



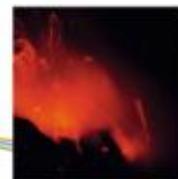
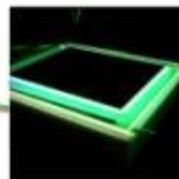
WATERPROTECT

Functional analysis

Ref: WaterProtect D5.2

Version: v3

Date: 10/05/2019



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CHANGE RECORD

Version	Date	Description
V1	31/05/2018	First version Actions lab Denmark and Poland are still under construction.
V2	20/08/2018	Second version The Irish action lab joins the WaterProtect tool from VITO. The functional analysis of the action labs Denmark and Poland are added.
V3	10/05/2019	Revision after midterm review: revision of case descriptions reflecting which pathways will be visualised and whether implementation of measures is included

Project Coordinator

Piet Seuntjens

VITO NV Mol, Belgium

Email: piet.seuntjens@vito.be

Tel: (+32-14) 33 67 83

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List of abbreviations & acronyms

AB	Aigües de Barcelona
ACA	Agència Catalana de l'Aigua
APCS	Associazione Piace Cibo Sano
ARPAE-ER	Agenzia Regionale per la Protezione e Prevenzione dell'Ambiente-Emilia Romagna
CPABLL	Consorci del Parc Agrari del Baix Llobregat
CSIC	Centro Superior de Investigaciones Científicas
CUADLL	Comunitat d'Usuaris d'Aigües del Delta del Llobregat
GISEL	Geographic Information System of el Llobregat
PPP	Plant Protection Product
UCSC	Università Cattolica del Sacro Cuore, OPERA research center
VMM	Flanders Environment Agency (Vlaamse MilieuMaatschappij)

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1 Introduction

Software development consists of different stages:

1. **Functional analysis:**

What is the purpose of the software tool to be build? What are the requirements and functionalities? All these questions need to be answered by gathering user requirements.

Based on these user requirements the functional analysis describes in detail how the software tool should work based on use cases and mock-up screens.

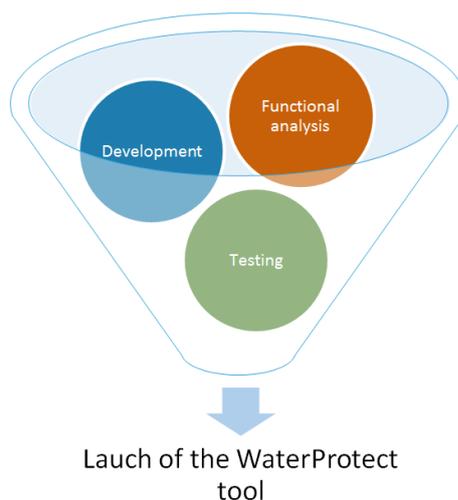
2. **Development:**

This stage includes the technical analysis based on the step 2 and the development of the tool. During the development stage the described prototype of the functional analysis can be improved and additional requirements can popup.

3. **Testing :**

Testing the first prototypes so that the developed tool fulfil the required specifications.

4. **Launch of software tool**



This report contains the functional analysis of the different action labs. The approach of the functional analysis is described in section 2.

2 Approach

The functional analysis consists of the following parts:

1. Context diagram
2. User requirements
3. Business process diagrams
4. Use cases
5. Wireframes

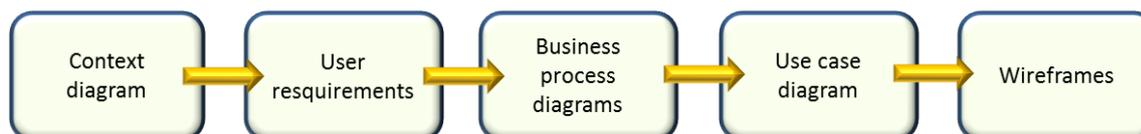


Figure 1: Different parts in a functional analysis

Every part contains more detailed information and is based on the previous part.

2.1 Context diagram

The Context Diagram or Data-Flow Diagram (DFD) shows the system under consideration as a single high-level process and then shows the existing relationships between the system and other external entities (systems, organizational groups, external data stores, etc.).

A DFD consists of a process (circle), external entities (rectangle), data stores (2 horizontal, parallel lines or ellipse) if applicable, and data flows (curved or straight line with arrowhead indicating flow direction). The main benefits of a DFD are:

- Shows the scope and boundaries of a system at a glance including the other systems that interface with it
- No technical knowledge is assumed or required to understand the diagram
- Easy to draw and amend due to its limited notation
- Easy to expand by adding different levels of DFDs
- Can benefit a wide audience including stakeholders, business analyst, data analysts, developers

2.2 User requirements

The user requirements are gathered and described in detail in deliverable 5.1.

2.3 Business process diagrams

We distinguish two types of diagrams a component diagram and sequence diagrams.

Component diagram

A component diagram gives an overview of the different components in the software and the main interfaces.

Sequence diagrams

A sequence diagram is an interaction diagram that shows how processes operate with one another and in what order. A sequence diagram shows object interactions arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. A sequence diagram shows, as parallel vertical lines (*lifelines*), different processes or objects that live simultaneously, and, as horizontal arrows, the messages exchanged between them, in the order in which they occur. This allows the specification of simple runtime scenarios in a graphical manner. Sequence diagrams are developed for every use case but these diagrams are optional and are not provided in every action lab

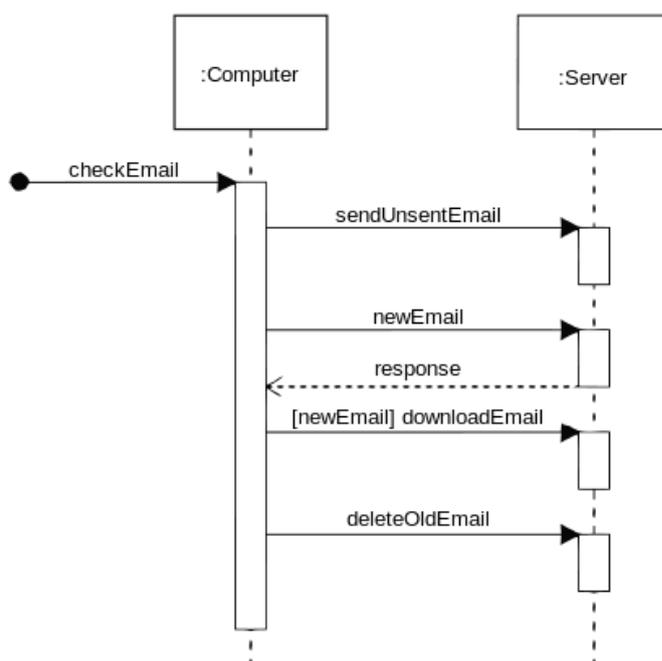


Figure 2: An example of a sequence diagram

2.4 Use case diagram

The desired functionalities are presented in a use case diagram. The use case diagram describes the functional requirements of the WaterProtect collaboration tool using use cases and actors. This model is used to describe the functionalities and to communicate with the partners and stakeholders to ensure that the requirements for the WaterProtect DSS are well understood and agreed upon. Besides, this model can be used for defining test cases of the WaterProtect DSS. The communication between the user and the system is the use case diagram represented with an arrow from the actor to the use case. Figure 3 explains the symbols used in a use case diagram.

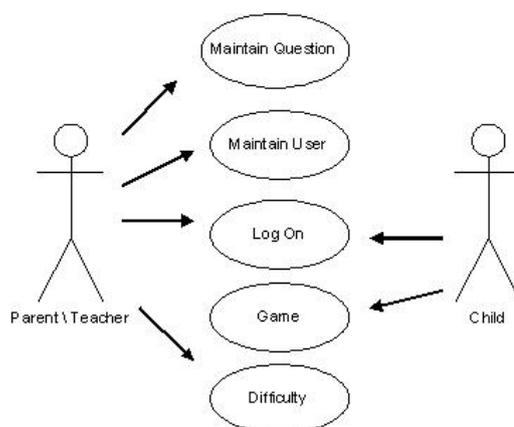
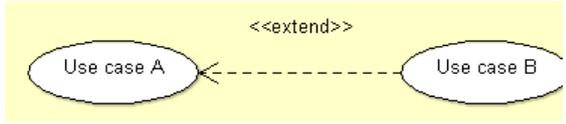


Figure 3: An example of an use case diagram

Table 1: Symbols used in use case diagram

Symbol	Description
	An actor is a person, machine or application that performs a use case or when performing a use case is consulted. Each use case has a primary actor who executes the primary use case. All other actors in a use case are called secondary actors.
	A use case is indicated by an oval symbol containing the name of the use case. Each use case diagram is a primary use case, which is divided into secondary use cases. The primary use case is carried out by the primary actor.
	When a use case A includes a use case B and performing use case B is necessary for successful use case A, then use case A will be connected to use case B by an arrow with the indication << include >>. The arrow points from use case A to use case B.

Symbol	Description
	<p>When a use case A uses a use case B, and the execution of use case B is not necessary for a successful use case A, then use case A will be connected to use case B by an arrow with the indication << extend >>. The arrow points from use case B to use case A.</p>

2.5 Wireframes

Wireframes are simple black and white layouts that outline the different page elements and functionalities. Wireframe are a blue print of your functional software design and can be used in the communication with the stakeholders, users, IT developers, etc.

The benefits of using Wireframes are:

- Wireframe allows for clarification how features are implemented into the software
- Wireframes display site architecture visually
- Wireframes push usability to the forefront
- Wireframes help make the design process iterative
- Wireframes save time on the entire project: content is more clearer, avoid hacks later in the project, etc.



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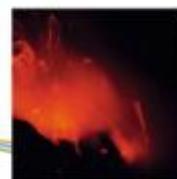
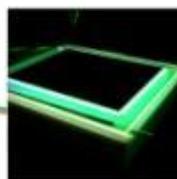
Action labs: Bollaertbeek, Val Tidone, Maramures and Wexford County

Lieve Decorte, Ingeborg Joris, Nele Desmet (VITO)

Nicoleta Alina Suciu (UNICATT)

Puscas Alexandra Erica (EcoLogic)

Per-Erik Mellander, Owen Fenton, Chris Fennell (Teagasc)



3 Action labs Bollaertbeek, Val Tidone, Maramures and Wexford County

3.1 Introduction

The WaterProtect tool shall be used by four action labs The Bollaertbeek (Belgium), Val Tidone (Italy), Maramures (Romania) and Wexford County (Ireland). The main objectives of the WaterProtect tool differs slightly between the four action labs.

3.1.1 Belgian use case

The Belgian use case is the Bollaertbeek catchment (23 km²/ 167 farmers) with mixed urban/rural land-use which is part of the surface water capturing area of the drinking water production company de Watergroep. Plant protection product (PPP) concentrations are a problem for water quality in the catchment. The WaterProtect tool should help to follow up the water quality status of the catchment, to determine the water pathways in the watershed and vulnerable zones for water pollution based on runoff of PPPs to surface water. The tool should support the assessment of suitable measures at the vulnerable zones to improve the water quality of the surface water in the Bollaertbeek.

3.1.2 Italian use case

The Italian use case is the Val Tidone catchment (207km²/ 455 farmers), placed in the north-west of Italy in Emilia Romagna region. The surface and ground water are used for drinking water, agricultural and zootechnical sectors. The groundwater in Val Tidone Catchment presents a significant concentration of pesticides and nitrates. By now the impact of the grape cultivation on pesticides and nitrates groundwater contamination was never investigated.

The WaterProtect tool will be used to follow up the water quality status of the catchment, to visualize the water pathways (leaching, runoff) in the watershed and vulnerable zones for water pollution, and to determine the possible contribution of grape cultivation on water contamination by pesticides and nitrates. The main objective is to decrease PPP and nitrates concentrations in ground water in the Tidone Catchment.

3.1.3 Romanian use case

The Romanian case is located in Mara catchment (20 km²), Maramures County, and it is representative for small scale/ subsistence farming systems in the Carpathian Mountains. Mara river is a protected area of local interest due to the presence of important protected species: trout (*Salmo trutta*), grayling (*Thymallus thymallus*) whose survival depends on the water quality. Cattle and sheep breeding in the catchment area affects the drinking water quality but also the surface water quality since manure is used as a large scale fertilizer and leaks from the barns of most of the households. There is no centralized sewage system in this case study, which poses major problems for surface and underground water quality.



The WaterProtect tool will be used to follow up the water quality status of the catchment, to visualize the water pathways through runoff in the watershed and vulnerable zones for water pollution. The tool should help to create more transparency on the link between farming systems and water quality at one side and at the other side the link between the application and origin of nitrates (organic or inorganic fertilizers, manure and/or human waste) and their occurrence in drinking water intake.

3.1.4 Irish use case

The Irish Actionlab is focused on farmland within County Wexford, in the south-east of Ireland and consists of two data-rich catchments (Ballycanew and Castledockerell), both extensively monitored since 2009 within the Agricultural Catchments Programme (ACP, www.teagasc.ie/agcatchments). Ballycanew catchment is close to 12 km² in area and is dominated by poorly drained soils mostly used for beef and dairy production. Castledockerell catchment is just over 11km² in area and is dominated by well drained soils mostly used for spring barley production. The catchments are part of the River Basin District Management Plan Ireland and belonging to the Owenavorrage and Slaney river catchments. Both catchments have small scale abstraction of groundwater to supply individual farms. Additionally, households within the catchment have common water supply from groundwater within the catchments. The drinking water resources are threatened by nutrients from inorganic/organic fertilisers as well as point sources (e.g. farmyards and septic tanks), pesticides and metabolites from crop production, and microbials and emerging organic contaminants from organic fertilisers and septic tanks.

The WaterProtect tool will be used to examine water quality status of the catchment at distinct points over time in the context of different layers, e.g. topography, soil type and land drainage class. Additional point functionality could be: Meteo data and Soil Moisture Deficit (SMD) values for Drainage Class Points (% in total), and catchment discharge. The tool should help to create more transparency with respect to the link between farming systems and water quality, over time it should have the capacity to document practice uptake and also provide farmers with an updated drainage specific SMD.

3.2 Context diagram

Figure 4 presents the context diagram of the WaterProtect tool. We distinguish three user roles (i) experts, (ii) consultants and (iii) farmers. The experts deliver data to the WaterProtect tool (except Consorzio di Bonifica Piacenza), view all data on map and in graphs, and export data. In a second version the experts are allowed to register planned measures and view the applicability of measures on a certain location. On the other hand the consultants are also primary user as the experts but they don't deliver data to the system and are not allowed to export data. They use the tool to support their activities in giving advices to the farmers. A third role are the farmers who can follow up the water quality in the catchment. As they are not familiar with this kind of tools and for encouraging the farmers they have the possibility to register for receiving notification mailings. The decision to send a mail can be based on:



- when new measurements are loaded

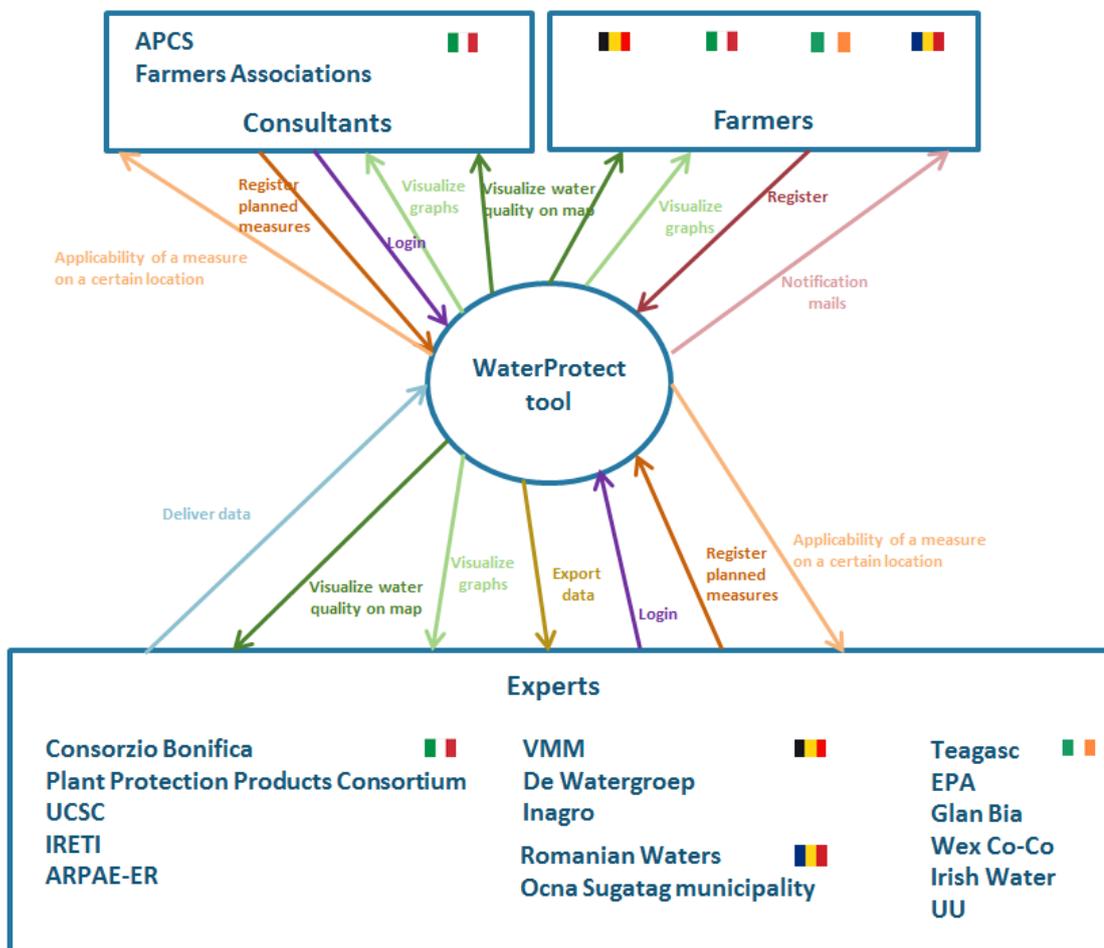


Figure 4: Context diagram of the Belgian, Italian, Romanian and Irish action labs

Experts and Consultants have a login for the extra functionalities.

Table 2 gives an overview of the data delivery to the WaterProtect tool.

Table 2: Overview of the data delivery

	Expert	Data
🇧🇪	VMM	Water quality data, water flow data, precipitation data
	De Watergroep	Water quality data
	Inagro	Measures data
🇮🇹	ARPAE-ER	Groundwater level data, precipitation data, land use data, water quality data
	IRETI	Water quality data
	UCSC	Water quality data

	Plant Protection Products Consortium Piacenza	Pesticides use data
	Romanian Waters	Water quality data, water flow data and precipitation data
	Ocna Sugatag municipality	Water quality data
	Teagasc (Agricultural Catchments Programme)	Hydrometric data (weather, water flow and groundwater flux), water quality data, ditch drainage data, Land Use data, Soil data (drainage class and chemistry), geophysical data, DEM's, CSA's and HSA's.
	EPA	Water quality data, water flow data
	Glanbia II	
	Wex Co-Co	Water quality data
	Irish Water	Water quality data
	UU	

3.3 Component diagram

Figure 5 presents the component diagram of the WaterProtect tool and **Error! Reference source not found.** describes the different components of the component diagram.

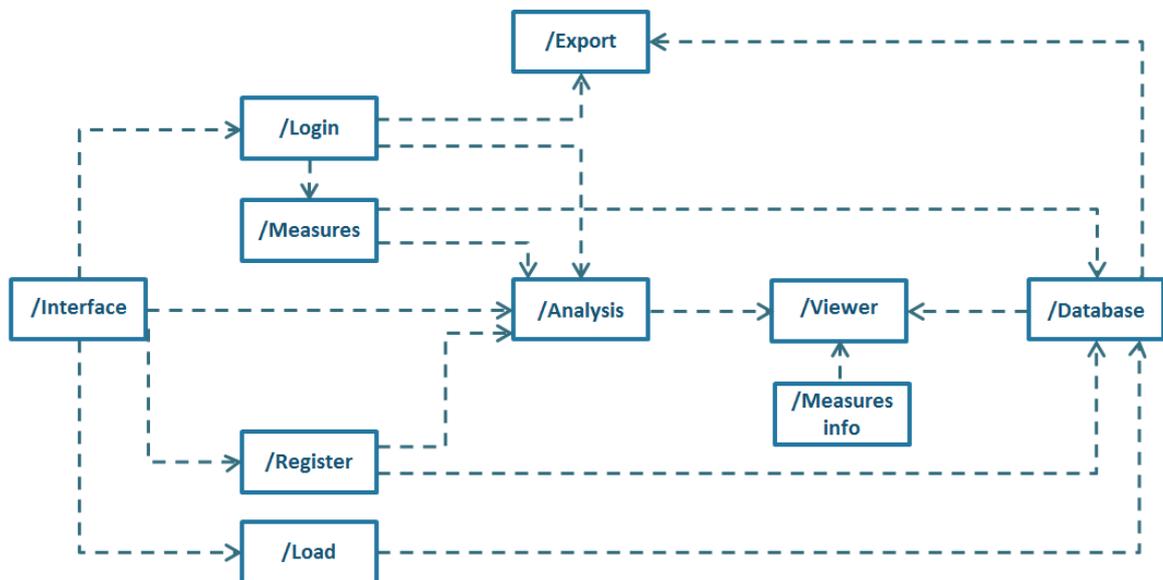


Figure 5: Component diagram of the WaterProtect tool



Table 3: Overview of the components

Component	Component description
/Interface	General screen of the WaterProtect tool
/Login	Expert users and consultants have a login for extra functionalities such as export data and registration of planned measures.
/Analysis	In the analysis component the users select the parameters like the catchment, the period, active substance, standard, ... before viewing the data
/Viewer	The viewer presents the selected data on map and in graphs
/Database	The database component contains all WaterProtect data
/Register	Users, particularly farmers, who want to be informed by notification mails need to register first.
/Measures	In the Measures component expert users and consultants can register planned measures on certain places, and the tool should be able to determine the applicability of a measure on a certain location
/Measures info	The measures info component contains the pdf data sheets of the available measures. The user can view this info by clicking on a measure.
/Export	The expert users can download: <ul style="list-style-type: none"> – monitoring data of a substance at a certain location for a particular period – precipitation data at a certain location for a particular period – water level at a certain location for a particular period
/Load	The administrator can upload their data into the WaterProtect tool

3.4 Use case diagram

Figure 6 contains the use case diagram for the WaterProtect tool and presents which use cases are applicable for which kind of user (expert user, consultant, farmer and administrator).

