



beAWARE

Enhancing decision support and management services in extreme weather
climate events

700475

D2.10

Final use cases and requirements

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Abstract

This document describes the final use cases and requirements based on end users' needs and technical partners' development of the beAWARE platform as also the final updated for each scenario after the first pilot execution, of the heatwave. The goal is the end users' needs and technical partners' development to meet up for the implementation of the project.

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Executive Summary

This Deliverable is the combination and the step forward of D2.1 and D2.3 in which the first use cases, user requirements as well as analysis of the demonstration sites, equipment, participants and protocols for the three (3) pilots were established.

Specifically, in this deliverable, the final use cases and user requirements are presented as the result of a process that leverage the feedback collected after the first evaluation cycle of the beAWARE platform. The acquired knowledge after the 1st release of the system results to the refinement of user requirements and to enrich the use cases with additional functionality.

For each pilot separately, a description of the initial and final user requirements, their comparison, as well as the ones that will be used to implement the pilot for each scenario is shown. The first step for all three scenarios is their pilot's description. Initially, a detailed description with maps and charts of the demonstration site is presented in order to understand where each pilot will take place. The next step is a detailed description of the pilot script, based on a storyline in order to offer an analytical presentation of all the steps that will take place. The final step, and a very important one, because compares the legacy tools and the beAWARE platform, and describes the emergency protocols and communication procedures based on D2.1 “Use Cases and Initial User Requirements” that will be used in the implementation of the pilot.

Finally, for all the three (3) scenarios, the equipment, the places where the PSAP was set as also the relief place and the participants are mentioned and analyzed. Additionally, for the Flood and Fire scenario were analyzed the updates in some Use Cases and User Requirements as also the reason for those updates. Thus, technical partners with end users have a clearer view of the implementation of the other two pilots based on use cases and user requirements. New ideas, suggestions, and limitations that highlighted during the 1st pilot from end users and technical partners were the motivation to reformulate and update the final list with requirements and use cases.

Abbreviations and Acronyms

CMT	Hellenic Crisis Management Team
COC	Municipal Crisis Operational Centers
EWS	Early Warning System
HMOD	Hellenic Ministry of Defense
HRC	Hellenic Red Cross
HRT	Hellenic Rescue Team
KAPI	Open Centre for Elder Protection
KB	Knowledge base module of beAWARE
PSAP	Public-safety answering point
UC	Use Case
UR	User Requirements
VHF	Very High Frequency

Glossary

Term	Meaning in beAWARE
A	
<i>Audio Item</i>	Audio recording.
B	
<i>Building</i>	A structure with walls and a roof and usually windows and often more than one level, used for any of variety of activities, as living, entertaining, or manufacturing (e.g. a house or factory).
C	
<i>Crisis</i>	Situation with high level of uncertainty that disrupts the core activities and/or credibility of an organization and requires urgent action.
<i>Crisis Management</i>	Management process that identifies potential impacts that threaten an organization and provides a framework for building resilience, with the capability for an effective response that safeguards the interests of the organization's key interested parties, reputation, brand and value creating activities, as well as effectively restoring operational capabilities. Crisis management also involves the management of preparedness, mitigation response, and continuity or recovery in the event of an incident, as well as management of the overall programme through training, rehearsals and reviews to ensure the preparedness, response and continuity.
<i>Crisis Classification Component</i>	In the content of beAWARE project, it is a component which integrates and deploys the necessary technological solutions enabling stakeholders (authorities, first responders, citizens) to (a) timely aware them for an upcoming extreme natural event by acting as an Early Warning System; (b) provide real-time monitoring of the ongoing crisis, facilitating the risk assessment and decision support processes via the PSAP (Public Safety Answering Points) component.
<i>Classification</i>	The action or process of classifying something.
<i>Communication</i>	Any type of (tele) communication infrastructure.
D	
<i>Damage</i>	Combination of exposure and vulnerability
<i>Data Analysis</i>	A type of a task involving data analysis.
<i>Disaster</i>	The occurrence of physical event who causes negative impact, such as a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.
<i>Drone</i>	an unmanned aircraft or ship guided by remote control or onboard computers
E	

