characteristic is its setting in the hilly landscape of Limburg.

As the characteristics of the landscape in Limburg differ strongly from the more typical flat or polder landscape in the remainder of the country. Innovations created and tested for a different landscape might not work in hilly areas with higher slopes and water velocities.

The location itself can be provided by one of the project partners (e.g., the municipality) or a company or knowledge institutes offering an operational space. ((PDF) Urban Living Labs: A Living Lab Way of Working (researchgate.net)

Living Lab Location Requirements

Living Labs	Field Site Requirements
Temporary Flood Barriers	• Sufficient ground quality (consolidated) • Change in channel structure etc. must be permitted • Accessible for heavy traffic • Close by water source as well as discharge option • Sufficient size
Smart Monitoring	• Discharge measurement location (for comparison) • Electricity • Accessible, but remotely enough to be able to install equipment (theft risk)
Hydrology Field Lab	• Electricity • Accessible, but remotely enough to be able to install equipment (theft risk)

Tabel 2: Requirements for different technologies for testing within a living lab

Living Lab Location Site Descriptions Template

- Description
- Location / Adress / Latitude / Longitude/ Ownership
- Location Map
- Climate / Elevation / Slope / Size / Soil Type
- Accessibility
- Facilities (Shelter, Electricity etc.)
- Filled in Requirement matrix
- Additional Documents
  - Pictures
  - Reference Documentation

Groene Rivier Roermond – living lab for flood risk management and innovations

Description
The Groene Rivier is an overflow location in the city of Roermond. The side has been used for testing temporary flood defence barrier before, however not as a permanent test location. The site has embankments of three different soil types (loess, clay, asphalt), which makes it a good location for various tests.

Location / Adress / Latitude / Longitude/ Ownership
Burgemeester Hoeppener Laan, Roermond
Longitude: 51.188, Latitude: 5.979

Location Map

Figure 22: Location of the Groene Rivier test site

Climate / Elevation / Slope / Size / Soil Type
The site is located in the city of Roermond at 22 m NAP.
The Groene Rivier has a length of 350m.

Figure 23: Soil Map of the Groene Rivier test site

Accessibility
Good transport access via Bisschop Lindanussingel, de Burgemeester Geuljanslaan and de Burgemeester Hoeppenerlaan. Good connection to A73 and N280.

Facilities (Shelter, Electricity, Water etc.)
Shelter: a container (keet), similar to Flood Proof Holland.
Electricity: yes, available.
Water: Water can be taken through a culvert the Roer. The average discharge of the Roer is 23.5 m^3/s; however, it can be quite low after dry periods (approx. 6 m^3/s).

Hommerich Discharge Station Test Site – Geul catchment

Description
The site is located next to the football pitch of the Voetbalvereniging Partij and the Hoeve Hommerich on the opposite site of the river. It can be reached by foot from the parking lot of the football club.
The waterboard Limburg has a water level measurement at this site and calculates the discharge through a frequently (monthly) validated stage-discharge relationship.
The site is also used as a test site for Rainbow Sensing and TAHMO, as well as for student research and experiments. See previous sections.

Location / Adress / Latitude / Longitude/ Ownership
Voetbalvereniging Partij:
Teventweg 20
6286 AN Wittem