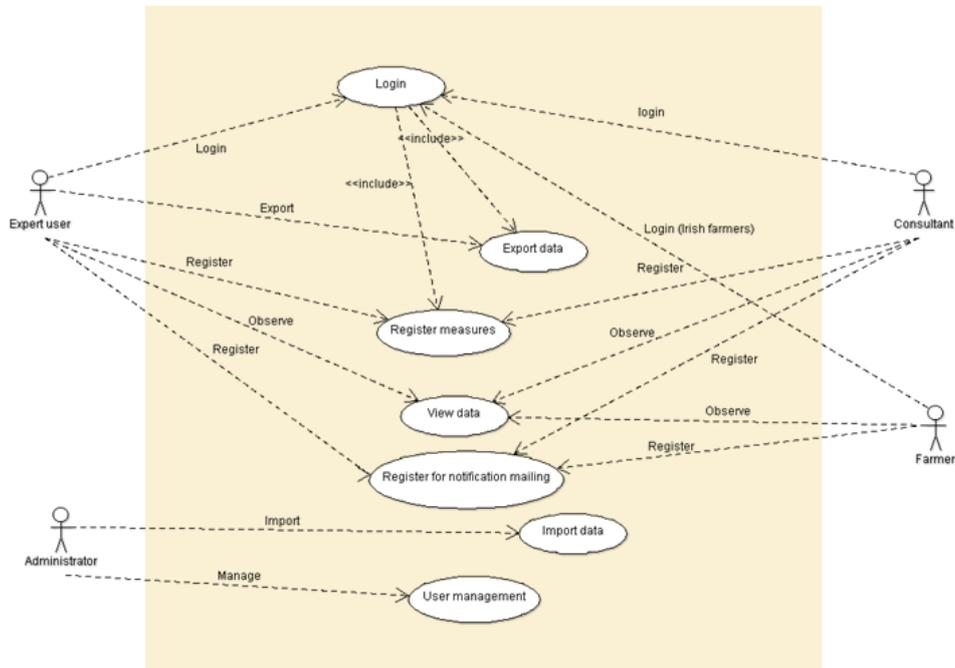


Figure 6: Use case diagram

The use case diagram includes the following use cases:

Table 4: Overview of the use cases

ID	Use case
UC-01	Login
UC-02	View data
UC-03	Register measures
UC-04	Register for notification mailing
UC-05	Import data
UC-06	Export data
UC-07	User management

The following table gives an overview of the user requirements that are used in the development of the WaterProtect tool, in relation to the use cases.

Table 5: Relation between user requirements and use cases

ID	Category	User requirement	Belgian action lab	Italian action lab	Romanian action lab	Irish action lab	Use case
URQ-1	Technical	The tool shall be a web tool so that users only need a browser for consulting WaterProtect data	x	x	x	x	NA
URQ-2	Technical	The web tool shall work on pc, tablet and smartphone	x	x	x	x	NA
URQ-3	Technical	The web tool shall be developed with open source framework and libraries	x	x	x	x	NA
URQ-4	Technical	The web tool shall use REST API for loading discharge and precipitation data.	x				NA
URQ-5	General	The web tool shall be user-friendly and easily understandable for farmers and other users	x	x	x	x	NA
URQ-6	General	The web tool shall be multilingual	x	x	x	x	UC-07 User management
URQ-7	General	The web tool shall contain user management	x	x	x	x	UC-07 User management
URQ-8	General	The web tool shall contain a search functionality on address	x	x	x	x	UC-01 View data
URQ-42 (**)	General	The Irish data is protected with a login. The web tool shall contain a security management where you define who can see what.				x	UC-07 User management
URQ-10	General	Farmers should receive e-mail notifications with a link to the WaterProtect App	x				UC-04 Register for notification mailing
URQ-11	Input	The tool should contain a load procedure for uploading monitoring data of a particular region	x	x	x	x	UC-05 Import data

ID	Category	User requirement	Belgian action lab	Italian action lab	Romanian action lab	Irish action lab	Use case
URQ-12	Input	The tool shall use an automatic load procedure for loading water level and precipitation data.	x			x	UC-02 View data
		<u>Maps</u>					
URQ-13	Data	The web tool shall contain the following set of possible maps: - Monitoring stations - Water courses - Agricultural land use - Groundwater levels - Potential erosion for agricultural parcels - Drainage areas linked to the monitoring stations - Risk map with demarcation critical areas for runoff of substances to surface water The list of possible maps is dependent on the action lab	x	x		x	UC-02 View data
URQ-14	Data	The web tool shall contain the following set of possible maps: - Monitoring stations - Nitrate sensitive zones - Water courses - Agricultural land use - Groundwater levels - Risk map with demarcation critical areas for runoff of substances to surface water The list of possible maps is dependent on the action lab				x	UC-02 View data

ID	Category	User requirement	Belgian action lab	Italian action lab	Romanian action lab	Irish action lab	Use case
URQ-15	Data	The web tool should contain following possible maps (if available): - groundwater protection zones - groundwater catchment map - sewerage map - soil type map - topographic map The list of possible maps is dependent on the action lab	x	x			UC-02 View data
URQ-16	Data	The web tool should contain following possible maps (if available): - groundwater catchment map - soil type map - topographic map - administrative areas The list of possible maps is dependent on the action lab			x		UC-02 View data
URQ-40 (**)	Data	The web tool should contain following possible maps (if available): - groundwater protection zones - groundwater catchment map - sewerage map - soil drainage map - soil type map - topographic map The list of possible maps is dependent on the action lab				x	UC-02 View data

ID	Category	User requirement	Belgian action lab	Italian action lab	Romanian action lab	Irish action lab	Use case
		<u>Monitoring data</u>					
URQ-19	Data	The tool shall contain the whole set of substances and visualize only the problem substances	x	x	x	x	UC-02 View data
URQ-21	Data	The tool shall contain nitrates	x	x	x	x	UC-02 View data
URQ-23	Data	The tool shall contain water level data	x			x	UC-02 View data
URQ-24	Data	The tool shall contain precipitation data	x	x		x	UC-02 View data
		<u>Measures data</u>					
URQ-25	Data	The web tool shall contain a set of measures with a detail description for each measure in pdf format	x	x	x	x	UC-02 View data
URQ-26	Program	The tool shall contain the following environmental standards: - Evaluation of the average concentration using the average for the selected period and dataset against the PNEC - Evaluation of the maximum concentration using the yearly maximum of the selected dataset against the MAC-EQS - Evaluation of the average concentration using the average for the selected period and dataset against the drinking water standard of 0,1 µ/l	x	x		x	UC-02 View data

ID	Category	User requirement	Belgian action lab	Italian action lab	Romanian action lab	Irish action lab	Use case
		<u>Standards</u>					
URQ-27(*)	Program	<p>The tool shall contain the following environmental standards:</p> <ul style="list-style-type: none"> - Evaluation of physical-chemical indicators (nitrates, nitrites, Dissolved Oxygen, pH, CBO5) according to the Water Framework Directive – Directive 2000/60/EEC, the Normative regarding the classification of surface water quality - The classification of the Water Framework Directive – Directive 2000/60/EEC (DCA) provides a system for classifying the surface water quality into five categories of quality: <p>Quality class 1: quality category - very good quality, level of impurities - absent, representation colour is blue.</p> <p>Quality class 2: quality category - good quality, level of impurities - low, representation colour is green.</p> <p>Quality class 3: quality category - moderate, level of impurities - moderate, representation colour is yellow.</p> <p>Quality class 4: quality category - satisfactory, level of impurities - critical, representation colour is orange.</p> <p>Quality class 5: quality category - degraded, level of impurities - heavy, representation colour is red.</p>					UC-02 View data
URQ-28	Program	The web tool shall not provide the possibility to use user defined standards	x	x	x	x	NA

ID	Category	User requirement	Belgian action lab	Italian action lab	Romanian action lab	Irish action lab	Use case
		<u>Measures</u>					
URQ-29	Program	The user shall be able to click on a particular measure to view detail measure info.	x	x	x	x	UC-02 View data
URQ-30	Program	The user should be able to register certain measures planned at a particular location on a map	x	x	x	x	UC-03 Register measures
URQ-31	Program	The web tool should be able to prioritize the applicability of a measure on a certain location, visualised in spider diagram or barchart	x	x	x	x	UC-03 Register measures
		<u>Visualizations</u>					
URQ-41 (**)	Program	The tool should visualize monitoring stations and locations with passive sampling on map				x	
URQ-33	Program	The web tool shall be able to generate a graph which visualises: - time series of monitoring data for a substance at a particular location - indication of the environmental standard (line)			x		UC-02 View data
URQ-34	Program	The web tool should be able to generate the following visualisations: - Graph with average and max. measurement per month, including annual average for a substance at a particular location - Pie chart of land use for the catchment associated with a particular location			x		UC-02 View data

ID	Category	User requirement	Belgian action lab	Italian action lab	Romanian action lab	Irish action lab	Use case
URQ-35	Program	<p>The web tool shall be able to generate a graph which visualises:</p> <ul style="list-style-type: none"> - time series of monitoring data for a substance at a particular location - the precipitation data (if available) - Water level data (if available) - indication of the environmental standard (line) <p>The user shall be able to deselect the precipitation data, water level data. The availability of the data is dependent on the action lab.</p>	x	x	x	x	UC-02 View data
URQ-36	Program	<p>The web tool should be able to generate the following possible visualisations:</p> <ul style="list-style-type: none"> - Graph with average and max. measurement per month, including annual average for a substance at a particular location - Graph with average and max. precipitation data per month, including annual average for a substance at a particular location -Graph with average and max. water level data per month, including annual average for a substance at a particular location - Pie chart of land use for the catchment associated with a particular location - Pie chart of erosion sensitivity for the catchment associated with certain location <p>The available data is dependent on the action lab.</p>	x	x	x	x	UC-02 View data

ID	Category	User requirement	Belgian action lab	Italian action lab	Romanian action lab	Irish action lab	Use case
URQ-36	Program	<p>The web tool should be able to generate the following possible visualisations:</p> <ul style="list-style-type: none"> - Graph with average and max. measurement per month, including annual average for a substance at a particular location - Graph with average and max. precipitation data per month, including annual average for a substance at a particular location -Graph with average and max. water level data per month, including annual average for a substance at a particular location - Pie chart of land use for the catchment associated with a particular location - Pie chart of erosion sensitivity for the catchment associated with certain location <p>The available data is dependent on the action lab.</p>	x	x	x	x	UC-02 View data
URQ-37	Output	<p>The user shall be able to download:</p> <ul style="list-style-type: none"> - monitoring data of a substance at a certain location for a particular period - precipitation data at a certain location for a particular period - water level data at a certain location for a particular period <p>The available data is dependent on the action lab.</p>	x	x	x	x	UC-06 Export data
URQ-38	Output	The web tool shall provide data downloads in csv format	x	x	x	x	UC-06 Export data

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() In order to maintain consistency and compatibility in the tool over all the use cases, there is decided with the Romanian action lab to adapt the implementation of URQ27 as follows: (i) environmental standards are only implemented for the parameters that are in the list of monitoring data (URQ19 – URQ25), and (ii) only one threshold value from the WFD classification is implemented, e.g. the threshold value that discriminates between good and moderate quality.*

*(**) New user requirements for the Irish action lab*

Planned for WaterProtect v2.0

3.5 Roles

<i>Identification:</i>	Expert user	<i>Type user:</i>	Primary
<i>Role:</i>	The expert user has a login and is authorized to export data. Other functionalities are to observe data in the viewer and register planned measures.		
<i>Users</i>	Belgium: VMM, De Watergroep, Inagro Italy : Consorzio Bonifica Piacenza, Plant Protection Products Consortium Piacenza, UCSC, IRETI, ARPAE-ER Romania: Romanian Waters, Ocna Sugatag municipality Ireland: Teagasc, EPA, Glanbia, Wex Co-Co, UU, Irish Water		

<i>Identification:</i>	Consultant	<i>Type user:</i>	Primary
<i>Role:</i>	The consultant has a login, observe data in the viewer and register planned measures.		
<i>Users</i>	Italy: APCS, Farmers Associations		

<i>Identification:</i>	Farmer	<i>Type user:</i>	Secondary
<i>Role:</i>	The farmer can observe the water quality data and measures data in the viewer. He has also the possibility to register for notification mailing. The Irish farmers can only view data when they are logged into the webtool because of privacy reasons of the data.		
<i>Users</i>	Belgium, Italy, Romania and Ireland: Farmers		

<i>Identification:</i>	Administrator	<i>Type user:</i>	Secondary
<i>Role:</i>	The administrator has the possibility to load new data into the tool and is responsible for user management.		
<i>Users</i>	Administrator of the web application		

The detailed description of the users can be found in deliverable D5.1 User Requirements, section 2.3 Users and user interface.

3.6 Use cases

3.6.1 Farmer

3.6.1.1 Use case: View data

3.6.1.1.1 Description

Use case: View data		Id: UC-02
Objective	Follow-up the water quality in the catchment	
Description	The farmer can observe the water quality on maps and in graphs. He can also view what measures are planned or executed.	
Primary actor(s)	Farmer	
Supporting actor(s)	Expert user, Consultant	
Scenarios	[UC-02-.01] View water quality status	

Scenario: View water quality status		Id: UC-02.01
Preconditions	✓ Irish farmers need to be logged into the web application	
Post conditions	Success condition: end	✓ The user makes a selection and the results are shown in the viewer
	Failure condition: end	✓ The results of the viewer are not corresponding to the selections in the analysis tab.
	Minimal guarantee:	✓ NA
Steps	<p>General view on the water quality status of the catchment</p> <ol style="list-style-type: none"> The user selects the catchment information that includes the name of the catchment and the source (surface water or groundwater). The relation between catchment and source is mostly 1 to 1, and in that case the source is automatically filled in after the selection of the name of the catchment. The user selects the period and clicks on 'Compute map'. The viewer zooms to the catchment and presents the water quality status for the catchment. <p><i>Remark: Only the dates wherefore data is available can be selected. It is also possible that we'll define periods like year, past 3 months, ...</i></p> <p>Water quality status for a particular monitoring station</p>	

3. The user selects a monitoring station in the analysis tab or he clicks on a monitoring station on the map. There are tooltips foreseen for the monitoring stations on the general water quality map.
4. The user selects an active substance from the dropdown list. The list contains *only the active substances with an exceedance in the selected monitoring station*. After clicking on 'Compute map' the viewer presents the water quality status for the selected active substance and according the environmental standard.

Remark: *The dropdown list of the active substances can contain a long list in some circumstances. When the user enters the first character of the active substance, the list goes automatically to the substances starting with the same character.*

5. The user can change the environmental standard into the drinking water standard in the analysis tab. When he clicks on 'Compute map', the viewer shows the water quality for the selected active substance according the drinking water standard.

Data in time series: water quality measurements, precipitation, water level (surface water and groundwater) and discharge (surface water)

6. The user can view the monitoring data for the selected monitoring station and selected active substance as a time series by clicking on 'Compute graph'. The bottom tab panel appears with the graph.
7. The user has also the possibility to see the precipitation data and the discharge data and water level data on the same graph by selecting the corresponding checkboxes.
The time series contains an indication of the selected standard (red line) and gives also the daily and the monthly average data.

Remarks:

- *Depending on the available discharge and precipitation data, there can be decided to provide one time series of discharge and precipitation data per catchment.*
- *On the graph we can provide a slider for zooming in on the data*

Changing the background maps

8. The user can change the background map or overlay layer by selecting or deselecting a map in the part of toggle maps.

Remarks: In toggle map section, background maps are visualized with radio buttons and overlay layers with checkboxes.

	<p>Search for a location</p> <p>9. The user has the possibility to search for a particular location in the catchment. He enters the address and clicks on the 'search' icon. The application sets a marker on the specified location on the map. Afterwards, the marker can be removed by clicking on the 'delete' icon in the search</p> <p>Remark: The buttons are foreseen of tooltips and the monitoring stations are also foreseen of tooltips with the name of the monitoring station.</p>
<p>Frequency</p>	<p>On user request</p>

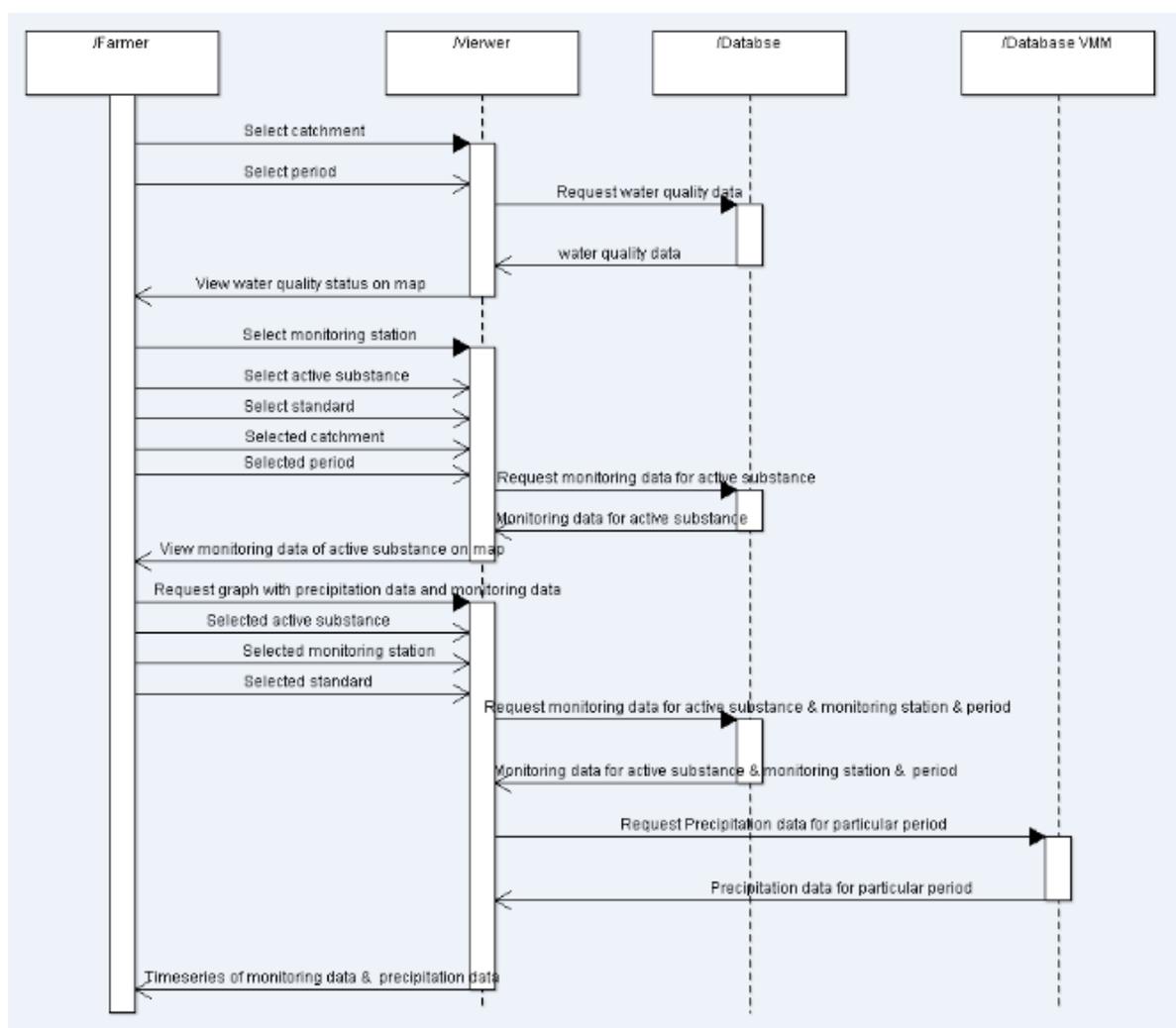


Figure 7: Sequence diagram with the data flow for the Belgian action lab

3.6.1.1.2 Wireframes

The user selects first the name of the catchment and the source (surface water or groundwater) is automatically filled in. Next he selects the period and clicks on 'Compute map'. The viewer presents

the water quality status of the catchment for the selected period on the map. Monitoring stations are coloured red when there is an exceedance of the environmental standard and stations are coloured yellow when there is an exceedance of the drinking water standard, otherwise they are coloured green (Figure 9).