Term	Meaning in beAWARE
<i>Early warning</i>	The provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response.
<i>Early warning system</i>	The set of capacities needed to generate and disseminate timely early warnings.
<i>Energy</i>	Any type of energy-generating infrastructure.
<i>Exposure</i>	The presence of people, livelihoods, environmental service and resources, infrastructures, economic and social and cultural assets in areas or places that are subject to the occurrence of physical events and that thereby are subject to future potential negative impact
F	
<i>Forecast</i>	Definite statement or statistical estimate of the likely occurrence of a future event or conditions for a specific area.
<i>Forecasting model</i>	Numeric representation of a physical phenomenon, which - starting from input data (other forecasts, measures, etc.) - solves by numerical techniques its internal equations and provides forecasts as output data.
<i>Flood</i>	An overflow of a large amount of water beyond its normal boundaries, involving an area usually dry, triggered by various events (rainfall, snowmelt, exceeding of a drainage network, ...)
<i>Flood forecasting model</i>	a forecasting model which provide estimation of hydraulic variables (such as water level, velocity, depth...) in a specific domain from meteorological forecasts or measure as (intensity of rain, humidity, temperature...) provided as input
<i>Flood map</i>	Hazard outcome in case if flood, expressing the spatial distribution of the intensity of the flood in terms of depth, persistence or velocity
H	
<i>Hazard</i>	The occurrence of a physical event with a certain probability and intensity. Unlike the disaster, hazard may not cause any negative impact
<i>Heatwave</i>	A period of abnormally and uncomfortably hot and usually humid weather
<i>Human</i>	Human beings in danger.
I	
<i>Image Analysis</i>	The task of extracting useful information from still images.
<i>Image Item</i>	Captured image.
<i>Impact</i>	The impact of natural disasters and incidents.
<i>Impact Type</i>	The various types of impacts, like human, economic, and environmental impacts (e.g. injuries, damage to properties etc.)
<i>Incident</i>	The various incidents taking place during a natural disaster.
<i>Incident Type</i>	The various types of incidents, like e.g. floods, blocked streets etc.
L	

Term	Meaning in beAWARE
<i>Living Being</i>	Any living being that is in danger during a natural disaster.
<i>Location</i>	A location (point or area), indicated by latitude, longitude, and radius.
M	
<i>Mission</i>	A mission assigned to a rescue unit during a crisis.
<i>Monument</i>	A structure or building that is built to honour a special person or event.
N	
<i>Natural Disaster</i>	The actual manifestation of a natural disaster type. An instance of a natural disaster has specific climate conditions with specific values (e.g. temperature = 45) plus some other properties (e.g. start/end time).
<i>Natural Disaster Type</i>	The various types of disasters, like e.g. floods, forest fires, storms or earthquakes etc.
P	
<i>Police</i>	Law enforcement infrastructure and services.
<i>Preparedness</i>	The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from the impacts of likely, imminent or current disasters.
<i>Prevention</i>	The outright avoidance of adverse impacts of hazards and related disasters.
<i>Priority</i>	The condition of being regarded as more important than others are.
<i>Property</i>	Any type of private property.
<i>Public awareness</i>	The extent of common knowledge about disaster risks, the factors that lead to disasters and the actions that can be taken individually and collectively to reduce exposure and vulnerability to hazards.
<i>Public information</i>	Information, facts and knowledge provided or learned because of research or study, available to be disseminated to the public.
R	
<i>Recovery</i>	The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.
<i>Relief Place</i>	a position or the state of being covered and protected
<i>Resilience</i>	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.
<i>Responder</i>	A first responder unit (e.g. a firefighter, police officer or emergency medical physician).
<i>Risk</i>	The combination of the probability of certain hazard to occur and of its potential negative consequences.

Term	Meaning in beAWARE
<i>Risk assessment</i>	A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend.
<i>Risk management</i>	The systematic approach and practice of managing uncertainty to minimize potential harm and loss.
<i>Risk map</i>	Spatial distribution of risk in a certain area, obtained by evaluation and combination of hazard, exposure and vulnerability in each point of spatial grid of a certain size
<i>River Section</i>	graphic representation of a river obtained by the intersection a river reach with a vertical plane usually orthogonal to the main direction of the flow
S	
<i>Scenario operational scenario</i> or	environmental and ecological context of the natural disaster and its impact of the elements at risk and stakeholder assets
<i>Sensor</i>	A Sensor is an instrument that observes a property or phenomenon with the goal of producing an estimate of the value of a parameter.
<i>Severity</i>	Measure of the possible consequences of a hazard, for example given by the comparison between a measurement or forecast of a weather variable (e.g. temperature, water level, rain ...) and one or more predefined alert thresholds.
<i>Stakeholder</i>	Every subject (person or groups) who holds interest or concern regarding a certain action, objective, project and can be affected by it or can affect it.
<i>Street</i>	The road network infrastructure.
<i>Subway</i>	Subway infrastructure.
T	
<i>Task</i>	A task that has to do with analysing or processing items.
<i>Text Analysis</i>	The task of analysing textual corpora.
<i>Text Item</i>	A piece of text.
<i>Transportation</i>	Transportation services and infrastructure.
<i>Technical requirement</i>	formalization, standardization and elaboration of the user requirement specification and allocation in the beAWARE subsystems
U	
<i>Use Case</i>	conceptual description of intended or expected utilization of the beAWARE system to prepare for, respond to, or act upon the occurrence of the scenario

Term	Meaning in beAWARE
<i>User Requirement</i>	expectation, request, guidelines for functionalities, capabilities, conditionalities and features that would facilitate the successful completion of an use case
V	
<i>Video Analysis</i>	The task of extracting useful information from video sequences.
<i>Video Item</i>	A video recording.
<i>Vulnerability</i>	Susceptibility or predisposition for loss and damage to human being and their livelihoods, as well as their physical, social and economic system when affected by hazardous physical event.
W	
<i>Water depth</i>	the height of the water (in a river section, channel section, section of a pipe, specific point of flooded area) measured from the bottom or the ground
<i>Water Level</i>	The height of the water (in a river section, channel section, section of pipe, specific point of a flooded area...) measured from well-defined zero (i.e. the mean sea level)
<i>Weather station</i>	Q place equipped for measure weather, meteorological, hydrological or hydraulic data