Longitude: 50.806, Latitude: 5.914

Location Map

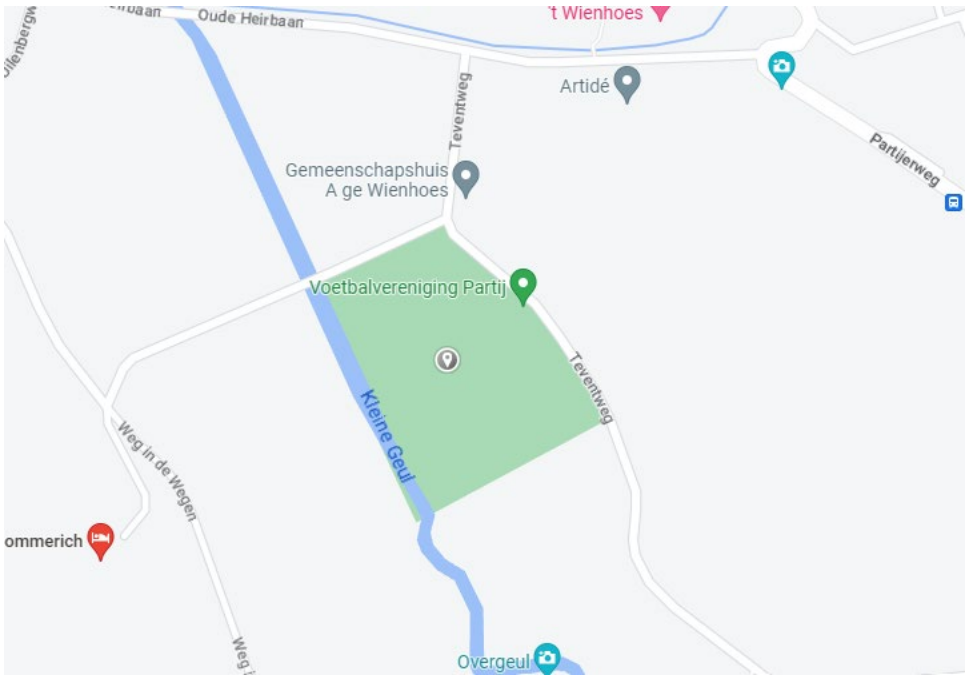


Figure 24: Location of the Hommerich test site

Climate / Elevation / Slope / Size / Soil Type
Elevation: 96m
Slope: approx. 3m/km
Soil type: clayey riverbanks
Size: The measurement station is at the riverbank as well as the camera from rainbow sensing. There is limited space at the location as can be seen from the picture below.

Accessibility
Good reachable with a personal car, no heavy transport possible.

Facilities (Shelter, Electricity etc.)
Shelter: no shelter
Electricity: Electricity is present and has been renewed after the floods in 2021.
Water: The average discharge at that location is 1.5m^3/s.

Filled in Requirement matrix

Additional Documents
Pictures
Reference Documentation

Figure 25: River and discharge station at the Hommerich test site

Ransdaal – former hydrological experimental set up

Description
The site is in the area of Ransdaal and is a former experimental site of the Waterboard Limburg. The rain gauge at that site is still active, but there are more opportunities for testing an experimenting there. In the ongoing project, we did not have enough time and resources to develop this site further. In the future, we aim to involve more stakeholders and develop concrete experiments at this test site.

Location / Adress / Latitude / Longitude/ Ownership
Adress: Achtbundersweg, Voerendaal
Longitude: 50.856, Latitude: 5.902