Next the user selects a monitoring station in the analysis tab or on the map and selects also an active substance. After clicking on 'Compute map', the viewer presents the water quality status for the selected active substance and according the environmental standard (Figure 10). The user can change the environmental standard into the drinking water standard and after clicking on 'Compute map', the viewer shows the results (Figure 10).

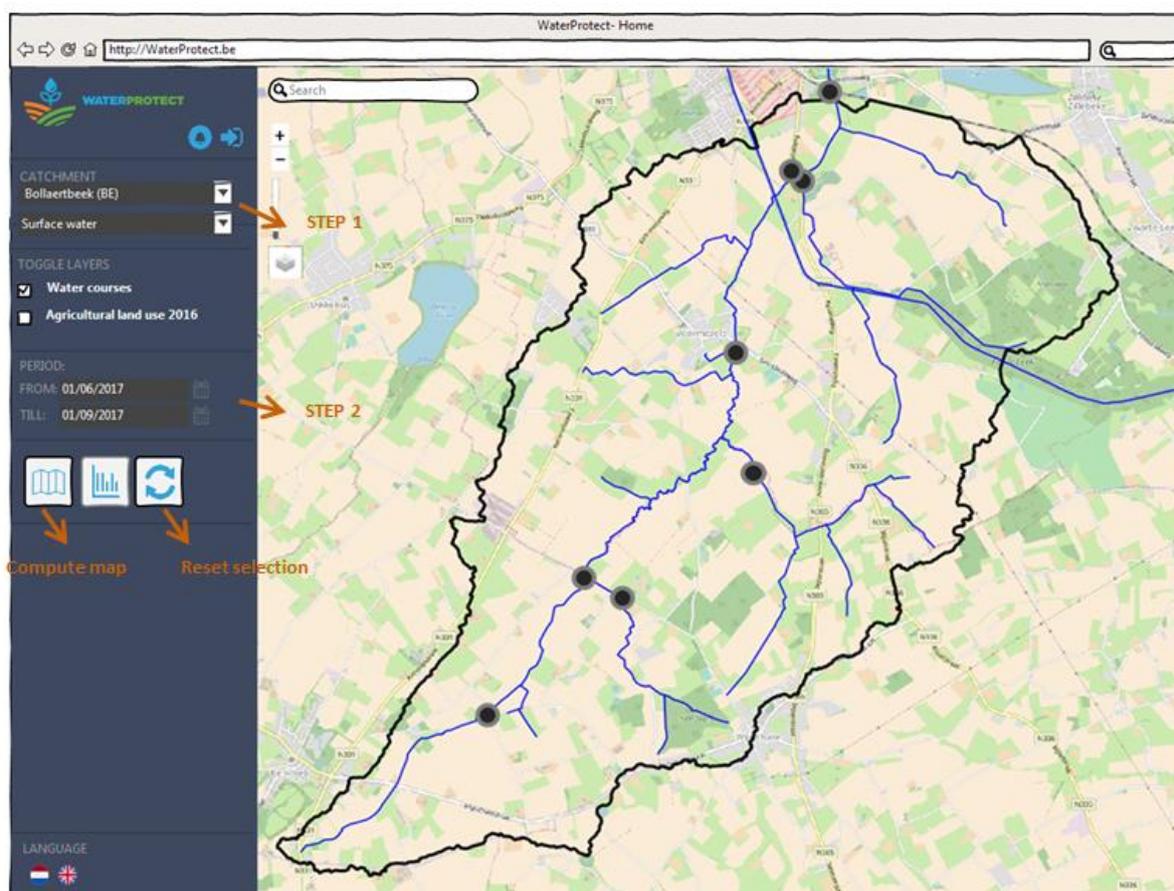


Figure 8: Selection of catchment and period in the analysis tab

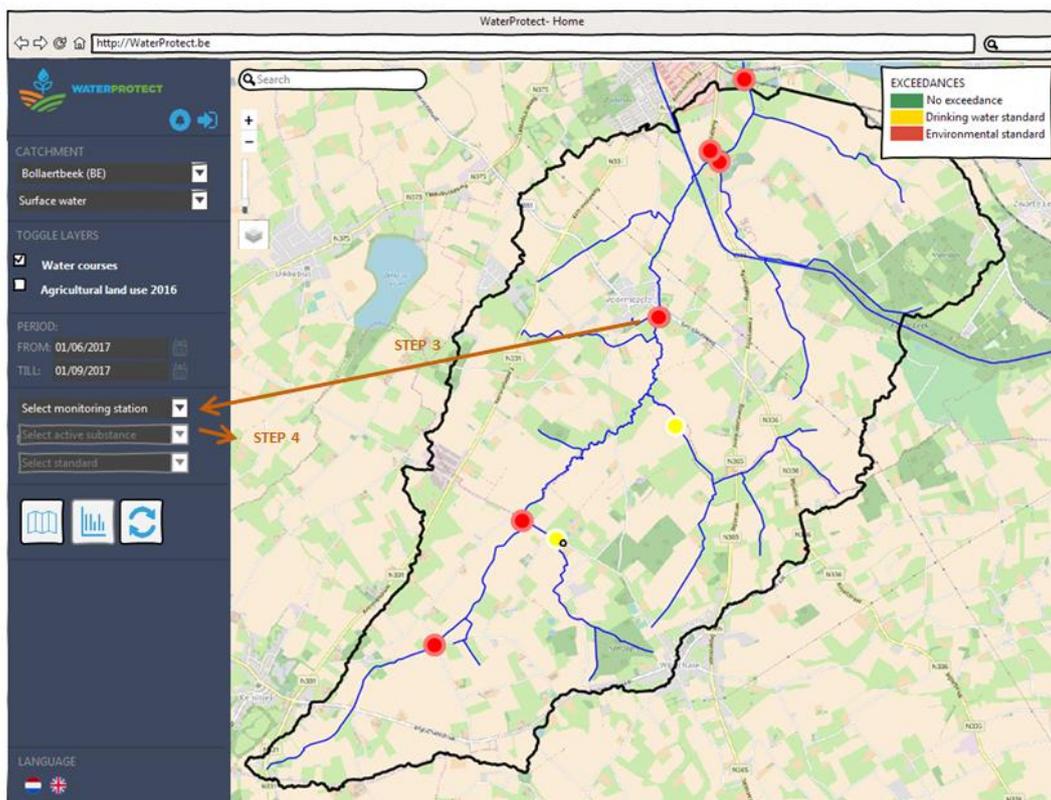


Figure 9: Water quality status of the catchment

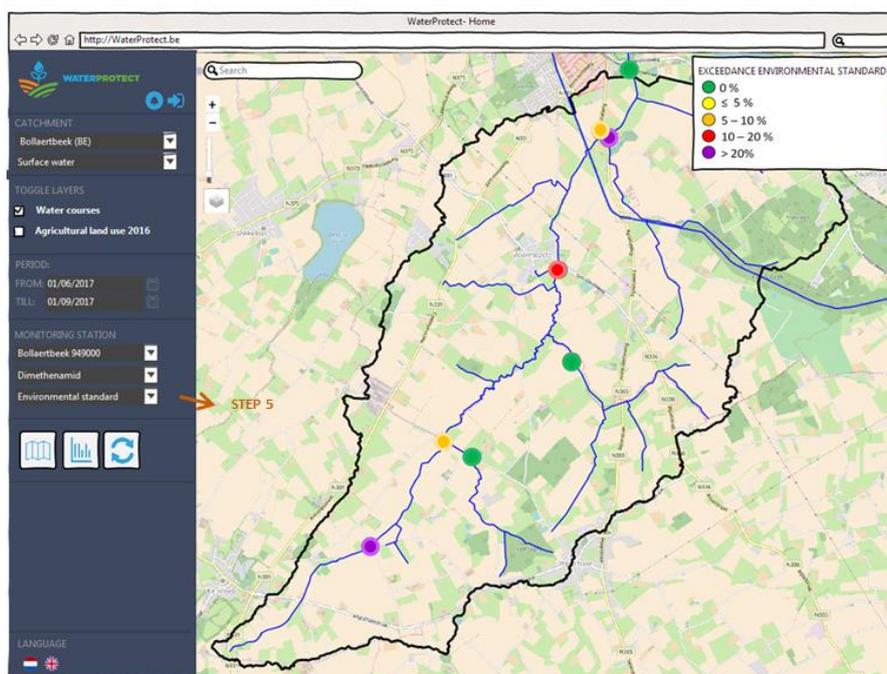


Figure 10: The water quality status in the catchment for the selected substance and according to the environmental standard

When the user clicks on 'Compute graph', the bottom appears with the time series of the monitoring data of the selected active substance and monitoring station. The user can also observe the precipitation data and the discharge data by selecting the corresponding checkbox.

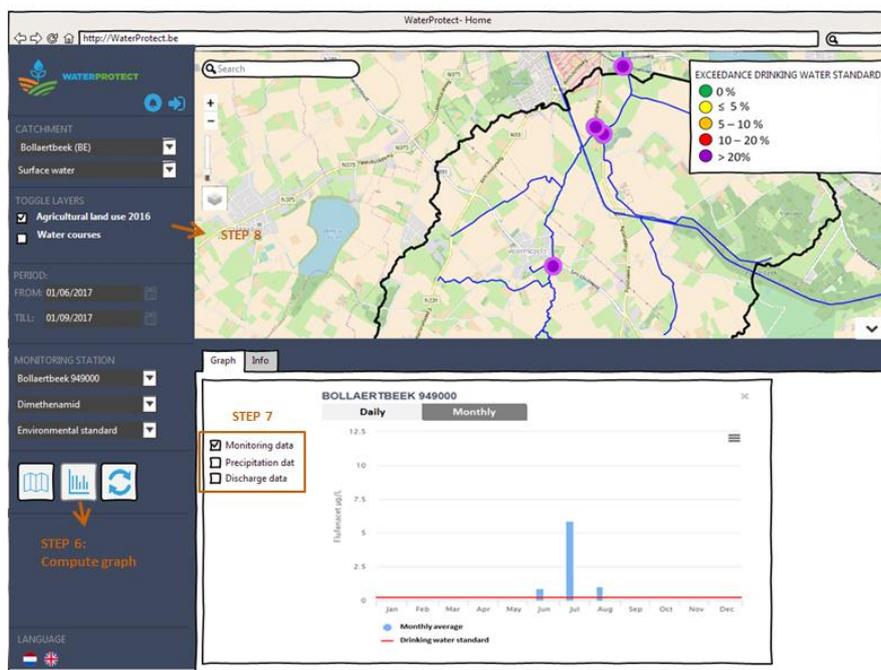


Figure 11: Time series of the monitoring data from the selected active substance and monitoring station

The user can change the background maps or add extra maps by selecting or deselecting a map in the section 'Toggle maps' (step 8 on Figure 11) and he can search a particular location on the map by entering an address and by clicking on the 'Search' icon. Next a marker appears on the particular location on the map. (Figure 12)

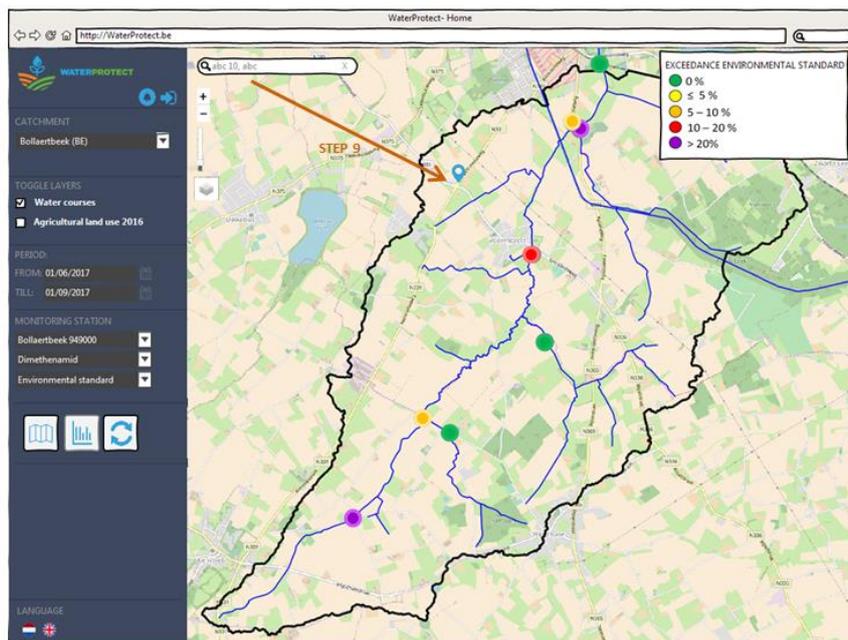


Figure 12: Search a particular location

3.6.1.2 Use case: Register for notification mail

3.6.1.2.1 Description

Use case: Register for notification mailing		Id: UC-04
Objective	Register for receiving notification mailings	
Description	- The user can register for receiving a notification mail. The mail is sent when new measurements are loaded	
Primary actor(s)	Farmer	
Supporting actor(s)	Expert user, Consultant	
Scenarios	[UC-04-.01] Register [UC-04-.02] Unregister [UC-04-.03] My notifications	

<i>Scenario: Register</i>		<i>Id: UC-04.01</i>
Preconditions	✓ NA	
Post conditions	Success condition: <i>end</i>	✓ The user is registered for receiving notification mails
	Failure condition: <i>end</i>	✓ The user is not registered in the database for receiving notification mailings ✓ The tool should generate an error message
	Minimal guarantee:	✓ NA
Steps	<ol style="list-style-type: none"> 1. The user clicks on the 'Alert' icon and selects 'Register for notifications'. 2. In the screen, the user selects the catchment. Normally the catchment is automatically selected on the condition that the catchment is selected in the analysis tab. 3. The user gives his email address and confirms that he wants to register for notification for the selected catchment. 4. Finally the user clicks on 'Save' 	
Frequency	On user request	

<i>Scenario: Unregister</i>		<i>Id: UC-04.02</i>
Preconditions	✓ NA	
Post conditions	Success condition: <i>end</i>	✓ The user is unregistered
	Failure condition: <i>end</i>	✓ The user is not unregistered and still receives notification mails ✓ The tool should generate an error message
	Minimal guarantee:	✓ NA
Steps	<ol style="list-style-type: none"> 1. The user receives a notification mail. The mail contains a message that new data is loaded for catchment XXX and water type YYY. The mail contains also a link to the WaterProtect tool with the selection of the catchment, the water type and the period from the previous upload date till the latest upload date of the data, so that the user can see immediately the water status. (Figure 9) At the end of the mail following sentence is included: 'Unregister for notification mails from WaterProtect for catchment XXX'. 2. The user clicks on this sentence and goes to a web page where he has to 	

	confirm that he wants to unregister. <i>Remark: Users can register for more than one catchment. This is not relevant for farmers, only for expert users and consultants.</i>
Frequency	On user request

Scenario: My notifications		Id: UC-04.03
Preconditions	✓ NA	
Post conditions	Success condition: end	✓ The tool gives an overview of the registered notifications of the user based on the email address
	Failure condition: end	✓ The tool cannot give an overview of the registered notifications of the user based on the email address and there are registered notifications on the email address in the database. ✓ The tool should generate an error message
	Minimal guarantee:	✓ NA
Steps	<ol style="list-style-type: none"> 1. The user clicks on the 'Alert' icon and selects 'My notifications'. 2. In the screen (Figure 14), the user enters his mail address and clicks on 'Show my notifications' . 3. The tool gives an overview of the registered notifications based on the email address. The user can also delete a particular notification from the list by clicking on the garbage icon. 4. Finally the user clicks on 'Save' <p>Remark: The icon has a tooltip with 'Delete' as text.</p>	
Frequency	On user request	

3.6.1.2.2 Wireframes

The user clicks on the notification icon and the register screen appears. Next he selects the catchment, if this is empty, and enters his personal information. Finally the user clicks on 'Save' and receives the message 'You are successfully registered'.

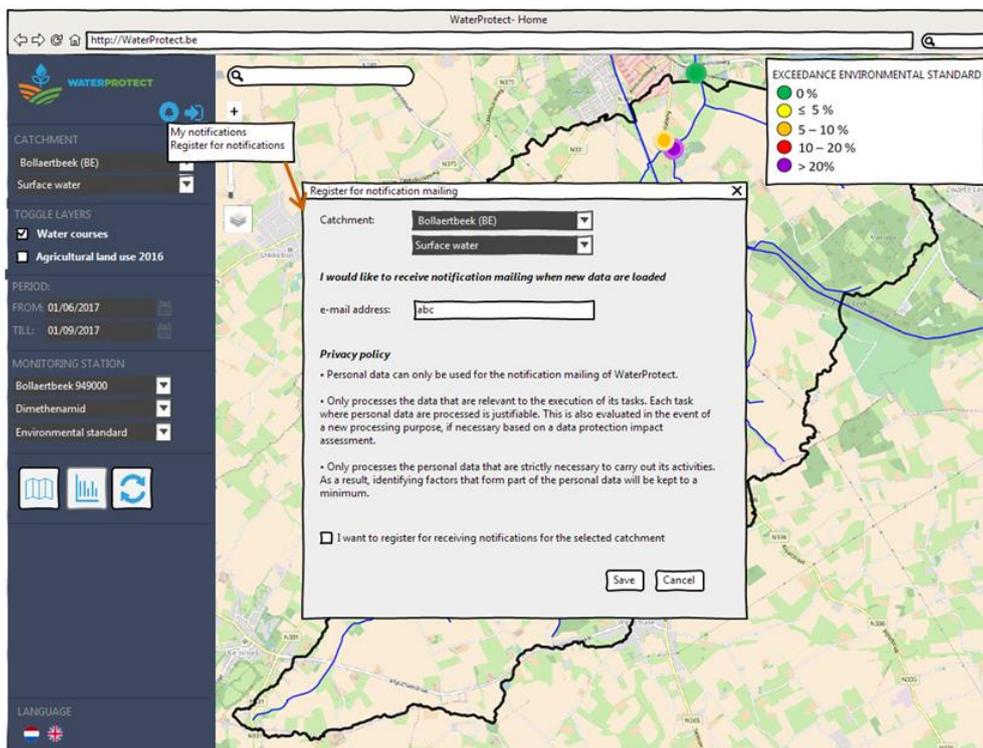


Figure 13: Register for notification mailing

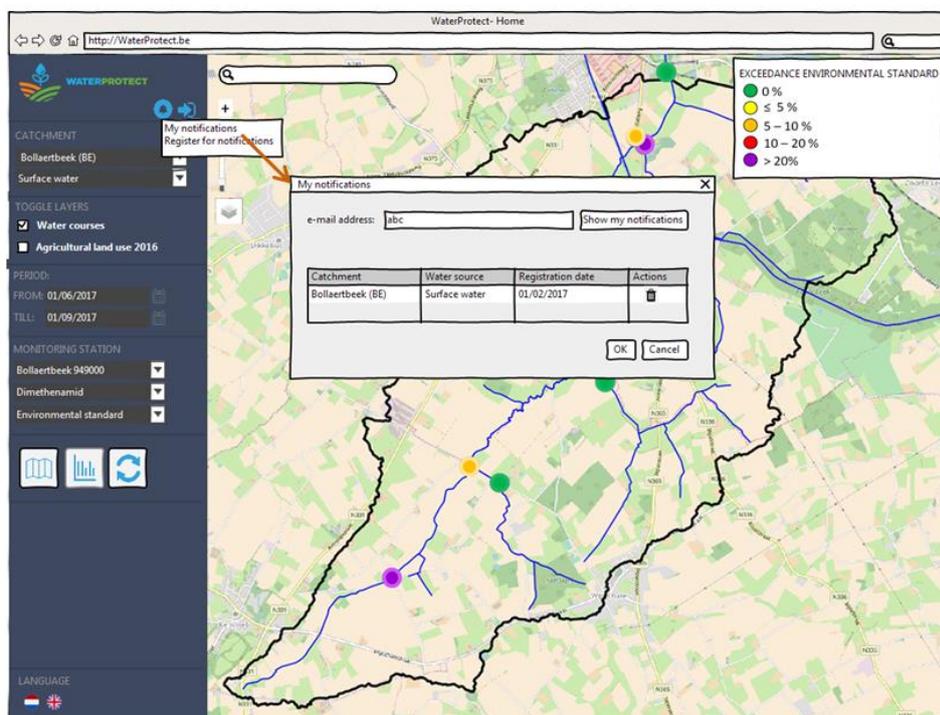


Figure 14: My notifications

3.6.1.1 Use case: Login

Farmers cannot view the Irish data without a login because of privacy reasons. See section 3.6.2.1 Use case: Login

3.6.2 Expert user

3.6.2.1 Use case: Login

3.6.2.1.1 Description

Use case: Login		Id: UC-01
Objective	Login into the WaterProtect tool to be authorized for performing extra functionalities	
Description	A login is required for following functionalities: <ul style="list-style-type: none"> - Export data - Register planned measures 	
Primary actor(s)	Expert user, consultant, Irish farmers	
Supporting actor(s)		
Scenarios	[UC-01-.01] Login [UC-01.02] Change user preferences	

Scenario: Login		Id: UC-01.01
Preconditions	✓ NA	
Post conditions	Success condition: <i>end</i>	✓ The user is logged into the web application and can perform the extra functionalities.
	Failure condition: <i>end</i>	✓ The tool should generate an error message if the user is unknown or wrong password
	Minimal guarantee:	✓ NA
Steps	1. The user clicks on login 2. The user enters his user name and password, and clicks on 'login'	
Frequency	On user request	

Scenario: Change user preferences		Id: UC-01.02
Preconditions	✓ NA	
Post conditions	Success condition: end	✓ The user preferences are updated
	Failure condition: end	✓ The user preferences cannot be updated in the database ✓ The tool should generate an error message
	Minimal guarantee:	✓ NA
Steps	3. The user clicks on preferences 4. The user can change his password, language, name and email address 5. The user clicks on 'Save'	
Frequency	On user request	

3.6.2.1.2 Wireframes

The user clicks on the login icon and the login screen appears. Here the user enters the login information.