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1 Introduction

This report provides the Use Cases and Users requirements updates as also the three (3) pilots' implementation updates from the end users' perspective and needs. It is important to note down that use cases and user requirements are important key factors for the successful implementation of the pilots. As stated in D2.3 "Pilot Use Cases Setup for the First Prototype", all scenarios complement each other and there are a continuous progress and evolution of the platform and the mobile application. This continuous progress in different aspects of the platform functionalities offers a complete overall picture of it.

The updated use cases and user requirements and with the continuous cooperation between technical partners and end users provides the ability for all consortium members to support the beAWARE platform and the successful implementation of its pilots.

In Section 2, initial and final uses cases and user requirements that will be supported from beAWARE platform for the flood pilot are presented. Additionally, updated versions of the use cases, "Management of new flood emergencies", "Sensor and Flood forecasting alerts" and "Management of the sand packs distribution points and of Safe Places" are mentioned. Moreover, two new use cases (UC_109 and UC_110) that will be tested are conferred. In the next subchapter of Section 2, the user requirements that beAWARE platform will support and some updated ones such as "Detect flooded elements from video", "Detect water depth and velocity" and "Real time flood mapping are presented and analyzed. The last subchapter presents the final demonstration site for the flood pilot which will take place in two different places the Vicenza City center and the S.Agostino district. Moreover, the storyline of the pilot that was agreed with the technical partners and based on the maturity level of the platform is analyzed. Additionally, the emergency protocols that already exist and are followed by national and local authorities are described, the equipment that will be used for the implementation of the pilot and the active areas that the pilot will be implemented are presented and lastly, the participants of the pilot which will be divided in 3 main categories, citizens, first responders and Decision Makers.

In Section 3, the initial and final Use Cases and User Requirements for the fire pilot are presented. Secondly, a comparative analysis of the initial use cases and user requirements with the final ones based on continuous collaboration between the end users and the technical partners and based on the maturity level of the platform is being made for the implementation of the fire pilot. Moreover, the updated ones "Pre-emergency level 3 activation", "Evacuation management during an emergency" and the "Aerial images/video (drone)" are described. The last sub-chapter presents the final demonstration site with detailed maps, describes the story-line of the fire scenario to be held in Valencia and finally the emergency protocols that already exist and some of them have been updated and the

storyline that will be followed. Finally, the equipment and the participants who are going to involve in the flood pilot are described.

In Section 4, the heatwave pilot implementation which took place from 19 to 20 of November 2018 in Thessaloniki at HRT Headquarters is presented. Since there are not initial and final Use Cases and User Requirements for the heatwave scenario the ones that were tested are presented. Additionally, the Use Cases and User Requirements that were not tested in the heatwave scenario, will be examined in future tabletop exercises and/or in the following pilots. At the last sub-chapter, a general overview of the area of the demonstration site and also the active areas during each session of the pilot are presented. Moreover, the storyline and all the three (3) sessions are presented within a fully analytical table. Finally, all the emergency protocols and communication procedures that are used up to today for the heatwave are conferred and exploited at the heatwave pilot in legacy tools and lastly, a list of the equipment and buildings that were used and the number of participants and their field of expertise are mentioned.

2 Flood Scenario final updates

The Flood pilot will take place in Vicenza from the 5th to the 7th of March 2019 in the ‘COC Room’ located in the ‘AIM palace’ (Contrà Pedemuro S. Biagio, 72, 36100 Vicenza VI), where the PSAP will be established for the implementation of the pilot. The selected room is the place where the Municipal Crisis Operational Centre (the COC) is established during an emergency that involves the Vicenza Municipality.

The participants to the pilot will be adequately trained to the beAWARE technology by AAWA staff before the week of the pilot, by organizing evening sessions of training in Vicenza.

Moreover, the 5th and the 6th of March, at the presence of the whole beAWARE Consortium, other sessions of training and the general test of the pilot will take place in suitable rooms provided by the Municipality of Vicenza.

All the training sessions will be differentiated for the control rooms operators and Decision Makers, who will use the PSAP, and for the volunteers who will use the mobile app instead; all the training session for the volunteers will take place in the evening, after the standard Italian working day.

2.1 Initial and Final Use Cases

In D2.1 a general report of all Use Cases and User requirements for the flood pilot was made, as result of the **elicitation process** (see D.2.1 for more detail), which involved AAWA, the technical partners of the consortium and the main stakeholders.

Nevertheless, those Use Cases and User Requirements were defined when the beAWARE technologies were at a very embryonic level of development; now, a better understanding of the beAWARE technologies - coming also from the 1st prototype pilot results - and the encapsulation addition of new technical features, after D2.1 submission, such as the video analysis of recordings from an autonomous drone flight, the implementation of the Regional Sensors’ network in the SensorThingsServer, etc, led to upgrade of the specifications of some Use Cases and to the creation of two new ones.