Location Map

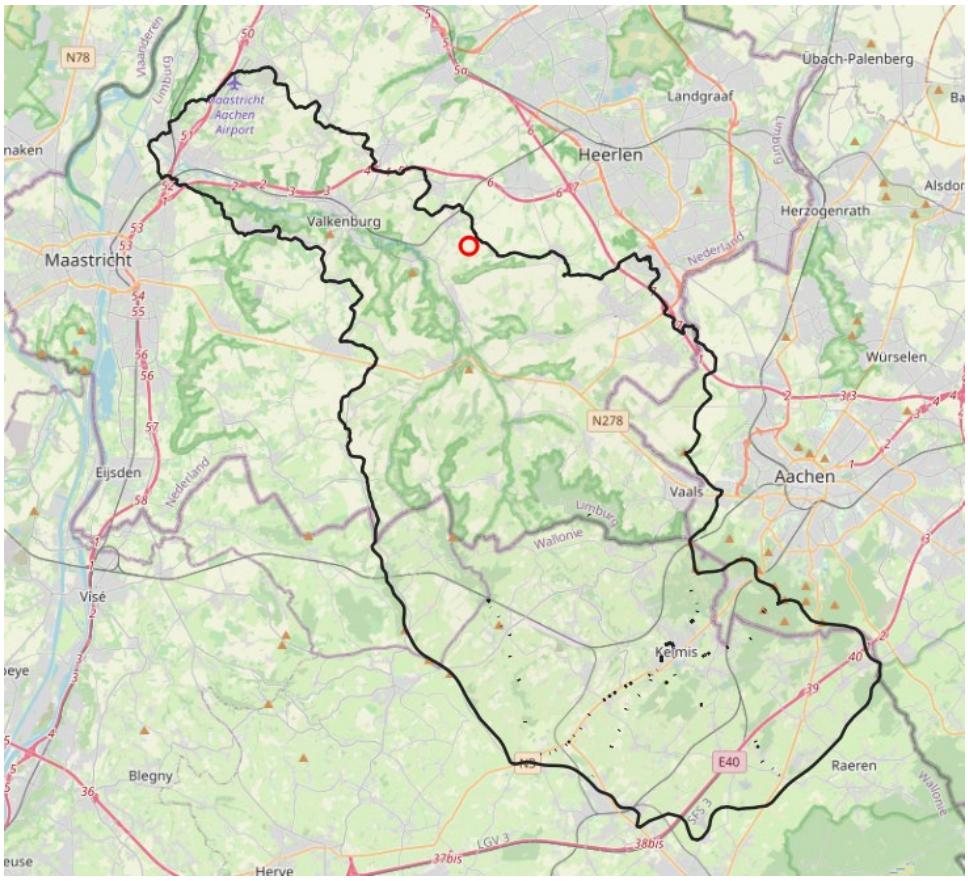


Figure 26: Location of the former experimental site near Ransdaal

Climate / Elevation / Slope / Size / Soil Type
Elevation: 130 m NAP.

Accessibility
Reachable by personal car, heavy traffic will be challenging and dependent on weather conditions.

Facilities (Shelter, Electricity, Water etc.):
Shelter: not yet
Electricity: yes
Water: yes

Filled in Requirement matrix

- Additional Documents:
- Pictures
- Reference Documentation

Blanc-Gravier Catchment (Belgium)

Description:
The Blanc-Gravier catchment is situated on the Sart-Tilman campus of the University of Liège. Its area is 2,51 km². Most of the watershed is composed of forest and artificial green spaces. The western part includes a large part of the Sart-Tilman golf course. The catchment also includes campus buildings. The Blanc-Gravier brook crosses this catchment and its length is about 2,5 km.

The Blanc-Gravier catchment has already been used to proceed to a hydrological and hydrogeological study of Sart-Tilman. An old rain gauge network was implemented but its current state needs to be checked and updates will be necessary.

Location / Adress / Latitude / Longitude / Ownership:
Sart-Tilman campus (Liège)
Longitude: 5.57863°
Latitude: 50.58358 °

Location Map:

The Blanc-Gravier catchment

Climate / Elevation / Slope / Size / Soil Type:
The area of the Blanc-Gravier watershed is 2,51 km². Regarding the slope of the catchment, it increases from upstream to downstream of the Blanc-Gravier brook. The average slope is equal to 13,4 % and the median slope is 9,7%. The Blanc-Gravier brook's spring is at an elevation of 240m and its mouth is at 78m.

Regarding the soil type, the Blanc-Gravier catchment is covered by Paleozoic formations (Emsian 2 and 3), Tertiary sands, and gravels and silts from the Meuse and Ourthe rivers.

Accessibility:
The Blanc-Gravier catchment is accessible by car from the campus and on foot via footpaths.

Facilities:
To be checked.

Filled in Requirement matrix:

Additional Documents:

Sources :
Aquapôle, Ministère de la Communauté française & Direction générale de l'enseignement non obligatoire et de la recherche scientifique (2009) : « Etude et modélisation des impacts hydrologiques de pluies exceptionnelles dans un environnement vallonné et boisé » D.O.45 – P.A. 20 – A.B.31.01

« WalOnMap | Géoportail de la Wallonie ». Consulté le 17 juillet 2023. https://geoportail.wallonie.be/walonmap#BBOX=-31618.822072644165,352953.82207264414,5215.6390652781265,178650.3609347219.

CALEMBERT L., PEL J., MONJOIE A., ESKENAZI E. (1970) : « Etude hydrologique et hydrogéologique du Sart Tilman : bassin du ruisseau du Blanc-Gravier, période 1963 – 1969 : établissement des bilans annuels des eaux » Université de Liège, Faculté des sciences appliquées.