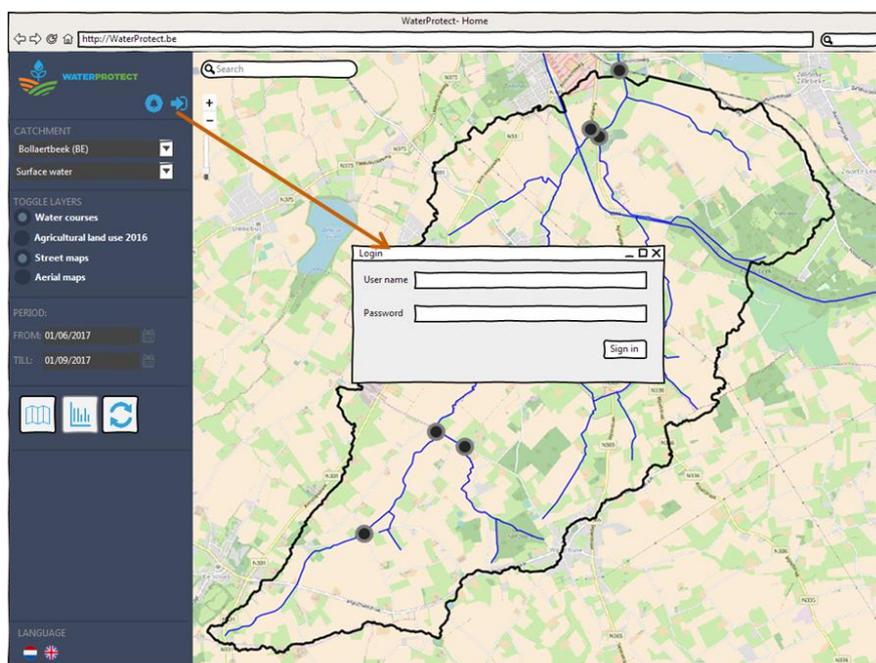


Figure 15: login screen

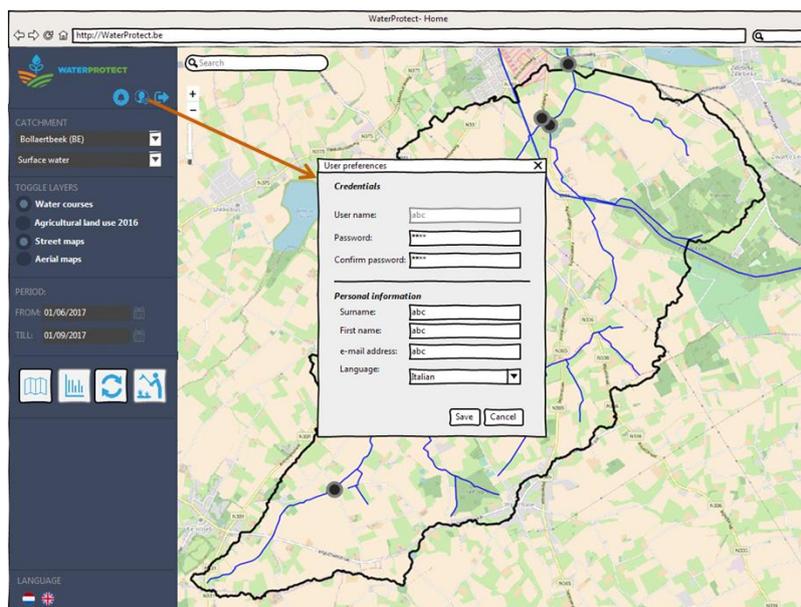


Figure 16: User preferences screen

The user clicks on the icon of user preferences and the user preferences screen appears. The user can change his password or his personal information.

3.6.2.2 Use case: View data

See section 3.6.1.1 Use case: View data

The expert users has access to more information than farmers. The result is that the expert users can view more statistics (land use data and erosion sensitivity data). (Figure 17)

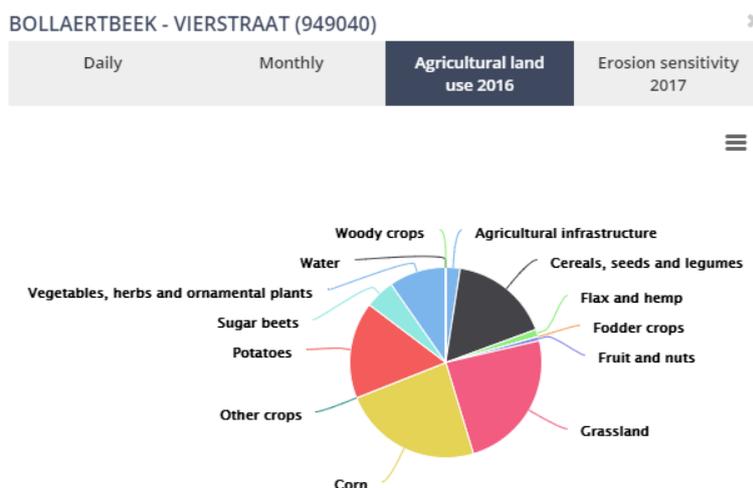


Figure 17: Piechart of Agricultural land use 2016

The land use chart is calculated for the selected period.

3.6.2.3 Use case: Export data

3.6.2.3.1 Description

Use case: Export data		Id: UC-06
Objective	Export the selected data in CSV format	
Description	<p>The user shall be able to download:</p> <ul style="list-style-type: none"> - monitoring data of a substance at a certain location for a particular period - precipitation data at a certain location for a particular period - water level data at a certain location for a particular period <p>The format is CSV.</p>	
Primary actor(s)	Expert user,	
Supporting actor(s)		
Scenarios	[UC-06-.01] Export data	

Scenario: Export data		Id: UC-06.01
Preconditions	<ul style="list-style-type: none"> ✓ The user is logged in ✓ Following selections are required: the catchment, the time period, monitoring station and an active substance. ✓ The user has clicked on 'compute graph' 	
Post conditions	Success condition: <i>end</i>	✓ The data is successfully downloaded and the user can view the data in excel
	Failure condition: <i>end</i>	<ul style="list-style-type: none"> ✓ The data is not downloaded or the file is corrupt ✓ The tool should generate an error message
	Minimal guarantee:	✓ NA
Steps	<ol style="list-style-type: none"> 1. In the graph tab there is a download icon provided 2. The user clicks on the download icon and the selected data will be exported to a csv file for downloading <p>Remark: The data export is also dependent on the checkboxes in the graph tab. Precipitation data or discharge data need to be selected if needed for the download.</p>	
Frequency	On user request	

3.6.2.3.2 Wireframes

In the graph tab the user can download the selected data. The data export is dependent on the data visualised in the graph. Precipitation data or discharge data can only be downloaded if their checkboxes are selected. (Figure 18)

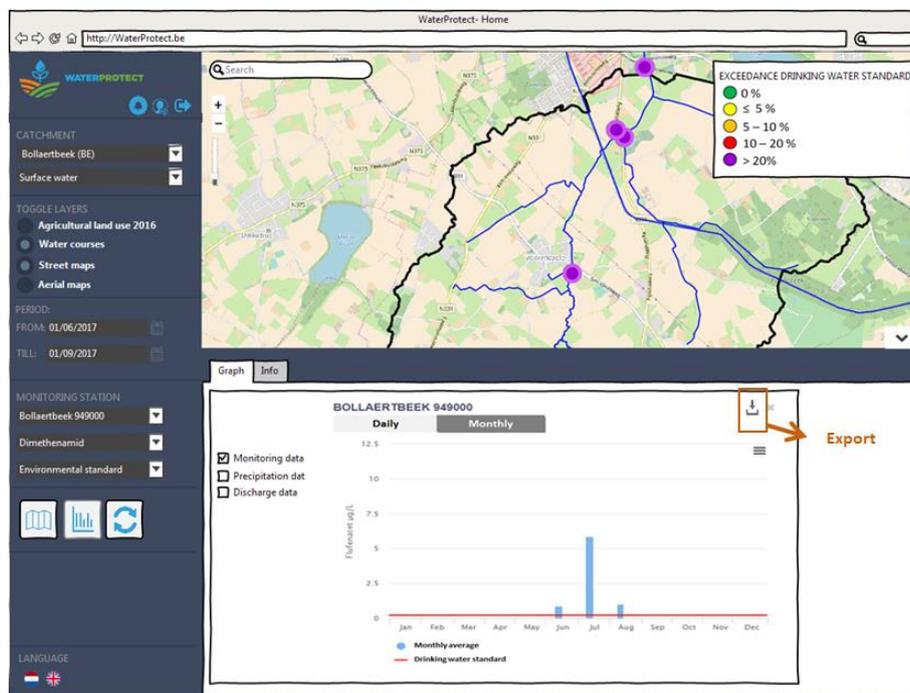


Figure 18: Export data

3.6.2.4 Use case: Register measures

3.6.2.4.1 Description

Use case: Register measures		Id: UC-03
Objective	The user can use the measure analysis to determine the applicability of a measure on a certain location. Afterwards the user can register a planned measure.	
Description	The user can determine the applicability of measures on a certain location through the measure analysis. Afterwards he has the possibility to register a measure. The user can view the registered measures by selecting the map 'measures' in the section of the toggle maps.	
Primary actor(s)	Expert user, consultant	
Supporting actor(s)		
Scenarios	[UC-03-.01] Measure analysis	

	<p>[UC-03-.02] Register a measure</p> <p>[UC-03-.03] View registered measures</p> <p>[UC-03-.04] Update a measure</p> <p>[UC-03-.05] Delete a measure</p>
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Scenario: Measure analysis		Id: UC-03.01
Preconditions	<ul style="list-style-type: none"> ✓ The user is logged in ✓ Required selections: the catchment 	
Post conditions	Success condition: end	✓ The user can view the applicability graph of measures at a certain location in the catchment
	Failure condition: end	<ul style="list-style-type: none"> ✓ The measure analysis does not give any information ✓ The tool should generate an error message
	Minimal guarantee:	✓ NA
Steps	<ol style="list-style-type: none"> 1. The user clicks on the measures icon. The measures analysis tab appears, the background map of agricultural land use 2016 and the layer of measures are automatically selected. Planned measures are visualized with a orange marker and for executed measures the lot is filled with dots. 2. First the user selects a lot in the catchment by selecting the marker and drop on the particular lot on the map. The marker can be removed by clicking on the 'waste bin' icon. <ul style="list-style-type: none"> Remark: When the user moves the marker, lots on the location of the marker are automatically highlighted. 3. After selecting the lot, the WaterProtect tool gives a suggestion of possible measures applicable in that area. 4. The user selects one or two measures to investigate the applicability. Next he clicks on 'Calculate'. 5. The tool generates a applicability graph. (e.g. a spider diagram) <p>View datasheet of a measure</p> <ol style="list-style-type: none"> 6. The user can view the datasheet of a measure by clicking on the info icon next to the measure. The pdf sheet will be opened in a new window tab in the browser. 	
Frequency	On user request	

<i>Scenario: Register measure</i>		<i>Id: UC-03.02</i>
Preconditions	<ul style="list-style-type: none"> ✓ The user is logged in ✓ The user has performed the measures analysis 	
Post conditions	Success condition: <i>end</i>	✓ The measure is registered
	Failure condition: <i>end</i>	<ul style="list-style-type: none"> ✓ The measure is not registered and not visible when the user selects the layer of measures. ✓ The tool should generate an error message
	Minimal guarantee:	✓ NA
Steps	<ol style="list-style-type: none"> 1. The user clicks on the 'register' button of a particular measure. 2. A marker is placed in the middle of the selected area. The user moves the marker to the right location on the map. Once the marker is on the right place, he clicks on the marker. 3. A window appears where the user register the selected measure. The measure cannot be changed here. The user can only view the datasheet of the measure by clicking on the info icon. The user enters minimum the planning date of the measure. 4. The user clicks on 'Save' and the marker becomes an orange marker when the planning date is filled in or a green marker when the execution date is filled in. When the user clicks on 'Cancel' the marker is removed from the map. 	
Frequency	On user request	

<i>Scenario: View registered measures</i>		<i>Id: UC-03.03</i>
Preconditions	<ul style="list-style-type: none"> ✓ The user is logged in ✓ Required selections: the catchment 	
Post conditions	Success condition: <i>end</i>	✓ The layer of measures is visible on the map
	Failure condition: <i>end</i>	✓ The tool should generate an error message
	Minimal guarantee:	✓ NA
Steps	<ol style="list-style-type: none"> 1. The user selects the layer of measures in the section of 'Toggle maps' in the analysis tab. 2. The layer is visualized on the map. Planned measures are visualized with 	

	orange markers and executed measures with green markers.
Frequency	On user request

Scenario: Update a measure		Id: UC-03.04
Preconditions	<ul style="list-style-type: none"> ✓ The user is logged in ✓ Required selections: the catchment, layer of measures 	
Post conditions	Success condition: end	✓ The info of the measure is updated
	Failure condition: end	<ul style="list-style-type: none"> ✓ No updates are accepted ✓ The tool should generate an error message
	Minimal guarantee:	✓ NA
Steps	<ol style="list-style-type: none"> 1. The user clicks on a particular marker or on a lot filled with dots and a popup window appears. 2. The user clicks on edit and enters new information 3. The user clicks on Save. When the execution date was entered, and this is the first executed measure for that lot, the lot shall be filled with dots. <p>Remark: Only users from the same organization are allowed to update measures registered by an user of their organization. E.g. the users of Inagro registers measures, users from 'De Watergroep' are not allowed to update one of these measures.</p>	
Frequency	On user request	

Scenario: Delete a measure		Id: UC-03.05
Preconditions	<ul style="list-style-type: none"> ✓ The user is logged in ✓ Required selections: the catchment, layer of measures 	
Post conditions	Success condition: end	✓ The measure is deleted
	Failure condition: end	<ul style="list-style-type: none"> ✓ The measure is not deleted ✓ The tool should generate an error message
	Minimal guarantee:	✓ NA

Steps	<ol style="list-style-type: none"> 1. The user clicks on a particular marker or on a lot filled with dots and a popup window appears. 2. The user clicks on delete. The tool generates a message 'Are you sure to delete this measure?' The user clicks on 'Yes' to delete the measure. <p>Remark: Only users from the same organization are allowed to delete measures registered by an user of their organization. E.g. the users of Inagro registers measures, users from 'De Watergroep' are not allowed to delete one of these measures.</p>
Frequency	On user request

3.6.2.4.2 Wireframes

[UC-03-01] Measures analysis

The user clicks on the measures icon and the measures analysis tab appears. The tool shows automatically the agricultural land use 2016 map as background map and the overlay layer 'Measures'. First the user selects a lot by clicking on the marker icon and drops the icon on the right lot (Figure 19). Next the tool gives a suggestion of possible measures in that area. The user selects one or two measures to investigate the applicability and clicks on 'calculate'. The tool generates the applicability graphs (e.g. a spider diagram). (Figure 20)

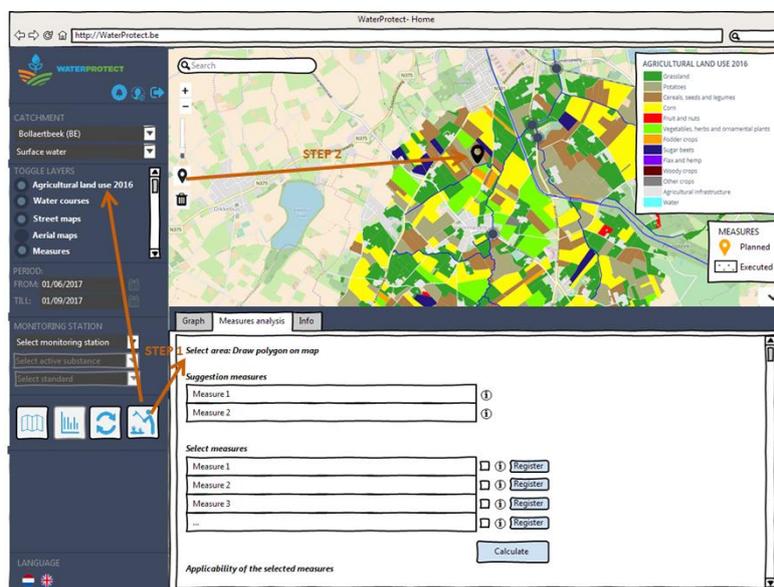


Figure 19: Measure analysis - select area

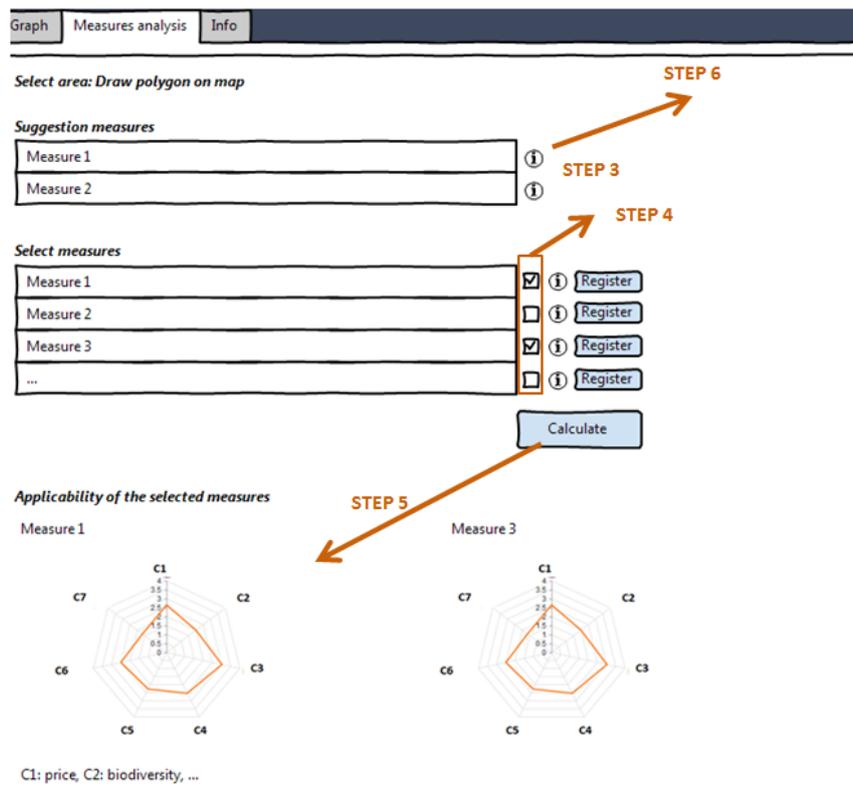


Figure 20: Measure analysis tab

The user can view the datasheet of a measure by clicking on the info icon. The pdf datasheet will be opened in another window tab in the browser..

[UC-03-02] Register measure

The user clicks on the register next to a particular measure and a popup window appears for registering the measure. Minimum the planning date is required for registering a measure. After clicking on 'Save', the marker becomes orange when only the planning date is entered. When the execution date was entered the lot is filled with dots.

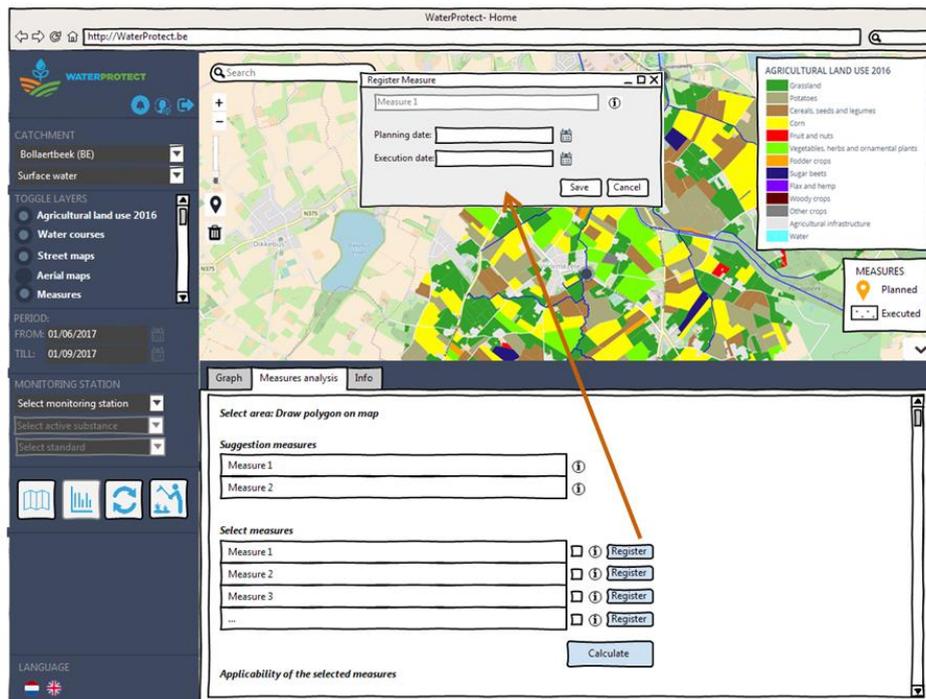


Figure 21: Register measure

[UC-03-03] View registered measures

The user selects the layer of Measures in the section 'Toggle layers' in the analysis tab. Planned measures are visualized with orange markers and for executed measures the lots are filled with dots.