The following table shows all the Use Cases for the flood scenario, the ones that have been updated from D2.1 are highlighted on blue, while the ones added in D2.10 are highlighted in green.

Table 1. Flood scenario Use Cases Modification

USE CASES FLOOD	HAS BEEN MODIFIED FROM D2.1?
UC_101: Declaration of the attention status and continuous monitoring of flood forecasting	No
UC_102: Management of new flood emergencies	Updated with the data from sensors
UC_103: Monitoring river water level and assignment of tasks to first responders	Updated with the data from sensors and the feature of detection obstacles from video analysis
UC_104: Evaluation of the execution of tasks	No
UC_105: Monitoring rainfall	Yes
UC_106: Monitoring river breaking/overtopping and assignment of relative tasks	Yes
UC_107: First responders monitoring	No
UC_108: Sensor and Flood forecasting alerts	Updated with the data from sensors
UC_109: Acquiring images and video from drones and static cameras for flood risk management	Added
UC_110: Management of the sand packs distribution points and of Safe Places	Added

2.1.1 Initial and Final Use Cases Comparison

This section provides a description of all the differences between the initial Use Cases (D2.1) and the final list.

UC_102 - Management of new flood emergencies

This Use Case concerns the management of new emergencies reported by citizens and first responders.

This Use Case has been updated after D2.1 in order to include measures taken by the sensors that have been integrated in the platform.

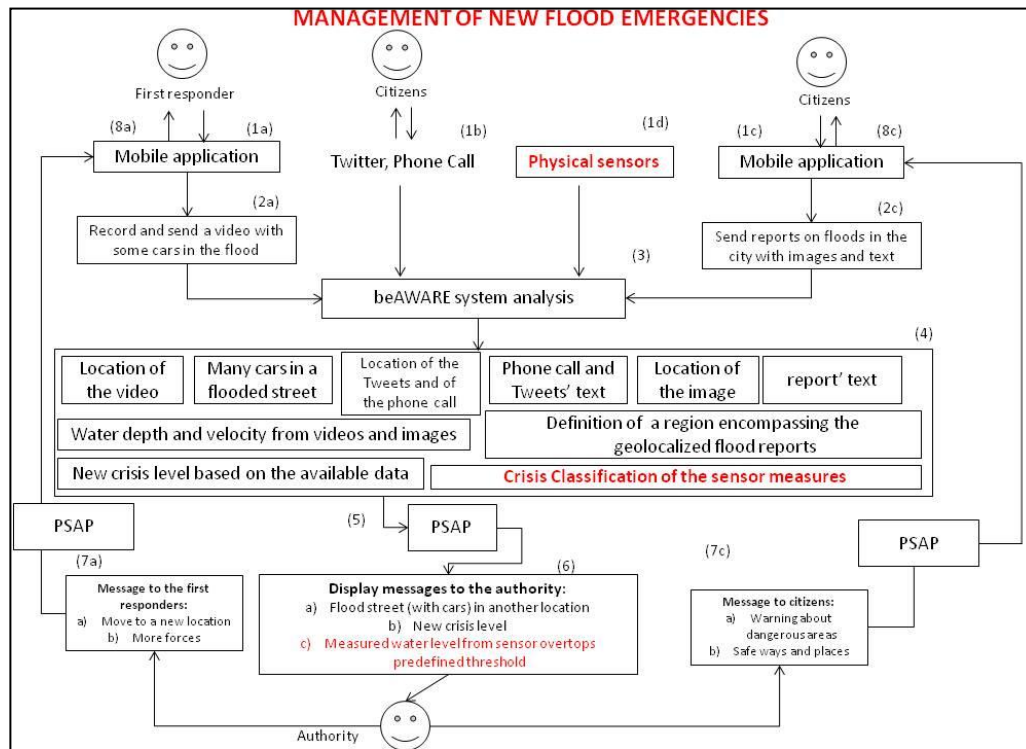


Figure 1. Block Diagram of the updated UC_102

The table below provided a comparison between the updated version of the UC and the initial one.

Table 2. Updates from the UC_102

D2.1	D2.10
Name	Name
Management of new flood emergencies	Management of new flood emergencies
Diagram	Diagram