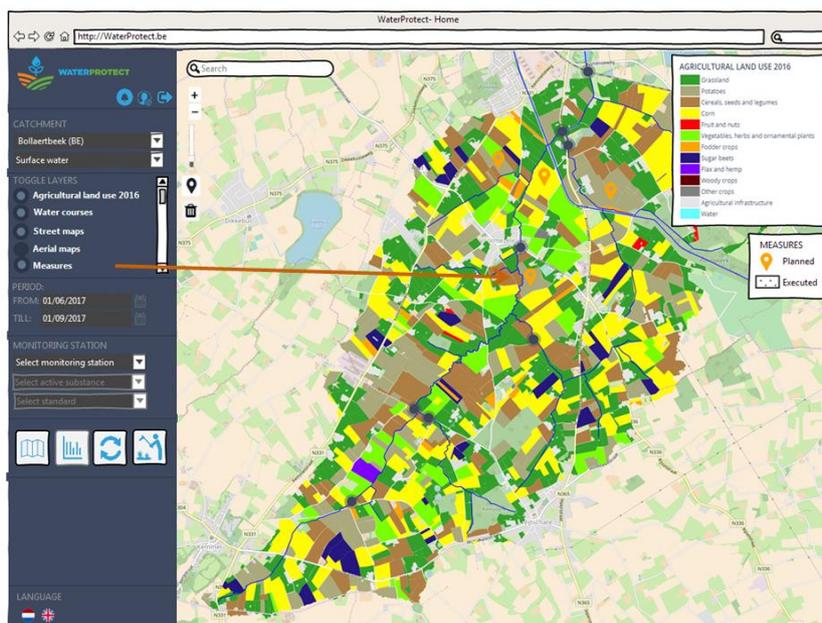


Figure 22: View registered markers

[UC-03-04] Update a measure

The user clicks on a marker to see the planned measures and a popup window appears. The user clicks on edit for updating the information of the measure. And finally he clicks on Save.

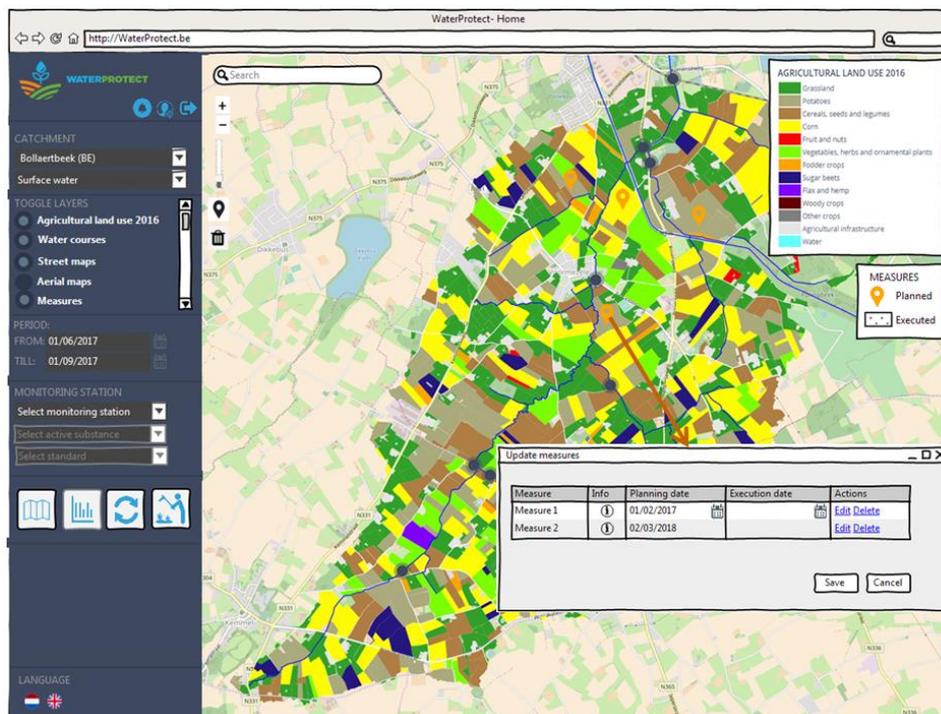


Figure 23: Measure info

When the user want to view the executed measures, he clicks on a lot filled with dots.

[UC-03-05] Delete a measure

The user clicks on a marker and a popup window appears. The user clicks on delete and a popup message appears 'Are you sure to delete this measure?'. The user clicks on 'Yes' for deleting the measure.

3.6.2.5 Use case: Register for notification mailing

See section 3.6.1.2 Use case: Register for notification mail

3.6.3 Consultant

3.6.3.1 Use case: Login

See section 3.6.2.1 Use case: Login

3.6.3.2 Use case: View data

See section 3.6.2.2 Use case: View data

3.6.3.3 Use case: Register for notification mailing

See section 3.6.1.2 Use case: Register for notification mail

3.6.3.4 Use case: Register measures

See section 3.6.2.4 Use case: Register measures

3.6.4 Administrator

3.6.4.1 Use case: Import data

3.6.4.1.1 Description

Use case: Import data		Id: UC-05
Objective	Load data into the WaterProtect tool	
Description	Load new measurement data and maps into the WaterProtect tool to follow-up the water quality of the catchment. Measurement data includes water quality data, water flow data, precipitation data, water level data, land use data and erosion data.	
Primary actor(s)	Administrator	
Supporting actor(s)		
Scenarios	[UC-05-.01] Load measurement data [UC-05.02] Load map data	

Scenario: Load measurement data		Id: UC-05.01
Preconditions	✓ New measurement data available	
Post conditions	Success condition:	end ✓ New data is loaded ✓ The batch process for the notification mailing should be triggered

	Failure condition:	end	✓ No new data is loaded ✓ Load procedure generates a log file where the administrator can follow-up the procedure and the error messages
	Minimal guarantee:		✓ NA
Procedure	There is on administrator per catchment and he can load data. The upload date, the catchment and the water type should be registered in the database because the batch process for the notification mailing is based on the upload date and the catchment. Every time new data is uploaded for a particular catchment the batch process of the notification mailing should be triggered. (see 3.6.1.2 Use case: Register for notification mail) Also the data owner is registered for data security		
Frequency	On user request		

Scenario: Load map data		Id: UC-05.02	
Preconditions	✓ New maps available for loading		
Post conditions	Success condition:	end	✓ New maps are loaded
	Failure condition:	end	✓ No new maps loaded ✓ Load procedure generates a log file where the administrator can follow-up the procedure and the error messages
	Minimal guarantee:		✓ NA
Procedure	The load procedure for maps is depending on the technical analysis which will clarify in what data store type (e.g. geoserver, ...) the maps should be loaded and determine what steps are needed for loading new maps.		
Frequency	On user request		

3.6.4.2 Use case: User management

3.6.4.2.1 Description

Use case: User management		Id: UC-07
Objective	Define new users and delete users	
Description	User management includes defining new users and deleting users. Updating user information is not required because every expert user or consultant is allowed the manage his own user preferences.	
Primary actor(s)	Administrator	
Supporting actor(s)		
Scenarios	[UC-07-.01] Add new user [UC-07.02] Delete user	

Scenario: Add new user		Id: UC-07.01
Preconditions	✓ New user must be defined	
Post conditions	Success condition: end	✓ The new user is added.
	Failure condition: end	✓ New user is not added. ✓ Load procedure generates a log file where the administrator can follow-up the procedure and the error messages .
	Minimal guarantee:	✓ NA
Procedure	The administrator adds a new user. The minimum data requirements are: <i>first name, surname, email address, language, role, username and password, and the data accessibility.</i>	
Frequency	On user request	

Scenario: Delete user		Id: UC-07.02
Preconditions	✓ A user must be deleted.	
Post conditions	Success condition: end	✓ The user is deleted from the database.

	Failure condition:	end	<ul style="list-style-type: none"> ✓ The user is not deleted from the database. ✓ Delete procedure generates a log file where the administrator can follow-up the procedure and the error messages .
	Minimal guarantee:		✓ NA
Procedure	The administrator delete an user.		
Frequency	On user request		

Remarks: User management includes also data security. The administrator defines which data the user can access.

3.7 Conclusions

The development of the WaterProtect tool shall be done in two stages:

- Stage 1 (version 1) requires the user requirements with priority one
- Stage 2 (version 2) shall contain the user requirements which are grey in the user requirements matrix.

The delivery of the first version is foreseen at the end of 2018 and the delivery of the second version at the end of 2019.

Next requirements are not taken into account in the functional analysis:

- URQ-9 The web tool may provide the possibility to see info of other action labs
- URQ-17 & URQ-18 The web tool may contain following maps
 - map of applied measures with an indication which measures had a positive effect
 - map with discharge monitoring stations
 - map with protected areas
 - map focus areas
- URQ-20 The tool may contain also the commercial product names, next to the active substances
- URQ-22 The tool may contain phosphates and suspended matter
- URQ-32 The web tool may give an indication of the possible effect of the measure on a certain location (field)
- URQ-39 The web tool may be able to create a pdf report with relevant info & graphs of a certain location

These requirements have priority 3 in the original user requirements matrix. More info can be found in D5.1. User requirements.

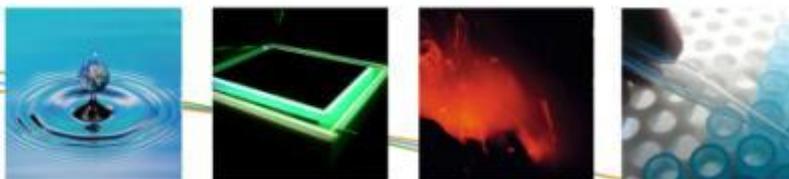
During the development stage the functional analysis can be further adapted with improvements or additional requirements.



WATERPROTECT

Action lab: Vester Hjerk

Erling Andersen & Andreas Aagaard Christensen
University of Copenhagen



4 Action lab Vester Hjerk

4.1 Introduction

The tool to be used in the Danish WaterProtect Action Lab is the dNmark Landscape tool developed under the auspices of the Danish nitrogen research alliance (dNmark). The tool is designed for use in local catchments and tested in five case areas in the period 2016-2018 (<http://dnmark.org>).

The overall objective of the tool is to provide a scientifically based dialog platform to foster good collaboration between key actors for identifying optimal solutions at catchment scale to reduce nitrate emissions from agriculture to groundwater and surface water systems. Specific objectives include:

- Visualisation of water quality data from national and local data sources
- Include relevant soil-crop-management data at a scale relevant to the farmers, e.g. field scale or less
- Provide “on-the-fly” calculations of nitrate leaching under current and alternative management scenarios
- Take transport pathways via drainage into consideration

The benefit and goal of the tool is that it will be designed to enable local stakeholders and communities to assess the effect of their land use practices on N-leaching and emission by making visualization, assessment and prediction functions available in an easily accessible interface.

The tool will build on the following assumptions: (1) That lack of information is a key driver for unsustainable farm scale nitrate management practices, and (2) That farm scale nitrate management is systematically suboptimal to catchment / landscape scale management practices. Therefore, the tool is designed to supply information and support decision making at appropriate scales.

4.2 Context diagram

Figure 24 presents the context diagram of the Danish Landscape tool.

The tool is to be used in a workshop setting where we distinguish two user roles (i) Workshop participants and (ii) Tool operator.

The workshop participants are stakeholders from the Action Lab area. In WaterProtect, we will focus on workshops predominately with farmers as participants. The Tool operator will in WaterProtect be a researcher with detailed knowledge of the tool. The tool is currently under development to enlarge the Tool operator group targeting local advisory services.

The context diagram follows the workshop set-up:

In a first data iteration (Blue track in diagram), the workshop participants are invited to assess visualization of the data and suggest changes to for example soil parameters, crop sequences and fertilizer management. The local data are added to the tool by the tool operator and again visualized for the workshop participants.

The second step of the workshops focus on agreement on the current situation. Based on the agreement amongst workshop participants the tool operator updates baseline variables in the tool and a baseline scenario are visualized for the workshop participants.

Finally, in the last step of the workshop process the workshop participants suggest solution to the initially agreed current situation. Suggested changes in land use and land management are added to the tool by the tool operator and a scenario solution are visualized for the workshop participants. This last iteration can be repeated to provide alternative solutions for assessment.

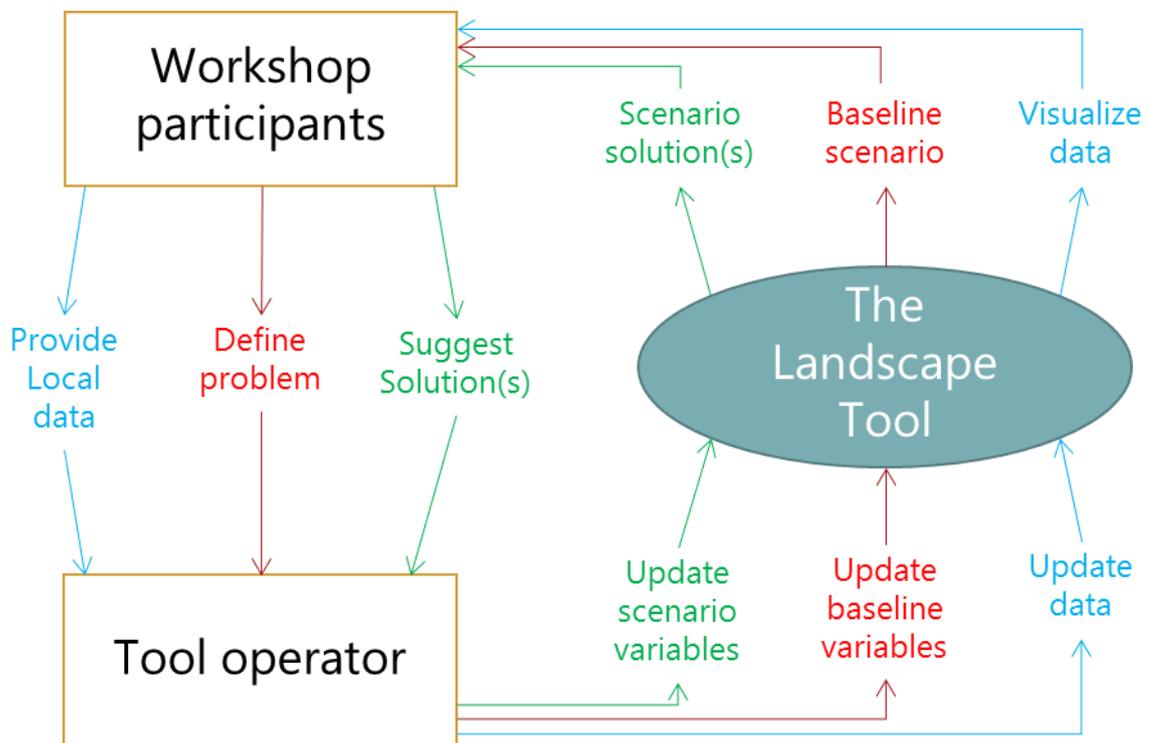


Figure 24: Context diagram

4.3 Component diagram

The current version of the dNmark Landscape Tool consists of five modules: (1) The pre-processing module prepares data for calculation. (2) The calculation module estimates the leaching and retention for 20 by 20 meter grid cells and outputs a landscape scale map showing the results. (3) The interface module consists of a selection tool and an array of drop-down menus, allowing the user to select a set of grid cells and change the input data and the land use and management of the selected cells. (4) The recalculation module re-calculates leaching and retention estimates on a cell-by-cell basis. (5) The comparison module compares the results from the status quo calculation with the scenario that was set up using the interface module.

Figure 25 presents the component diagram of the Landscape tool and Table 3 describes the different component of the component diagram.

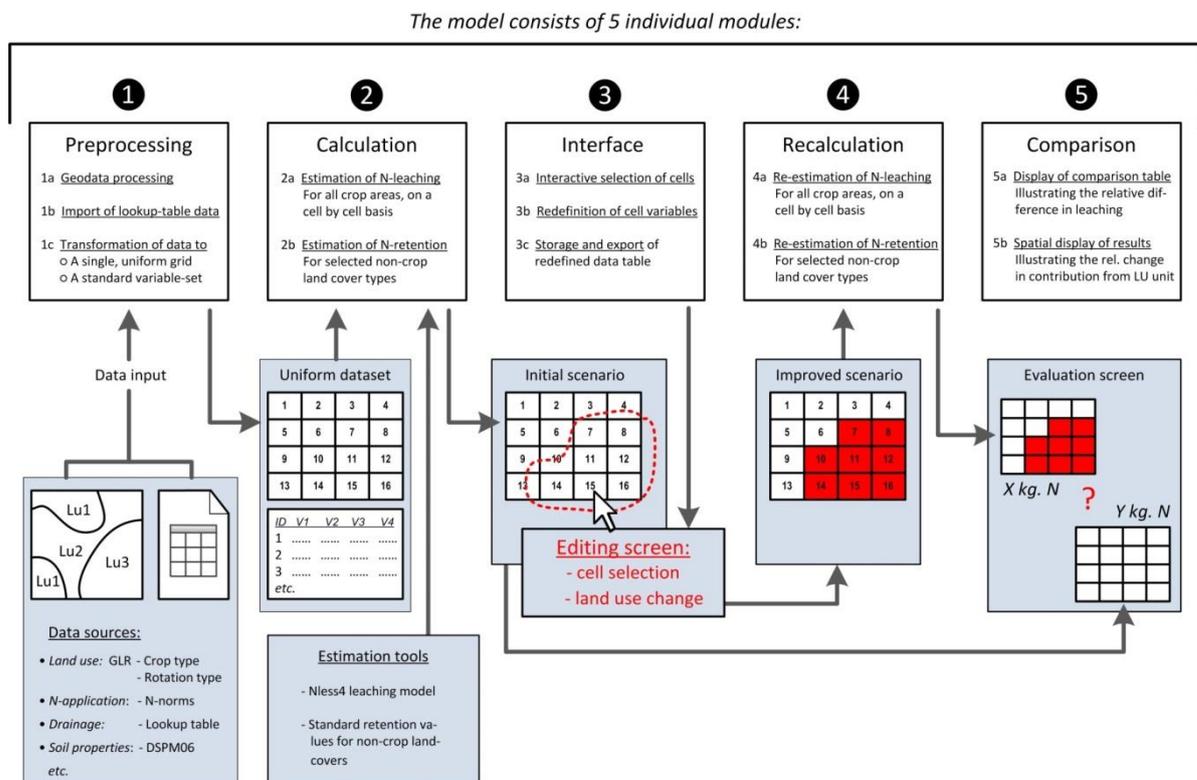


Figure 25: Component diagram of the WaterProtect tool

Table 6: Overview of the components

Component	Component description
Preprocessing	The preprocessing module prepares data for calculation. It is run prior to workshop situations and serves the purpose solely of standardizing and automating the data processing procedures necessary for the calculation module to be fed with consistent data. Ensuring the consistency of the datasets used is critical, because the model is intended for use in live situations where

	<p>breakdowns and failure to compute is unacceptable. The preprocessing module is designed to accept standard national scale datasets and as such it is able to output datasets for any non-urban case area in Denmark. Variables are stored as columns in the attribute table of the vector grid map. Variable outputs from the preprocessing module include (1) Editable data such as land use data and selected geo-ecological data, as well as (2) Stable non-editable location-specific factors such as, precipitation and conditions for irrigation. Land use is recorded either as five-year crop rotations (on rotational land) or as a permanent land use type such as permanent grasslands, forest or wetlands (for areas outside rotation)</p>
Calculation	<p>The calculation module estimates the leaching and retention of each cell and outputs a map showing the results. For each cell the output map shows: (1) Average yearly leaching estimated over a five year period, depending on the crops grown, winter cover, amount of applied N and geo-ecological conditions (based on the Nless 4 model); (2) Average yearly retention estimated over a five year period, depending on the type of land cover (based on standard retention figures per area unit derived from Eriksen et al. 2014); (3) Net. N-effect per year average, calculated as the total of N-retained and N-leached per year over a five year period.</p>
Interface	<p>The interface module consists of a selection tool and an array of drop-down menus, allowing the user to select a set of cells and change the land use of the selected cells. When the land use of a cell is changed, a number of variables are changed automatically with it (table 2), allowing subsequent calculations to compute swiftly. The options available for changing land use (i.e. the alternative land uses applied) are picked up from two tables: (1) A table detailing standard rotations to choose from; and (2) A table detailing standard N-retention measures to choose from. These tables are prepared based on the workshop design and are necessary inputs to the interface module. In addition to changes in land use, the interface module allows the user to modify four other variables: Catch crops, Amount of applied N, Presence of field drains and Soil type. The output from the interface module is an amended dataset representing a scenario to be evaluated.</p>
Recalculation	<p>The recalculation module re-calculates leaching and retention estimates on a cell-by-cell basis. It functions exactly as the calculation module described above, but results are stored in separate output fields making it possible to compare with original status quo calculations directly.</p>
Comparison	<p>The comparison module compares the results from the status quo calculation with the scenario that was set up using the interface module, and relates the two to a retention map of the case area (to be described). On this basis, if the case area corresponds with a defined watershed, an estimate for the net. flow of N in kg. per year out of the case area is calculated for each of the two</p>

	scenarios and compared.
--	-------------------------

4.4 Use case diagram

Figure 26 contains the use case diagram for the Landscape tool and presents which use cases are applicable for which kind of user (Tool operator and workshop participant). In UC-01 new local knowledge on drainage patterns will be added to the tool based on information from the local farmers. This will improve the current data significantly. In UC-02, the capability of the tool will be expanded from covering only surface waters to include groundwater. This will be applied by adding information on the split between these to the current data on retention. UC-01 and UC-02 is linked as the drainage influences the amount of N leached from the root zone. UC-03 will add a new spatial option to the visualizations. Currently, visualisations and results can be generated at grid or catchment level. By adding a layer with spatial layout of farms, visualizations at farm level will also be possible. Data for both UC-02 and UC-03 is available from national data sources. UC-04 is not generated from user requirements, but is a part of the work description of WaterProtect. It includes both data from existing national data sets, but also local survey data from Vester Hjerk generated in WaterProtect. A decision on UC-04 is still pending, as it might be more feasible to make the water quality data available in a dedicated web-browser solution.

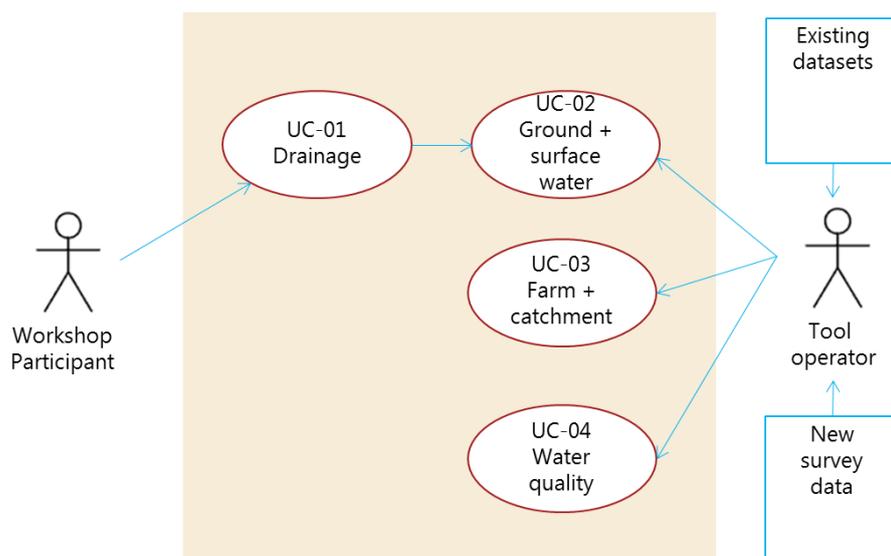


Figure 26: Use case diagram. Arrows are data flows

Table 7: Overview of the use cases

ID	Use case
UC-01	Local drainage data
UC-02	Ground- and surface water
UC-03	Results from farm to catchment level
UC-04	Water quality data

Table 8 gives an overview of the user requirements that are used in the development of the Landscape tool, in relation to the use cases. Note that the use cases only include the improvements to be implemented in the tool in the WaterProtect project.

Table 8: Relation between user requirements and use cases

ID	Category	User requirement	Use case
URQ-1	Technical	Grid cell level inputs	NA
URQ-2	Technical	On the fly calculations	NA
URQ-3	Technical	Available through web-browsers	NA
URQ-4	Technical	User management system including individual data access	NA
URQ-5	Technical	Detailed logging of changes	NA
URQ-6	General	Assess emissions to both surface waters and groundwater	UC-02 Ground- and surface water
URQ-7	General	Account for landscape variation in model estimations	NA
URQ-8	General	Scales from farm level to catchment level	UC-03 Results from farm to catchment level
URQ-9	General	For workshop with several stakeholder inputs	NA
URQ-10	General	Shall be used by trained consultants	NA
URQ-11	General	Guidance on use of the tool in workshop situations	NA
URQ-12	General	Calculation time < 5 minutes in workshops	NA
URQ-13	Input	Allow editing of data based on local knowledge	NA
URQ-14	Input	Shall specify data source type	NA
URQ-15	Input	Shall use most recent Danish retention mapping	UC-02 Ground- and surface water
URQ-16	Input	Shall consider drainage e.g. through input of modelled estimates for drained and not drained areas.	UC-01 Drainage
URQ-17	Input	Shall allow transparency regarding sources of input data	NA
URQ-18	Input	Shall allow selection of waterbodies in focus based on modules	NA
URQ-19	Output	Shall generate data for export	NA
URQ-20	Output	Shall allow easy comparison with other result estimates	NA
URQ-21	Functionality	Shall allow easy selection of case areas	NA
URQ-22	Functionality	Shall allow easy choice of scale of intervention	NA
URQ-23	Functionality	Shall handle dynamic effects between measures	NA
URQ-24	Functionality	User interface should be simple and easy to use	NA
URQ-25	Visualization	Shall use easy-to-read maps to illustrate results	NA
URQ-26	Visualization	Maps and reports on results should be generated	NA

4.5 Roles

<i>Identification:</i>	Workshop participant	<i>Type user:</i>	Primary
<i>Role:</i>	The workshop participant provides input data based on local knowledge. They define baseline as well as future scenarios and assess the results.		
<i>Users</i>	Farmers and other stakeholder in Vester Hjern Action Lab		

<i>Identification:</i>	Tool operator	<i>Type user:</i>	Primary
<i>Role:</i>	The tool operator operates the tool. This includes managing inputs from workshop participants, initiating calculations and presenting visualizations to the workshop participants.		
<i>Users</i>	In WaterProtect a researcher from University of Copenhagen. In the future local experts predominately agricultural advisors.		

The detailed description of the users can be found in deliverable D5.1 User Requirements, section 2.3 Users and user interface.



4.6 Use cases

4.6.1 Tool operator

4.6.1.1 Use case 01: Local drainage data

<i>Use case: Local drainage data</i>		<i>Id: UC-01</i>
Objective	To improve the data on drainage in landscape tool	
Description	Improved data on drainage in the landscape tool is needed to provide more reliable results on Nitrate leaching.	
Primary actor(s)	Tool operator, workshop participants	
Supporting actor(s)		
Scenarios	[UC-01.01] Local drainage data	

<i>Scenario: Local drainage data</i>		<i>Id: UC-01.01</i>
Preconditions	✓ Drainage in the current version of the landscape model is represented by knowledge rules derived from soil characteristics and divided in three classes.	
Post conditions	Success condition: <i>end</i>	✓ > 50% of the agricultural area in Vester Hjern action lab is covered by local knowledge on drainage
	Failure condition: <i>end</i>	✓ < 50% of the agricultural area in Vester Hjern action lab is covered by local knowledge on drainage
	Minimal guarantee:	✓ NA
Steps	3. Local knowledge on drainage is provided by workshop participants to tool operator. 4. The tool operator integrates the new data into the tool.	
Frequency	Depending on frequency of workshops	

4.6.1.2 Use case 02: Ground- and surface water

<i>Use case: Ground- and surface water</i>		<i>Id: UC-02</i>
Objective	To add groundwater to the visualizations and results from the landscape tool.	

Description	Assessment of the N emissions should integrate the leaching to the groundwater as well as the discharge to surface recipients.
Primary actor(s)	Tool operator
Supporting actor(s)	
Scenarios	[UC-02.01] Ground- and surface water

Scenario: Ground- and surface water		Id: UC-02.01
Preconditions	✓ The output of the tool in the current version covers only surface waters.	
Post conditions	Success condition: end	✓ The tool can provide results for surface- as well as groundwater.
	Failure condition: end	✓ The tool cannot provide results for surface- as well as groundwater.
	Minimal guarantee:	✓ NA
Steps	<ol style="list-style-type: none"> Information on the split between groundwater and surface water is provided at grid level by researchers based on existing national datasets. The tool operator integrates the new data into the tool. 	
Frequency	One operation	

4.6.1.3 Use case 03: Results from farm to catchment level

Use case: Results from farm to catchment level		Id: UC-03
Objective	To provide results from the tool at different spatial levels.	
Description	Workshop participants are expected to request results at the farm level.	
Primary actor(s)	Tool operator	
Supporting actor(s)		
Scenarios	[UC-03.01] Results from farm to catchment level	

Scenario: Results from farm to catchment level		Id: UC-03.01
Preconditions	✓ In the current version the tool provides visualization and results at grid and catchment level.	

Post conditions	Success condition: <i>end</i>	✓ It is possible at workshops to results at farm level to the participants.
	Failure condition: <i>end</i>	✓ It is <u>not</u> possible at workshops to results at farm level to the participants.
	Minimal guarantee:	✓ NA
Steps	<ol style="list-style-type: none"> 1. A GIS-layer on the spatial configuration of the farms is produced based on existing data. 2. The tool operator integrates the new data into the tool at grid level. 	
Frequency	Yearly updates. The information will always be from last year, but can serve as a starting point.	

4.6.1.4 Use case 04: Water quality data

Use case: Water quality data		Id: UC-04
Objective	To include water quality data in the tool.	
Description	Water quality data could be included in the visualization options of the tool to provide information to the workshop participants. The aim is not to include the water quality data in calculations.	
Primary actor(s)	Tool operator	
Supporting actor(s)		
Scenarios	[UC-04.01] Water quality data	

Scenario: Water quality data		Id: UC-04.01
Preconditions	✓ The current version of the landscape tool does not include water quality as an option for visualization.	
Post conditions	Success condition: <i>end</i>	✓ It is possible at workshops to present water quality data to the participants.
	Failure condition: <i>end</i>	✓ It is <u>not</u> possible at workshops to present local water quality data to the participants.
	Minimal guarantee:	✓ NA
Steps	<ol style="list-style-type: none"> 1. Data from/links to existing national data sets are provided. 2. Data from WaterProtect surveys are provide. 	

	3. The tool operator integrates the new data into the tool.
Frequency	To be decided if it should be based on dynamic linking or for example yearly updates.

4.6.2 Workshop participant

4.6.2.1 Use case: Local drainage data

See 3.6.1.1 where the role of the workshop participants is described.

4.7 Conclusions

The survey of user requirements for Deliverable 5.1 generated 26 user requirements (see table 4).

Four of these (6+8+15+16) are covered by the three use cases on drainage, ground- and surface waters and farm level visualizations and results. Additionally, one use case is added on water quality data to comply with the work description of WaterProtect.

The remaining user requirements fall in two large groups:

- Requirements, for which the current version of the tool already comply (user requirements 1+2+7+9+11+13+19+20+23+25).
- Requirements that requires substantial additional resources to be implemented (user requirements 3+4+5+10+12+14+17+21+22+24+26). If additional resources become available in the future, these are good candidates for implementation.

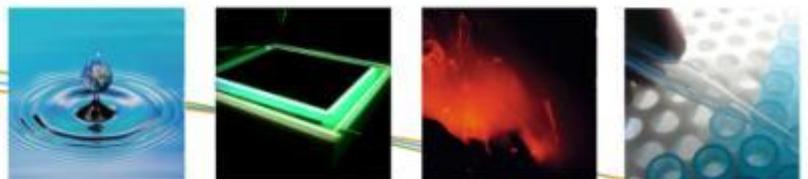
Finally, we find that one requirement, selection of water bodies (user requirement 18), is not of interest for the future use of the tool.



WATERPROTECT

Action lab: Llobregat case

Enric Queralt, Vinyet Solà



5 Action lab Spain

5.1 Introduction

The Llobregat case is formed by aquifers covering 120 km² and a 22-km stretch of the Llobregat River. The water is used for drinking water, industry and agriculture.

The Llobregat case had an old geographic information system defined in 2004 and used until 2017. This tool was made in ARC GIS software. Thanks to the WaterProtect project we have defined a new tool called GISEL (Geographic Information System of el Llobregat) supported by open source (Open GIS). Moreover, this tool will have more functionalities with more partners and more visibility for society in general.

Old version	New version
One user	Online display: everyone can find data
Arc Gis (commercial licence)	QGIS (open source)
Groundwater data	Surface and groundwater data
Data included from 3 partners	Data included from 6 partners
Typical chemical parameters	Extensive chemical parameters

Table 9: Comparison between the old and new versions

The GISEL tool enables better management of several waters (surface and groundwater), easy access to information, monitoring quality and pollution status and providing data to farmers to improve Best Management Practices.

5.2 Description of the software

QGIS: This software makes it possible to create, edit, display, analyse and publish geospatial information on Windows, Mac, Linux and BSD (Android coming soon). QGIS is very useful for desktop, server, in your web browser and as developer libraries. The software hosts a database with waterpoints, location, chemical data, etc.

FEFLOW: It is a groundwater modelling solution to simulate flow and transport contamination. This tool is only for advanced users and all data will be provided from QGIS. FEFLOW provides best-in-class technology for groundwater flow, contaminants, groundwater age and heat transport simulations. With its efficient user interface and its as yet unmatched range of functionality and

flexibility, FEFLOW has become a standard in premium groundwater modelling over the last 35 years.

BENEFITS

- FEFLOW is a completely integrated package from simulation engine to user interface. Maximise our productivity and limit the time and effort spent on model setup, simulation runs and results evaluation
- Flexible meshing strategies and the option to include time-varying geometries allow for accurate spatial representation of geology
- Increase the reliability of your model results with FePEST, our tool for model calibration, uncertainty quantification and sensitivity analysis
- FEFLOW is designed to handle plug-ins for extended functionality or for automating workflows. Develop your own plug-ins or let us customise the software for you
- It is available in a number of feature levels to provide the functionality that matches your project
- FEFLOW includes a licence for WGEO, an excellent tool for quick and easy georeferencing and processing of spatially-related raster data
- Worldwide expert user support

TYPICAL APPLICATIONS: FEFLOW is applicable for a multitude of groundwater, porous media and heat transport projects from the local to the regional scale. It is the ideal software for regional groundwater management, simulation of open-pit progress, land use and climate change scenarios, groundwater remediation and natural attenuation, groundwater-surface water interaction and simulation of industrial porous media.

5.3 Context diagram

The next figure presents the context diagram of the WaterProtect tool. We set out the institutions that provide data and how to extract/consult data.

GISEL is the program that stores all data about the quality and quantity of water from several sources: groundwater, surface water and supply water.



INPUT: DATA SOURCES



OUTPUT: REPORTS AND SPECIFIC QUERIES

Figure 27: Context diagram for the GISEL program

5.4 Component diagram

The next figure shows the component diagram and its type of data.

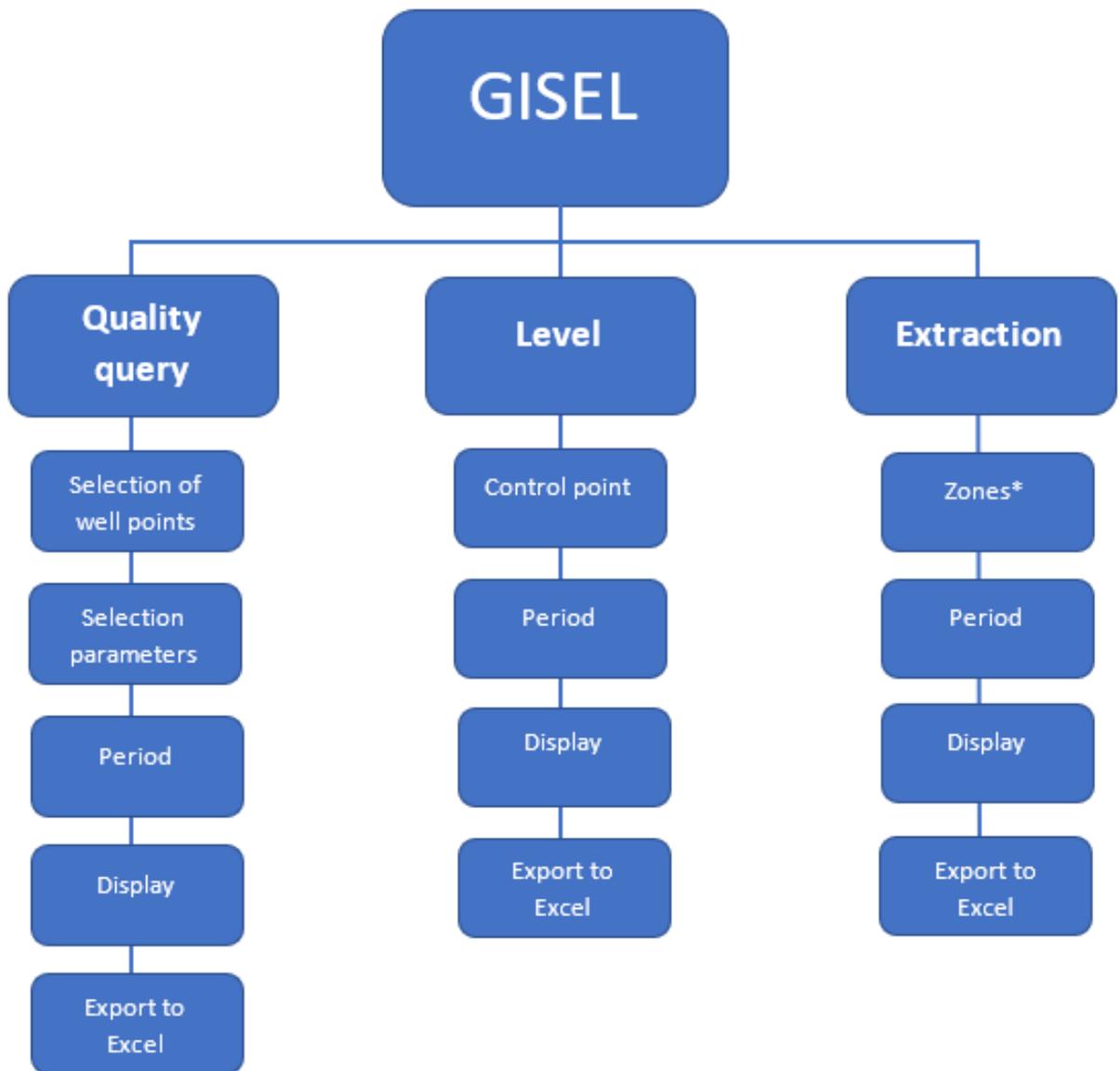


Figure 28: Component diagram by data type

**GISEL contains individual user extraction and this data is considered confidential. There will only be public extraction by zone or total extraction.*

5.5 Use case diagram

The next figure shows roles and data flows. We distinguish three user roles: (i) administrator, (ii) editor and (iii) viewer. The administrator manages the database, the editor can import and manage the data and the viewer can access public data.

All the institutions send data by email to CUADLL and this organisation imports the data into GISEL. This strategy assures the format and quality of the data.

Confidential data will only be accessible by CUADLL.

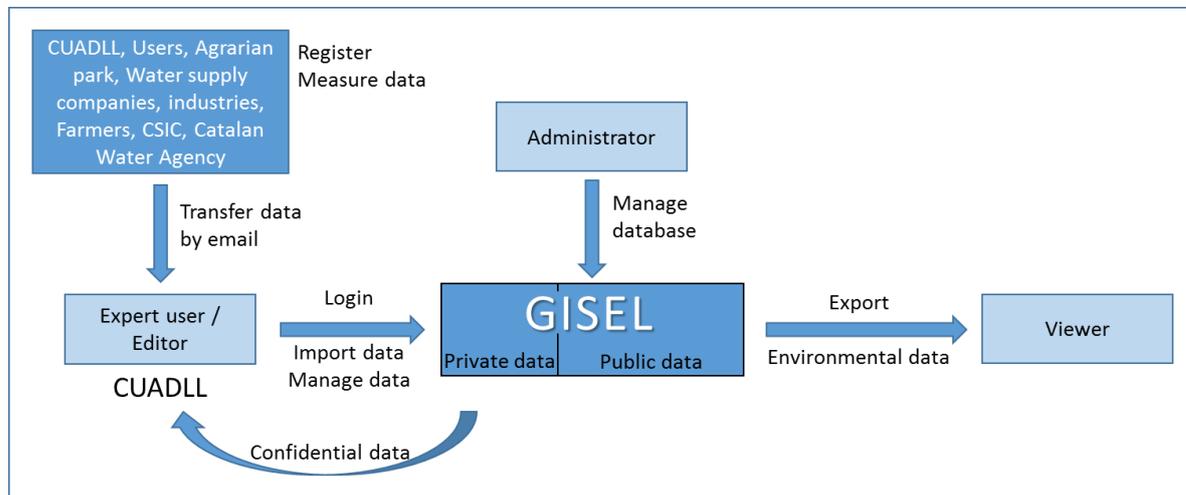


Figure 29: Use case diagram for the GISEL program

The use case diagram includes the following use cases:

Table 10: Overview of the use cases

ID	Use case
UC-01	Login
UC-02	View data
UC-03	Register measures
UC-04	Register for notification mailing
UC-05	Import data
UC-06	Export data
UC-07	Management database

The next table gives an overview of the user requirements that are used in the development of the WaterProtect tool in relation to the use cases.