<p>MANAGEMENT OF NEW FLOOD EMERGENCIES</p> <p>The flowchart illustrates the process of managing new flood emergencies. It starts with data collection from three sources: First responder (1a), Citizens (1b), and Mobile application (1c). The First responder (1a) records and sends a video with some cars in the flood (2a). Citizens (1b) send reports on floods in the city with images and text (2c). The Mobile application (1c) also sends reports on floods in the city with images and text (2c). These reports are processed by the beAWARE system analysis (3). The analysis outputs include: Location of the video, Many cars in a flooded street, Location of the Tweets and of the phone call, Phone call and Tweets' text, Location of the image, report' text, Water depth and velocity from videos and images, and Definition of a region encompassing the geolocalized flood reports. This leads to a New crisis level based on the available data (4). The system then triggers PSAP messages (5) to first responders (7a), authorities (7b), and citizens (7c). The messages to the authority (7b) include: a) Flood street (with cars) in another location, b) New crisis level, and c) Safe ways and places.</p>	<p>MANAGEMENT OF NEW FLOOD EMERGENCIES</p> <p>This flowchart is similar to the one on the left but includes an additional input: Physical sensors (1d). The Physical sensors (1d) send reports on floods in the city with images and text (2c). The beAWARE system analysis (3) also takes these sensor reports into account. The analysis outputs include: Location of the video, Many cars in a flooded street, Location of the Tweets and of the phone call, Phone call and Tweets' text, Location of the image, report' text, Water depth and velocity from videos and images, Definition of a region encompassing the geolocalized flood reports, and Crisis Classification of the sensor measures. This leads to a New crisis level based on the available data (4). The system then triggers PSAP messages (5) to first responders (7a), authorities (7b), and citizens (7c). The messages to the authority (7b) include: a) Flood street (with cars) in another location, b) New crisis level, c) Measured values to verify from sensor overtop: predefined threshold, and d) Safe ways and places.</p>
<p>Explanation</p>	<p>Explanation</p>
<p>Current Status (initial phase of the scenario)</p>	<p>Current Status (initial phase of the scenario)</p>
<ul style="list-style-type: none"> During the flood 	<ul style="list-style-type: none"> During the flood
<p>What is known to the beAWARE system already</p>	<p>What is known to the beAWARE system already</p>
<ul style="list-style-type: none"> Weather forecast Location of the flooded area 	<ul style="list-style-type: none"> Weather forecast Location of the flooded area Sensors of the weather stations
<p>What is happening</p>	<p>What is happening</p>
<ul style="list-style-type: none"> A first responder (rescue service) is recording a video of a flooded street in another location in the city Tweets and phone calls are mentioning flooded areas in another location in the city Citizens are sending reports on floods with images and text in another location in the city 	<ul style="list-style-type: none"> A first responder (rescue service) is recording a video of a flooded street in another location in the city Tweets and phone calls are mentioning flooded areas in another location in the city Citizens are sending reports on floods with images and text in another location in the city The system compares the measured data with the fixed thresholds and detects a threshold exceeding [New] The system defines a new crisis level based on the available data [New]
<p>Outcome</p>	<p>Outcome</p>
<ul style="list-style-type: none"> The authority (e.g. mayor) move forces to the new location The authority (e.g. mayor) sends notifications to citizens approaching the dangerous areas and suggests alternative ways The system defines a new crisis level based on the available data 	<ul style="list-style-type: none"> The authority (e.g. mayor) move forces to the new location The authority (e.g. mayor) sends notifications to citizens approaching the dangerous areas and suggests alternative ways

UC_103: Monitoring river water level and assignment of tasks to first responders

This Use Case concerns the assignment of tasks to first responders based on the monitored river water level both by the installed sensors and the results of visual analysis from cameras.

This Use Case has been updated after D2.1 in order to include the measurements taken by the sensors that have been integrated in the platform and that, according to the Municipal Civil Protection Plan, are one of the main parameters that triggers a set of pre-defined tasks. In fact, the Plan imposes some specific preventive measures when the water level recorded by the sensors in Bacchiglione River exceeds some fixed thresholds. Furthermore, it has also updated with respect to the possible sources of water level video capturing (e.g. a static camera instead of arbitrary videos from citizens through the mobile application).