Table 11: Relation between user requirements and use cases

ID	Category	User requirement	Llobregat action lab	Use case
URQ-1	Technical	The tool will be a web tool so that users only need a browser to consult WaterProtect data	x	NA
URQ-2	Technical	The web tool will work on PC, tablet and smartphone		NA

ID	Category	User requirement	Llobregat action lab	Use case
URQ-3	Technical	The web tool will be developed with an open source framework and libraries	x	NA
URQ-4	Technical	The web tool will use REST API for loading discharge and precipitation data.		NA
URQ-5	General	The web tool will be user-friendly and easily understandable for farmers and other users	x	NA
URQ-6	General	The web tool will be multilingual		UC-07 User management
URQ-7	General	The web tool will contain user management		UC-07 User management
URQ-8	General	The web tool will contain a search functionality by address	X	UC-01 View data
URQ-10	General	Farmers will receive e-mail notifications with a link to the WaterProtect app		UC-04 Register for notification mailing
URQ-11	Input	The tool will contain a load procedure for uploading monitoring data of a particular region	X	UC-05 Import data
URQ-12	Input	The tool will use an automatic load procedure for loading discharge and precipitation data.		UC-02 View data
		<u>Maps</u>		
URQ-13	Data	The web tool will contain the following basic set of maps: - Monitoring stations - Watercourses - Agricultural land use - Potential erosion for agricultural plots - Drainage areas linked to the monitoring stations - Risk map with demarcation of critical areas for runoff of substances to surface water		UC-02 View data
URQ-14	Data	The web tool will contain the following basic set of maps: - Monitoring stations - Nitrate sensitive zones - Watercourses - Agricultural land use - Risk map with demarcation of critical areas for runoff of substances to surface water	x	UC-02 View data
URQ-15	Data	The web tool will contain the following maps: - Groundwater protection zones - Groundwater catchment map - Sewerage map - Soil type map - Topographic map	x	UC-02 View data
URQ-16	Data	The web tool will contain the following maps: - Groundwater catchment map - Soil type map - Topographic map - Administrative areas	x	UC-02 View data

ID	Category	User requirement	Llobregat action lab	Use case
		<u>Monitoring data</u>		
URQ-19	Data	The tool will contain the whole set of substances and display only the problem substances	x	UC-02 View data
URQ-21	Data	The tool will contain nitrates	x	UC-02 View data
URQ-23	Data	The tool will contain discharge data		UC-02 View data
URQ-24	Data	The tool will contain precipitation data		UC-02 View data
		<u>Measures data</u>		
URQ-25	Data	The web tool will contain a set of measures with a detailed description of each measure in a PDF	x	UC-02 View data
		<u>Standards</u>		
URQ-26	Program	The tool will contain the following environmental standards: - Evaluation of the average concentration using the annual average of the selected dataset against the PNEC - Evaluation of the maximum concentration using the yearly maximum of the selected dataset against the MAC-EQS - Evaluation of the average concentration using the annual average of the selected dataset against the drinking water standard of 0.1 µ/l		UC-02 View data
		<u>Manage database</u>		
URQ-27	Program	Manage software, requirements, adaptation and personalisation of the tool	X	UC-07 Management data

5.6 Roles

Three roles have been defined in deliverable 5.1 . Their details are shown in the tables below.

<i>Identification:</i>	Expert user or editor	<i>User type:</i>	Primary
<i>Role:</i>	The expert user has a login and is authorised to edit, import and export data. Other functionalities are to observe data in the viewer and register planned measures.		
<i>Users</i>	CUADLL: Only CUADLL can import data from other partners such as AGBAR, CPA and CSIC and other stakeholders such as APSA, Consorci Espais Protegits, municipalities, etc.		

<i>Identification:</i>	Viewer	<i>User type:</i>	Primary
<i>Role:</i>	The viewer has a login and can observe public data in the viewer and register planned measures.		
<i>Users</i>	Everybody who has access.		

<i>Identification:</i>	Administrator	<i>User type:</i>	Secondary
<i>Role:</i>	The administrator can load new data into the tool and is responsible for user management.		
<i>Users</i>	Administrator of the web application		

5.7 Use cases

5.7.1 Expert user or editor

<i>Use case: Login</i>		<i>ID:</i> UC-01
<i>Objective</i>	Login into the WaterProtect tool to be authorised for performing extra functionalities	
<i>Description</i>	A login is required for the following functionalities: <ul style="list-style-type: none"> - Edit data - Import data - Register planned measures 	
<i>Primary actor(s)</i>	Administrator and Expert user	
<i>Supporting</i>	CUADLL	

actor(s)	
Scenarios	[UC-01-.01] Login [UC-01.02] Change user preferences

Scenario: Login		ID: UC-01.01
Preconditions	✓ NA	
Post conditions	Success condition: end	✓ The user is logged into the web application and can perform the extra functionalities
	Failure condition: end	✓ The tool should generate an error message if the user is unknown or the password is wrong
	Minimal guarantee:	✓ NA
Steps	5. The user clicks login 6. The user enters their user name and password and clicks 'Login'	
Frequency	On user request	

Scenario: Change user preferences		ID: UC-01.02
Preconditions	✓ NA	
Post conditions	Success condition: end	✓ The user preferences are updated
	Failure condition: end	✓ The user preferences cannot be updated in the database ✓ The tool should generate an error message
	Minimal guarantee:	✓ NA
Steps	5. The user clicks preferences 6. The user can change their password, language, name and email address 7. The user clicks 'Save'	
Frequency	On user request	

Use case: Import data	ID: UC-05
------------------------------	------------------

Objective	Load data into the WaterProtect tool
Description	Load new measurement data and maps into the WaterProtect tool to follow up the water quality of the catchment. Measurement data includes water quality data, water flow data, precipitation data and groundwater level data.
Primary actor(s)	Editor
Supporting actor(s)	
Scenarios	[UC-05-.01] Load measurement data [UC-05.02] Load map data

Scenario: Load measurement data		ID: UC-05.01
Preconditions	✓ New measurement data available	
Post conditions	Success condition: end	✓ New data is loaded
	Failure condition: end	✓ No new data is loaded ✓ The load procedure generates a log file where the administrator can follow up the procedure and the error messages
	Minimal guarantee:	✓ NA
Procedure	The load procedure contains scripts for loading measurement data. The administrator can follow up the execution of the scripts in the log file.	
Frequency	On user request	

Scenario: Load map data		ID: UC-05.02
Preconditions	✓ New maps available for loading	
Post conditions	Success condition: end	✓ New maps are loaded
	Failure condition: end	✓ No new maps are loaded ✓ The load procedure generates a log file where the administrator can follow up the procedure and the



		error messages
	Minimal guarantee:	✓ NA
Procedure	The load procedure for maps depends on the technical analysis which will clarify in which data store (e.g. geoserver, etc.) the maps should be loaded and determine what steps are needed for loading new maps.	
Frequency	On user request	

5.7.1.1.1 Wireframes

The user clicks the login icon and the login screen appears. Here the user enters the login information. This part is only available for CUADLL, who manage the data.

The user clicks the user preferences icon and the user preferences screen appears. The user can change their password in their personal information.

5.7.2 Viewer

Everybody can open GISEL and search public data.

5.7.2.1 Use case: View data

Use case: Import data		ID: UC-02
Objective	Follow up the water quality in the catchment	
Description	The farmer can observe the water quality on maps and in graphs. They can also view what measures are planned or executed.	
Primary actor(s)	Viewer	
Supporting actor(s)	Expert user, Viewer	
Scenarios	[UC-02-.01] View water quality status [UC-02.02] ...	

Scenario: View water quality status		ID: UC-02.01
Preconditions	✓ NA	
Post conditions	Success condition:	end ✓ The user makes a selection and the results are shown in the viewer

	Failure condition:	✓ The results of the viewer do not correspond to the selections in the analysis tab
	Minimal guarantee:	✓ NA
Steps	<p>General view on the water quality status of the catchment</p> <p>10. The user selects the catchment information that includes the name of the catchment and the source (surface water or groundwater). The ratio between catchment and source is mostly 1 to 1, and in that case the source is automatically filled in after the selection of the name of the selection.</p> <p>11. The user selects the period and clicks 'Compute map'. The viewer presents the water quality status for the catchment.</p> <p>Water quality status for a particular monitoring station</p> <p>12. The user selects a monitoring station in the analysis tab and clicks 'Compute map' or clicks a monitoring status on the map. There are tooltips provided for the monitoring stations on the general water quality map.</p> <p>13. The user selects an active substance from the dropdown list and clicks 'Compute map'. The list contains <i>only the active substance with an exceedance in the selected monitoring station</i>. After clicking 'Compute map' the viewer presents the water quality status for the selected active substance and according to the environmental standard.</p> <p>14. The user can change the environmental standard into the drinking water standard in the analysis tab. When they click 'Compute map', the viewer shows the water quality for the selected active substance according to the drinking water standard.</p> <p>Monitoring data, precipitation data and discharge data in time series</p> <p>15. The user can view the monitoring data for the selected monitoring station and selected active substance as a time series by clicking 'Compute graph'. The bottom tab panel appears with the graph.</p> <p>16. The user also has the option to see precipitation data and discharge data on the same graph by selecting the corresponding checkboxes. The time series contains an indication of the selected standard (red line) and also gives the daily and monthly average data.</p>	
Frequency	On user request	

5.7.2.1.1 Wireframes

The user first selects the name of the waterpoint and the source (surface or groundwater) is automatically filled in. Next, they select the period and click 'Compute map'. The viewer presents the water quality status of the waterpoint for the selected period in the analysis tab. Monitoring stations are coloured red when there is an exceedance of the environmental standard and stations are coloured yellow when there is an exceedance of the drinking water standard. If there aren't any threshold references, the colours are homogeneous.

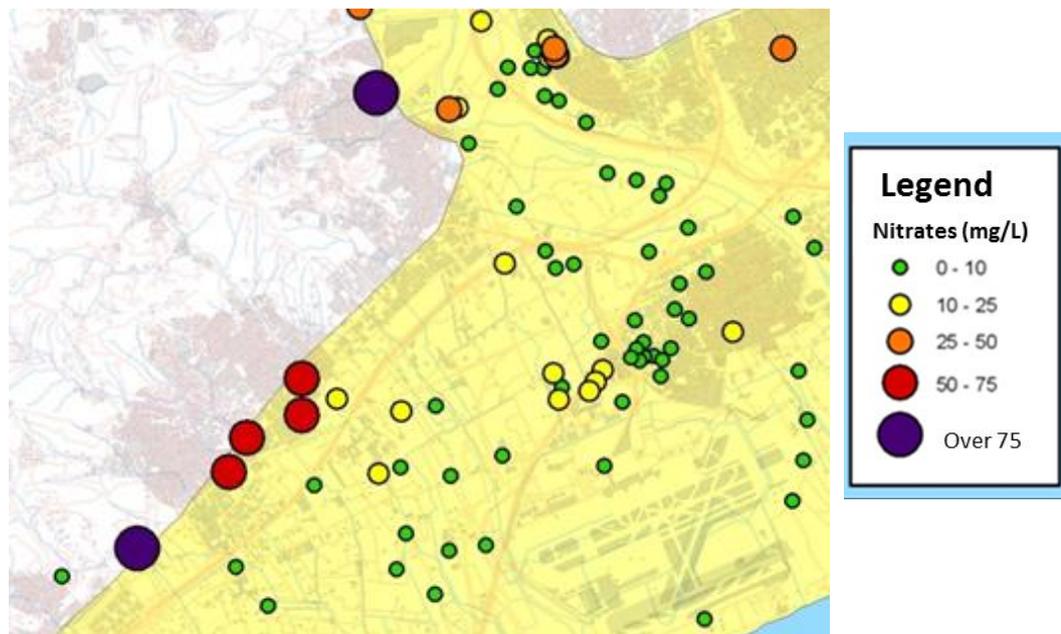


Figure 30: Example of several waterpoints and their nitrate quality

Next the user selects a monitoring station in the analysis tab or on the map and also selects an active substance. After clicking 'Compute map', the viewer presents the water quality status for the selected active substance and according to the regulation and its threshold. The user can change the environmental standard into the drinking water standard, surface water standard or groundwater body standard, and after clicking 'Compute map' the viewer shows the results.

When the user clicks 'Compute graph', the bottom tab appears with the time series of the monitoring data of the selected active substance and monitoring station. The user can also observe precipitation data and discharge data by selecting the corresponding checkbox.

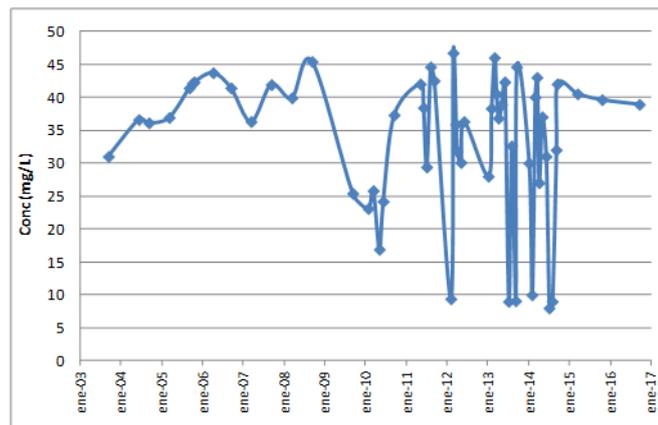


Figure 31: Example of time series of nitrate in a groundwater well

5.7.3 Administrator

5.7.3.1 Description

<i>Use case: User management</i>		<i>ID: UC-07</i>
Objective	Define new users and delete users	
Description	User management includes defining new users and deleting users. Updating user information is not required because every expert user or viewer is allowed to manage their own user preferences.	
Primary actor(s)	Administrator	
Supporting actor(s)		
Scenarios	[UC-07-.01] Add new user [UC-07.02] Delete user	

<i>Scenario: Add new user</i>		<i>ID: UC-07.01</i>
Preconditions	✓ A new user has to be defined	
Post conditions	Success condition: <i>end</i>	✓ The new user is added
	Failure condition: <i>end</i>	✓ The new user is not added ✓ The load procedure generates a log file where the administrator can follow up the procedure and the

		error messages
	Minimal guarantee:	✓ NA
Procedure	The administrator uses a script for adding a new user and can follow up the execution of the script in the log file. The minimum data requirements are: <i>first name, surname, email address, language, role, username and password.</i>	
Frequency	On user request	

Scenario: Delete user		ID: UC-07.02
Preconditions	✓ A user has to be deleted	
Post conditions	Success condition: end	✓ The user is deleted from the database
	Failure condition: end	✓ The user is not deleted from the database ✓ The delete procedure generates a log file where the administrator can follow up the procedure and the error messages
	Minimal guarantee:	✓ NA
Procedure	The administrator uses a script for deleting a user and can follow up the execution of the script in the log file.	
Frequency	On user request	

Use case: User management		ID: UC-07
Objective	Define the structure of the tool and review functional analysis	
Description	The software needs a review and a specific design that will be done by the administrator. The administrator has knowledge and experience in the program and can personalise demands from the editor and viewer.	
Primary actor(s)	Administrator	
Supporting actor(s)	All	

Scenarios	
------------------	--

Scenario: Manage software		ID: UC-07
Preconditions	✓ Detection of a failure or improvement	
Post conditions	Success condition:	✓ Improvement of the tool
	Failure condition:	✓ The program has an error and needs to be improved
	Minimal guarantee:	✓ NA
Steps	The administrator programs a new and specific solution	
Frequency	On user request	

5.7.3.1.1 Wireframes

There are no wireframes envisaged for user management.

5.8 Conclusions

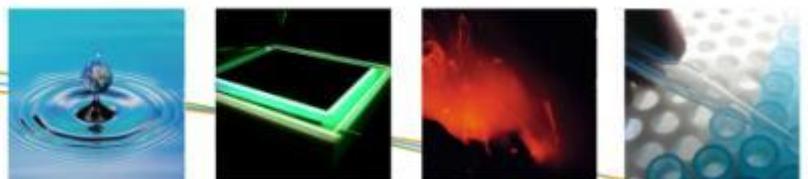
New requirements or new elements will appear in the tool's development stage which are not provided for in the functional design. The administrator will adapt to these new requirements.



WATERPROTECT

Action lab: Gowienica Miedwiańska Catchment, PL

Wojciech Paciura, Anna Kuczyńska, Marzena Nowakowska



6 Action lab Gowienica Catchment

6.1 Introduction

The main objectives of the WaterProtect tool for Gowienica catchment is to provide a data exchange platform between different stakeholders with an easy access to data. The tool aims to visualise data collected for the project; however is not destined to be an advanced GIS processing software, as this was not defined as an objective during the user requirements study in D.5.1 report. Based on our initial research among our stakeholders, the overall objectives of the tool are:

- Fast and convenient access to data gathered from many national and local databases including fields of hydrology, hydrogeology, meteorology, agronomy, landscape and more that will be continuously updated,
- Visualisation of the above data;
- Provision of data for better water management and more rational use in the catchment area.

Gowienica river is a relatively small river of some 15 km length, located in the north-western part of Poland. It constitutes one of the inflows to Lake Miedwie, which is a water source for the city of Szczecin – the capital of the Westpomeranian region. The Miedwie surface water intake supplies water to 330 000 people. Area of the Gowienica catchment is characterised by very good agricultural soils, hence it is dominated by intensive arable farming. There are 8 villages scattered within the Gowienica catchment with some 2600 inhabitants. There are 3 municipal groundwater intakes within catchment area, three wastewater treatment facilities with variable technologies and capabilities discharging directly into the Gowienica river.

The Gowienica catchment lies within a Nitrates Vulnerable Zone (NVZ) and Miedwie water intake protection zone. Monitoring within the area has been ongoing since 1982 including data on water quality (both surface and groundwater) and nitrate load. Despite large number of orders and bans introduced in land use management within the area, problem of high nitrate concentrations in surface and groundwater feeding the lake still exists and despite the relatively low flows, the Gowienica river brings high loads of nutrients into the lake Miedwie (estimated at 15,5T/year of NO₃). Inappropriate communal sewage systems might be an important source leading to nitrate problems in the area (although currently mainly attributed to agriculture). The relative contribution of different sources is still unknown.

Responsibilities for water management within the catchment are split between the following stakeholders: River Basin Management Authorities, Inspectorate for Environmental Protection and Warnice Borough. Additional important stakeholders are 2 major water supply companies and agricultural users (big farms and small local farmers). All except local farmers collect various data



on either land use and management or water quality and quantity. Numerous academic research provide additional information for catchment characteristics and ongoing processes.

The WaterProtect tool should allow easy data exchange information and therefore help to follow up the water quality status of the catchment and its interrelations with land use management and other activities that can impact on water quality.

The tool should support the assessment of suitable measures at the vulnerable zones and determine the results of the applied measures to improve the water quality of the Gowienica river.

6.2 Context diagram

Figure 32 presents the context diagram of the WaterProtect tool. Two user roles are identified: experts and farmers. The experts deliver data to the Water Protect tool, view all data on Map Viewer and in the database by his own desktop tools and export data for using in his own analytical systems. The farmers can follow up the water quality in the catchment on Map Viewer. All users have also the possibility to register for receiving notification mailings.

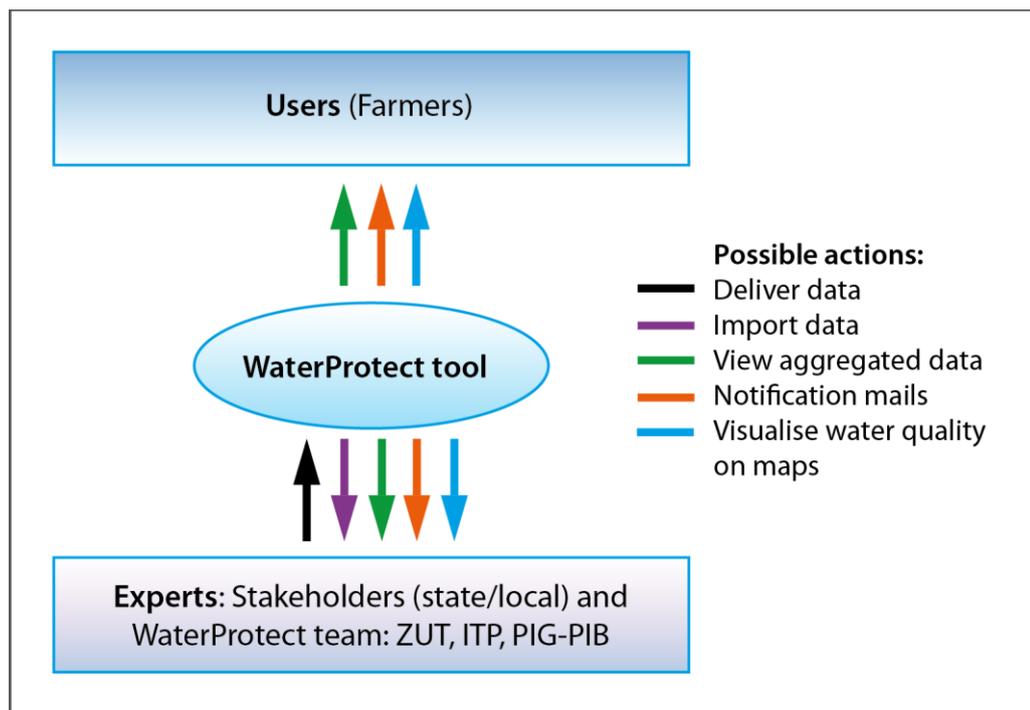


Figure 32: Context diagram

Stakeholders and WaterProtect team including administrator form PIG-PIB have a login for the extra functionalities. Table 12 gives an overview of the data delivery to the WaterProtect tool.