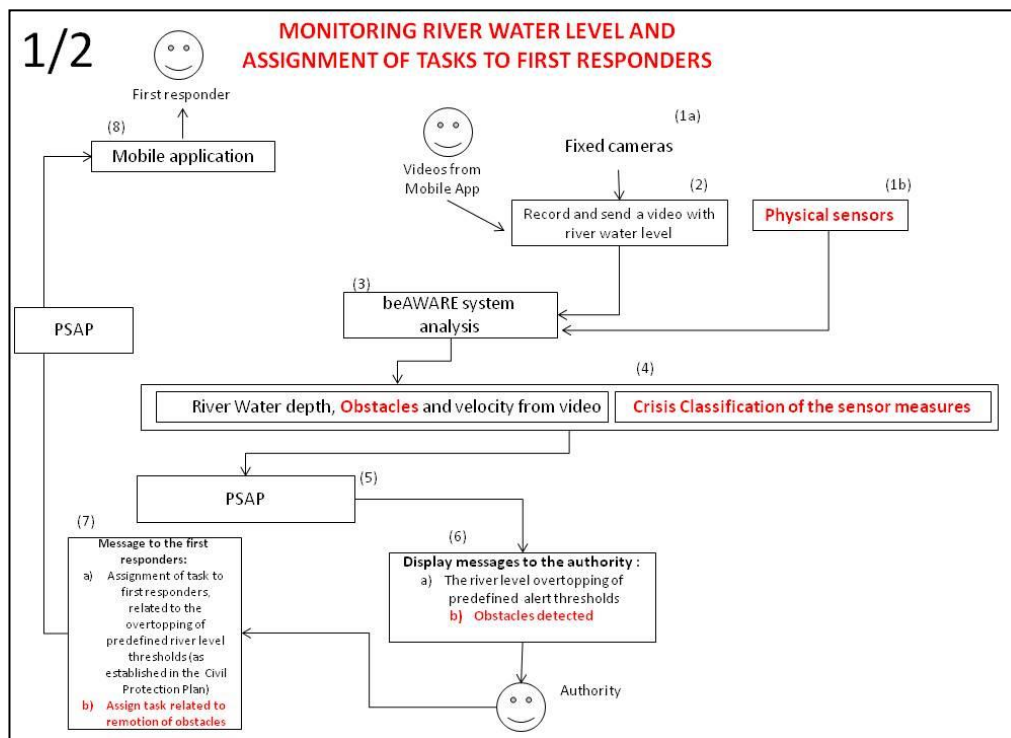


Figure 2. Block Diagram of the updated UC_103

The table below provided a comparison between the updated version of the UC and the initial one.

Table 3. Updates from the UC_103

D2.1	D2.10
Name	Name
Monitoring river water level and assignment of tasks to first responders	Monitoring river water level and assignment of tasks to first responders
Diagram	Diagram
<p>MONITORING RIVER WATER LEVEL AND ASSIGNMENT OF TASKS TO FIRST RESPONDERS</p> <p>The diagram illustrates the process for monitoring river water level and assigning tasks to first responders. It involves a First responder (8) using a Mobile application (8) to send videos to a Fixed camera (1). The camera records and sends a video with river water level (2) to the beAWARE system analysis (3). The analysis outputs River Water depth and velocity from video (4) to the PSAP (5). The PSAP then sends a Message to the first responders (7) and a Display messages to the authority (6). The authority (6) displays the river level overtopping of predefined alert thresholds.</p>	<p>MONITORING RIVER WATER LEVEL AND ASSIGNMENT OF TASKS TO FIRST RESPONDERS</p> <p>This diagram is an updated version of D2.1, adding Physical sensors (1b) and Crisis Classification of the sensor measures (4). The process starts with a First responder (8) using a Mobile application (8) to send videos to a Fixed camera (1a). The camera records and sends a video with river water level (2) to the beAWARE system analysis (3). The analysis also receives input from Physical sensors (1b) and outputs River Water depth, Obstacles and velocity from video (4) and Crisis Classification of the sensor measures (4) to the PSAP (5). The PSAP then sends a Message to the first responders (7) and a Display messages to the authority (6). The authority (6) displays the river level overtopping of predefined alert thresholds (a) and Obstacles detected (b).</p>
Explanation	Explanation
<p>Current Status (initial phase of the scenario)</p> <ul style="list-style-type: none"> Before the flood <p>What is known to the beAWARE system already</p> <ul style="list-style-type: none"> Weather forecast Predefined alert thresholds of river level Location of the forecasted flooded area <p>What is happening</p> <ul style="list-style-type: none"> A fixed camera, located in correspondence of a river section of interest, records continuously water level inside the river A citizen records video continuously of water level inside the river <p>Outcome</p> <ul style="list-style-type: none"> Once the river water level overtops predefined alert thresholds, the authority (e.g. mayor) assigns tasks to 	<p>Current Status (initial phase of the scenario)</p> <ul style="list-style-type: none"> Before the flood <p>What is known to the beAWARE system already</p> <ul style="list-style-type: none"> Weather forecast Sensors of the weather station for water level measures <i>[New]</i> Predefined alert thresholds of river level Location of the forecasted flooded area <p>What is happening</p> <ul style="list-style-type: none"> A fixed camera, located in correspondence of a river section of interest, records continuously water level inside the river The system compares the measured data from sensors and the estimated water level from video analysis with the fixed thresholds aiming to detect a threshold exceeding <p>Outcome</p> <ul style="list-style-type: none"> Once the river water level overtops predefined alert thresholds, the authority (e.g. mayor) assigns

first responders	tasks to first responders <ul style="list-style-type: none"> Once the video analysis detects the presence of obstacles in the river (i.e trunks) that can create obstruction to the flow and increase the water level, the authority (e.g. mayor) assigns tasks to first responders
Omitted tasks	Explanation
<ul style="list-style-type: none"> A citizen records video continuously of water level inside the river 	This task should be omitted due to the following technical limitation: <ul style="list-style-type: none"> It is very challenging to estimate the river's water level from arbitrary viewpoints due to algorithmic calibration requirements

UC_105: Monitoring rainfall

This Use Case concerns the assignment of tasks to first responders based on the monitored rainfall intensity.

The Use Case has been updated after D2.1 in order to include the measurements taken by the sensors that have been integrated in the platform.

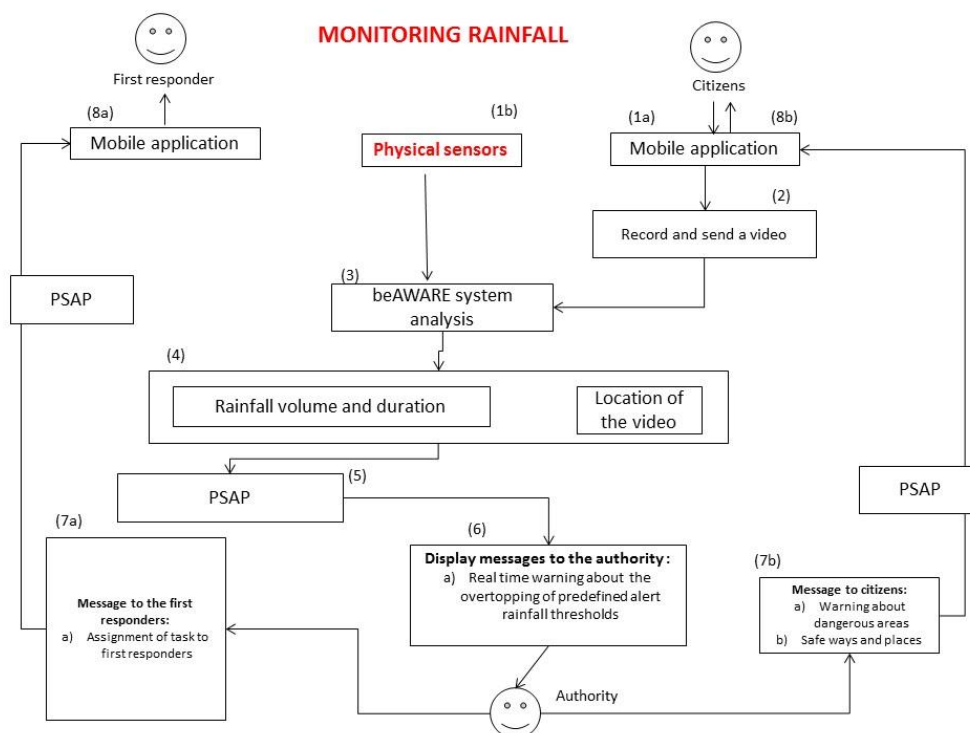


Figure 3. Block Diagram of the updated UC_105

The table below provided a comparison between the updated version of the UC and the initial one.

Table 4: Updates from the UC_105

D2.1	D2.10
Name	Name
Monitoring rainfall	Monitoring rainfall
Diagram	Diagram
Explanation	Explanation
<p>Current Status (initial phase of the scenario)</p> <ul style="list-style-type: none"> During an intense rainfall event <p>What is known to the beAWARE system already</p> <ul style="list-style-type: none"> Weather forecast Land use Soil moisture Location of the forecasted flooded area Predefined alert rainfall thresholds <p>What is happening</p> <ul style="list-style-type: none"> Citizens are recording a video about a rainfall event <p>Outcome</p> <ul style="list-style-type: none"> Once the rainfall threshold is overtopped the authority (e.g. mayor) assigns tasks to first responders (e.g. Pumping stations to be activated) Once the rainfall threshold is overtopped the authority (e.g. mayor) sends notifications to citizens approaching the dangerous areas (e.g. underpass to be 	<p>Current Status (initial phase of the scenario)</p> <ul style="list-style-type: none"> During an intense rainfall event <p>What is known to the beAWARE system already</p> <ul style="list-style-type: none"> Weather observations Land use Soil moisture Location of the observed flooded area Predefined alert rainfall thresholds <p>What is happening</p> <ul style="list-style-type: none"> Sensing data regarding weather observations (temperature, precipitation) are obtained and analysed Citizens are recording a video about a flooded area impacted after a rainfall event <p>Outcome</p> <ul style="list-style-type: none"> Video analysis confirms that the area is flooded Once the rainfall threshold is overtopped the authority (e.g. mayor) assigns tasks to first responders (e.g. Pumping stations to be activated)

avoided) and suggests alternative ways	<ul style="list-style-type: none"> Once the rainfall threshold is overtopped the authority (e.g. mayor) sends notifications to citizens approaching the dangerous areas (e.g. underpass to be avoided) and suggests alternative ways
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UC_106: Monitoring river breaking/overtopping and assignment of relative tasks

This Use Case concerns the assignment of tasks to first responders based on the monitored river breaking/overtopping.

The Use Case has been updated after D2.1 so as the monitoring of river breaking/overtopping will be done by static surveillance cameras, located in the river sections of interest. The cameras will record continuously water level inside the river. The videos will be analysed aiming to timely and accurately detect water level rising, which potentially could cause the river's overflow. Furthermore, the analysis module will take under consideration messages from the citizens' mobile applications concerning the river breaking/overtopping.