Table 12: Overview of the data delivery

Data holder	Data	Owner/Source
PIG-PIB	Numerical terrain model	GUGiK ¹
	Topographic map	GUGiK
	Topographic objects database	GUGiK
	Ortophotomaps	GUGiK
	Corine Land Cover	Ministry of Environment
	Agricultural Soils Map	IUNG
	Hydrological Map of Poland	The Treasury
	Hydrogeological Map of Poland	The Treasury
	Detailed Geological Map of Poland	The Treasury
	Main Groundwater Aquifers of Poland	The Treasury
	Groundwater bodies database	The Treasury
	Intake database	The Treasury
	National Groundwater Quality Monitoring database	The Treasury
	Waterprotect water quality monitoring database	The Treasury
	Waterprotect hydrogeological model of Gowienica catchment including hydroisohips; infiltration, direction of water flow	Waterprotect
Point sources of sewage discharges	Waterprotect	
RZGW	Point sources of discharges (all types)	The Treasury
	Water supply intakes	The Treasury
	Areas of source protection zones	The Treasury
	Drinking water protection areas	The Treasury
	Anthropo-pressure data base	The Treasury
WIOŚ	National Water Quality Monitoring database	The Treasury
ZUT	Water quality data	ZUT
ITP	Water quality data	ITP
	Meteo Data	ITP
Warnice Borough	Anthropo-pressure data base	Warnice Borough

6.3 Component diagram

Figure 33 presents the component diagram of the WaterProtect tool and Table 13 describes the different component of the component diagram.

¹ the Head Office of Geodesy and Cartography



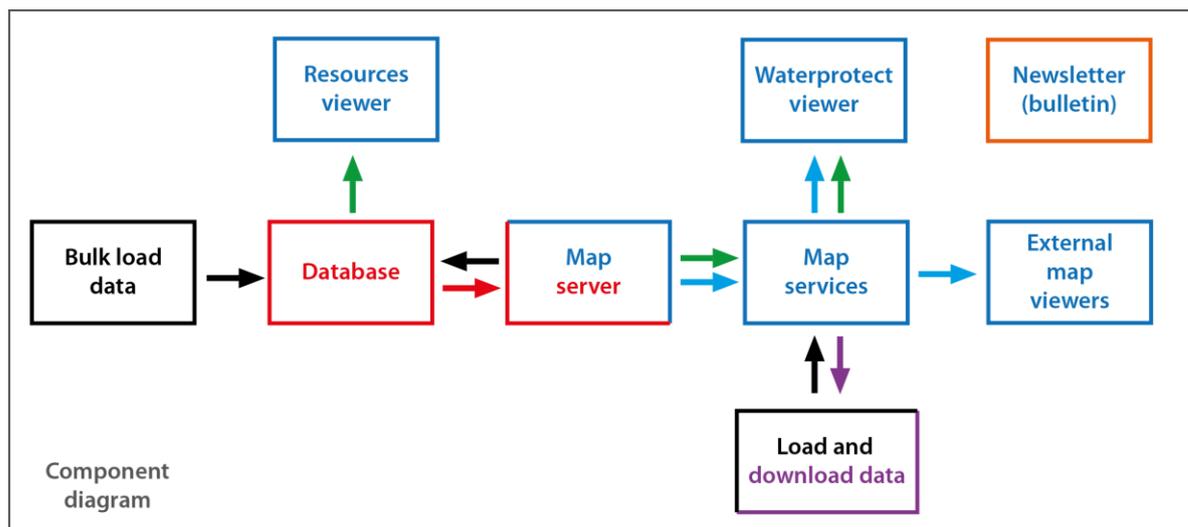


Figure 33: Component diagram of the WaterProtect tool

Table 13: Overview of the components

Component	Component description
/Database	The database component contains all WaterProtect data.
/Map server	Server publishing GIS data from the database WaterProtect using network services.
/Map services	Various types of web services, including services requiring login, allowing full access to data (writing, reading, modification).
/Bulk load? data	PGI experts load data using prepared by stakeholders sets of archival data Waterprotect team users can upload their data into the WaterProtect tool
/Load, download data	Stakeholders can upload their new data into the WaterProtect database by webservices. They can also download all types of data in the same way
/Waterprotect viewer	The tool presents selected data on maps using map services (REST).
/External viewer	Other user tools, geoportals will be able to present selected data on maps using the WMS map services. This additional functionality resulting from the capabilities of the server and the application logic
/Resources verwer	A standard CBDG database tool used widely, among others to provide aggregated data, prepared reports, scans, photographs, etc. objects connected by a unique database identifier with objects displayed on the map (empty link: http://baza.pgi.gov.pl/resources.html)
/ Newsletter (bulletin)	A standard CBDG tool used to disseminate newsletters. Users, who want to be informed by notification mails need to register first.

6.4 Use case diagram

Figure 34 contains the use case diagram for the WaterProtect tool and presents which use cases are applicable for which kind of user (expert user, farmer and administrator).

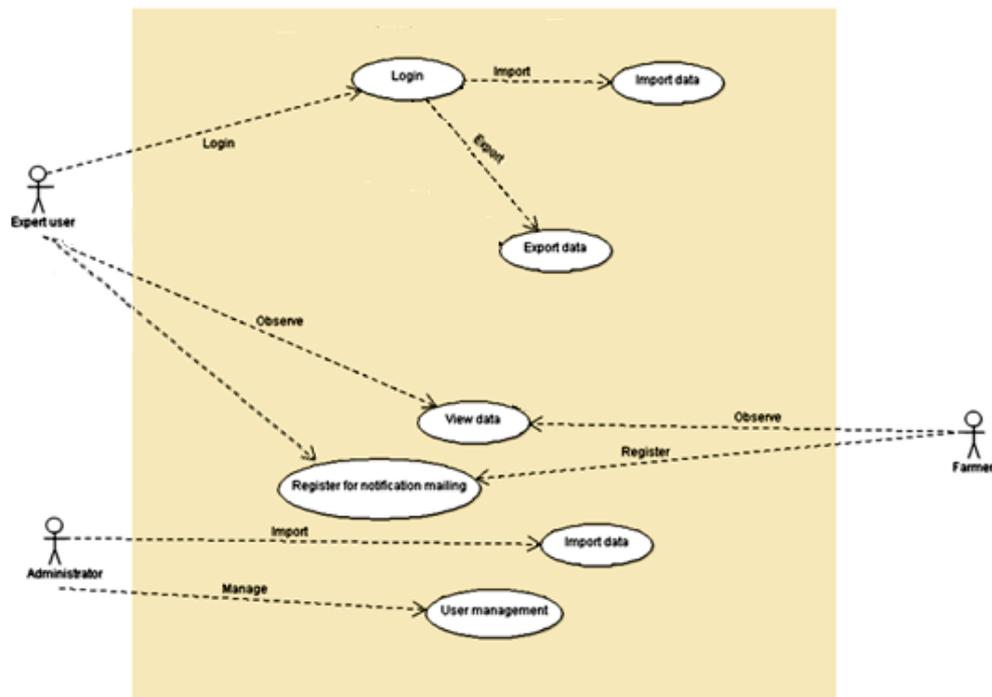


Figure 34: Use case diagram

The use case diagram includes next use cases:

Table 14: Overview of the use cases

ID	Use case
UC-01	View data
UC-02	Register for notification mailing
UC-03	Login
UC-04	Import data
UC-05	Export data
UC-06	User management

Use cases UC-02 to UC-07 are designed to support standard desktop software outside the WaterProtect tool.

Next table gives an overview of the user requirements that are used in the development of the WaterProtect tool, in relation to the use cases.

Table 15: Relation between user requirements and use cases

ID	Category	UR	UC	Priority of URQ
URQ-001	General	RWD standard a web application	UC-01	1
URQ-002	Viewing	Tabular statements	UC-01*	1
URQ-003	Viewing	Charts	UC-01*	2
URQ-004	Viewing	Single thematic maps	UC-01	1
URQ-005	Viewing	Map sets aggregating information from different areas	UC-01	1
URQ-006	Viewing	Queries directly to the database	UC-05**	2
URQ-007	Functionality	Spatial analysis	UC-05**	3
URQ-008	Import	Load WMS services	UC-01	1
URQ-009	Export	Export map	UC-01***	1
URQ-010	Export	Export results of search	UC-05**	1
URQ-011	Data	Groundwater	UC-01	1
URQ-012	Data	Surface waters	UC-01	1
URQ-013	Data	Land use	UC-01	1
URQ-014	Data	Forms of nature protection	UC-01	1
URQ-015	Data	Satellite imagery	UC-01	1
URQ-016	Data	Topographic base maps	UC-01	1
URQ-017	Data	Weather data	UC-01	2
URQ-018	Data	Agriculture	UC-01	1
URQ-019	Data	Sewage management	UC-01	1

*) Pre-prepared for download by experts

**) Implemented with user tools after download data

***) Implemented by providing html code for embedding maps on websites, social media etc. (on-line map window instead of jpg off-line)



6.5 Roles

<i>Identification:</i>	Farmer	<i>Type user:</i>	Secondary
<i>Role:</i>	The farmer can observe the aggregated water quality data in the viewer. He has also the possibility to register for notification mailing.		
<i>Users</i>	Poland: Farmers		

<i>Identification:</i>	Expert user	<i>Type user:</i>	Primary
<i>Role:</i>	The expert user has a login and is authorized to import and export data. Other functionalities are to observe data using his own tool via web services the viewer and register planned measures.		
<i>Users</i>	Poland: ZUT, ITP, PIG-NRI, RZGW (subject to confirmation); WIOŚ (subject to confirmation); Warnice Commune (subject to confirmation).		

<i>Identification:</i>	Administrator	<i>Type user:</i>	Secondary
<i>Role:</i>	The administrator has the possibility to bulk load new data into the tool and is responsible for user management.		
<i>Users</i>	Administrator of the tool: PIG-NRI		

6.6 Use cases

6.6.1 Farmer

6.6.1.1 Use case: View data

<i>Use case: View data</i>		<i>Id:</i> UC-01
<i>Objective</i>	Get information about the objects on a map of the catchment	
<i>Description</i>	The farmer can get information from many multilayers maps in an application.	
<i>Primary actor(s)</i>	Farmer, Expert user, Administrator	
<i>Supporting actor(s)</i>		
<i>Scenarios</i>	[UC-01-.01] View water quality status on maps	

Scenario: View simple data on map		Id: UC-01.01
Preconditions	✓ NA	
Post conditions	Success condition: end	✓ The user makes a selection and the results are shown in the viewer
	Failure condition: end	✓ Browser results do not match the object you are looking for or return too many objects
	Minimal guarantee:	✓ NA
Steps	<p>General view on maps</p> <p>User can configure in many ways the appearance of maps in the application and obtain information about the objects presented on the maps. There are many application functions for this:</p> <ul style="list-style-type: none"> • Selection – Select objects on the map with point or circle. The size of the circle depends on the length of the press. Information about objects will appear in the <i>Results</i> panel. • Layers - select the layers and their sequence, basic maps, add new WMS • Configuration -> Map management panel: <ul style="list-style-type: none"> ○ Map sets - thematic blocks with easy-to-access handheld map information ○ Maps - selection of map services to display. The search box at the top helps you find the right layer. Here you can also change the order of layers. To do this, press and hold the layer for a moment and then move it to the desired position. ○ Layers - enable or disable visibility of layers within map services and customize their transparency ○ Base maps - choose a base map of different compositions • Legend - descriptions of objects displayed on the map • Find a place - search locations, address, for example: Warnice, postal code: 74-201 and by the following coordinates: decimal degrees (DD), ie for example. 52.208853, 21.013119 • My location - using the GPS signal or local Wi-Fi network, you can move and zoom the map to the location where you are • Add WMS - add new WMS • Import tracks - import GPS tracks in <i>.kml</i> or <i>.gpx</i> format • Share - three ways to share the currently viewed map: <ul style="list-style-type: none"> ○ Ready code to embed a map on any web page, ○ A link to a map that you can send, for example, by e-mail, ○ Publish the map on social networks: Facebook, Twitter, Google+, LinkedIn. • Information - information about the application and the data sources used in the app • Help - information about application functionalities • Terms of use - conditions of use of published data • Język / Language - switching the application language versions 	

	<ul style="list-style-type: none"> • Contact - contact information
Frequency	On user request

6.6.1.1.1 Wireframes

There are no wireframes for the view data.

6.6.1.2 Use case: View data

Use case: View data		Id: UC-01
Objective	Get more information about the water quality in the catchment	
Description	The farmer can observe the water quality on pre-prepared materials	
Primary actor(s)	Farmer, Expert user, Administrator	
Supporting actor(s)		
Scenarios	[UC-01-.02] View water quality status in details	

Scenario: View detailed data		Id: UC-01.02
Preconditions	✓ NA	
Post conditions	Success condition: end	✓ The user makes a selection and the results are shown in the viewer with link "See more..."
	Failure condition: end	✓ Browser results do not match the object you are looking for or return too many objects
	Minimal guarantee:	✓ NA
Steps	<p>Detailed view on the water quality status of the catchment</p> <p>For the selected object it is possible to obtain detailed information in the form of a set of previously prepared charts, tables, photographs, etc. using the CBDG "Resources" application.</p> <p>17. In the <i>Results</i> panel there is link <i>See more</i> redirecting to other domain applications with a wider range of information about the object, in this case, for the "Resources" application.</p>	
Frequency	On user request	

6.6.1.2.1 Wireframes



There are no wireframes for the view data.

6.6.1.3 Use case: Register for notification mailing

Use case: Register for notification mailing		Id: UC-02
Objective	All users have the possibility to register for receiving notification mailings.	
Description	<p>The CBDG newsletter, based on the open source "PHP List" solution (http://www.phplist.com/), will be used for this purpose. This newsletter will send bulletins informing about threats and other news related to the area under investigation. The decision to send a mail can be based on:</p> <p>18. Information about updating monitoring data.</p> <p>19. Exceedance of a particular standard at a certain monitoring location.</p> <p>20. Based on particular parameters (for example meteo) - more as warning system to prevent exceedances.</p>	
Primary actor(s)	Farmer, Expert user	
Supporting actor(s)	Administrator	
Scenarios	[UC-02] Register for notification mailing	

Scenario: Register for notification mailing		Id: UC-02
Preconditions	✓ NA	
Post conditions	Success condition:	✓ The user subscribes to a newsletter CBDG
	Failure condition:	✓ The tool generate an error message if the user put wrong password or is on blacklisted
	Minimal guarantee:	✓ NA
Steps	<p>7. The user gives an e-mail and his name.</p> <p>8. The user presses the subscribe button.</p> <p>9. Confirms subscription in the e-mail he receives from the system.</p>	
Frequency	On user request	

6.6.1.3.1 Wireframes



6.6.2 Expert user

6.6.2.1 Use case: Login

Use case: Login		Id: UC-03
Objective	Login into the WaterProtect tool to be authorized for performing extra functionalities	
Description	A login is required for following functionalities: <ul style="list-style-type: none"> - Export data - Register planned measures 	
Primary actor(s)	Expert user	
Supporting actor(s)		
Scenarios	[UC-02] Login	

Scenario: Login		Id: UC-03
Preconditions	✓ Login and password received from administrator	
Post conditions	Success condition: end	✓ The user is logged into web services in the web application and can perform the extra functionalities.
	Failure condition: end	✓ The tool should generate an error message if the user is unknown or wrong password

	Minimal guarantee:	✓ NA
Steps	<ol style="list-style-type: none"> 1. The user clicks on login 2. The user enters his user name and password, and clicks on 'login' 	
Frequency	On user request	

6.6.2.1.1 Wireframes

There are no wireframes for the login procedure.

6.6.2.2 Use case: Import data

Use case: Import data		Id: UC-04
Objective	Load data into the WaterProtect tool	
Description	Load new measurement data into the WaterProtect tool to follow-up the water quality of the catchment. Measurement data includes water quality data, water flow data, precipitation data, groundwater level data.	
Primary actor(s)	Expert user	
Supporting actor(s)	Administrator	
Scenarios	[UC-04-01] Load measurement data	

Scenario: Import measurement data		Id: UC-04.01
Preconditions	✓ New measurement data available	
Post conditions	Success end condition:	✓ New data is loaded
	Failure end condition:	✓ No new data is loaded ✓ Load procedure generates a log file where the administrator can follow-up the procedure and the error messages
	Minimal guarantee:	✓ NA
Procedure	After logging in, the user gets access to editing attribute data and can load new data, or correct previously collected data.	

6.6.2.2.1 Wireframes



There are no wireframes foreseen for the load procedure.

6.6.2.3 Use case: Export data

<i>Use case: Export data</i>		<i>Id: UC-05</i>
Objective	Download data from the WaterProtect tool	
Description	After logging in, the user will be able to download the all collected data.	
Primary actor(s)	Expert user	
Supporting actor(s)	Administrator	
Scenarios	[UC-05-01] Download measurement data [UC-05-02] Download map data	

<i>Scenario: Export measurement data</i>		<i>Id: UC-05.01</i>
Preconditions	✓ Measurement data available for loading	
Post conditions	Success end condition:	✓ User download measurement data
	Failure end condition:	✓ User did not download data. ✓ Load procedure generates a log file where the administrator can follow-up the procedure and the error messages
	Minimal guarantee:	✓ NA
Procedure	<ol style="list-style-type: none"> 1. The user enters his user name and password, and clicks on 'login' 2. The user downloads the necessary data 	
Frequency	On user request	

<i>Scenario: Import map data</i>		<i>Id: UC-05.02</i>
Preconditions	✓ Spatial data available for loading	
Post conditions	Success end condition:	✓ Spatial data are downloaded
	Failure end condition:	✓ User did not download spatial data. ✓ Load procedure generates a log file where the



	condition:	administrator can follow-up the procedure and the error messages
	Minimal guarantee:	✓ NA
Procedure	The download procedure for spatial data is depending on the technical analysis which will clarify to what datastore (f.i. geoserver, ...) the maps should be downloaded and determine what steps are needed for downloading maps.	
Frequency	On user request	

6.6.2.3.1 Wireframes

There are no wireframes foreseen for the load procedure.

6.6.3 Administrator

6.6.3.1 Use case: Import data

Use case: Import data		Id: UC-04
Objective	Load data into the WaterProtect tool	
Description	Load new measurement data and maps into the WaterProtect tool to follow-up the water quality of the catchment. Measurement data includes water quality data, water flow data, precipitation data, groundwater level data.	
Primary actor(s)	Administrator	
Supporting actor(s)		
Scenarios	[UC-05-01] Load measurement data [UC-05-02] Load map data	

Scenario: Import measurement data		Id: UC-04.02
Preconditions	✓ New measurement data available	
Post conditions	Success condition: end	✓ New data is loaded
	Failure condition: end	✓ No new data is loaded ✓ Load procedure generates a log file where the administrator can follow-up the procedure and the error messages



	Minimal guarantee:	✓ NA
Procedure	The load procedure contains scripts for loading measurement data. The administrator can follow-up the execution of the scripts in the log file.	
Frequency	On user request	

Scenario: Import map data		Id: UC-04.03
Preconditions	✓ New maps available for loading	
+Post conditions	Success condition:	✓ New maps are loaded
	Failure condition:	✓ No new maps loaded ✓ Load procedure generates a log file where the administrator can follow-up the procedure and the error messages
	Minimal guarantee:	✓ NA
Procedure	The load procedure for maps is depending on the technical analysis which will clarify in what datastore (f.i. geoserver, ...) the maps should be loaded and determine what steps are needed for loading new maps.	
Frequency	On user request	

6.6.3.1.1 Wireframes

There are no wireframes foreseen for the load procedure.

6.6.3.2 Use case: User management

Use case: User management		Id: UC-06
Objective	Define new users and delete users	
Description	User management included defining new users and deleting users.	
Primary actor(s)	Administrator	
Supporting actor(s)		
Scenarios	[UC-07-.01] Add new user [UC-07.02] Delete user	



Scenario: Add new user		Id: UC-06.01
Preconditions	✓ New user must be defined	
Post conditions	Success condition:	✓ The new user is added.
	Failure condition:	✓ New user is not added. ✓ Load procedure generates a log file where the administrator can follow-up the procedure and the error messages .
	Minimal guarantee:	✓ NA
Procedure	The administrator create or delete users manually. The minimum data requirements are: <i>first name, surname, email address, language, role, username and password.</i>	
Frequency	On user request	

Scenario: Delete user		Id: UC-06.02
Preconditions	✓ A user must be deleted.	
Post conditions	Success condition:	✓ The user is deleted from the database.
	Failure condition:	✓ The user is not deleted from the database. ✓ Delete procedure generates a log file where the administrator can follow-up the procedure and the error messages .
	Minimal guarantee:	✓ NA
Procedure	The administrator delete a user manually and can follow-up the execution of the script in the log file.	
Frequency	On user request	

6.6.3.2.1 Wireframes

There are no wireframes foreseen for user management.



6.7 Conclusions

It will not be possible to build spatial queries in the web application. Users perform such tasks faster and easier in their standard desktop applications and they will be able to do it after downloading the data.