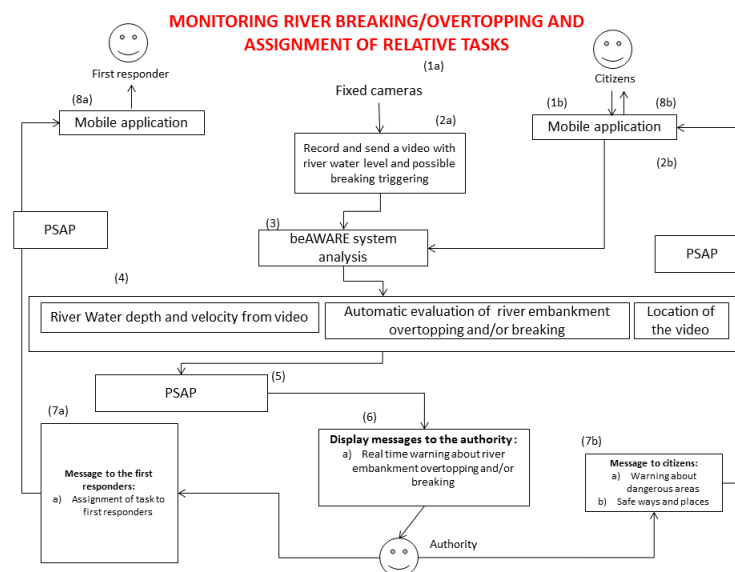
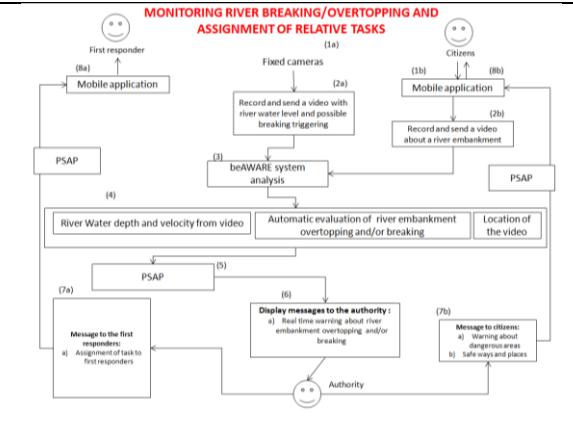
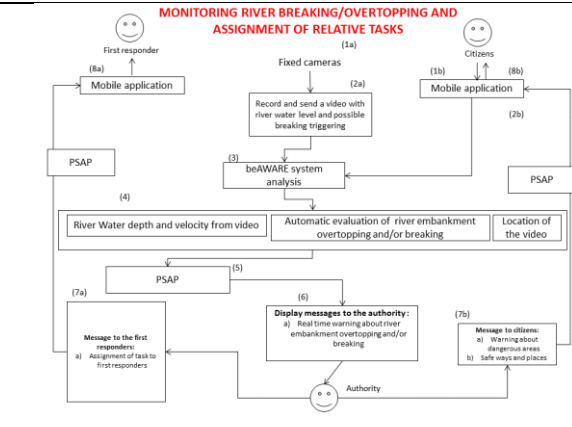


Figure 4: Block Diagram of the updated UC_106

The table below provided a comparison between the updated version of the UC and the initial one.

Table 5: Updates from the UC_106

D2.1	D2.10
Name	Name
Monitoring river breaking/overtopping and assignment of relative tasks	Monitoring river breaking/overtopping and assignment of relative tasks
Diagram	Diagram
	
Explanation	Explanation
<p>Current Status (initial phase of the scenario)</p> <ul style="list-style-type: none"> Before the flood <p>What is known to the beAWARE system already</p> <ul style="list-style-type: none"> Weather forecast Location of the forecasted flooded area <p>What is happening</p> <ul style="list-style-type: none"> A fixed camera, located in correspondence of a river section of interest, records continuously water level inside the river and the possible breaking triggering Citizens are recording a video about a river embankment <p>Outcome</p> <ul style="list-style-type: none"> Once the embankment is overtopped or broken the authority (e.g. mayor) assigns tasks to first responders Once the embankment is overtopped or broken the authority (e.g. mayor) sends notifications to citizens approaching the dangerous areas and suggests alternative ways 	<p>Current Status (initial phase of the scenario)</p> <ul style="list-style-type: none"> Before the flood <p>What is known to the beAWARE system already</p> <ul style="list-style-type: none"> Weather forecast Location of the forecasted flooded area <p>What is happening</p> <ul style="list-style-type: none"> Static surveillance cameras, located in the river sections of interest, record continuously water level inside the river and the possible overtopping triggering Citizens are sending messages via mobile application concerning the river embankments and overtopping <p>Outcome</p> <ul style="list-style-type: none"> Once the water level rises and its close to overflow the authority (e.g. mayor) assigns tasks to first responders Once the water level rises and its close to overflow the authority (e.g. mayor) sends notifications to citizens approaching the

UC_108: Sensor and Flood forecasting alerts

This Use Case concerns the automatic creation of alert based on the detection of threshold exceeding both from the forecast (alert for future flood event) and from the real-time measurement of the sensors (incoming flood events).

Initially this UC concerned only water level forecasts; however, after the inclusion of the observations from the weather stations in beAWARE's SensorThings Server and the enhancement of the Crisis Classification Module with the ability to analyse those data, this UC has been updated by adding the feature to provide automatic alerts based also on the real-time measurements.

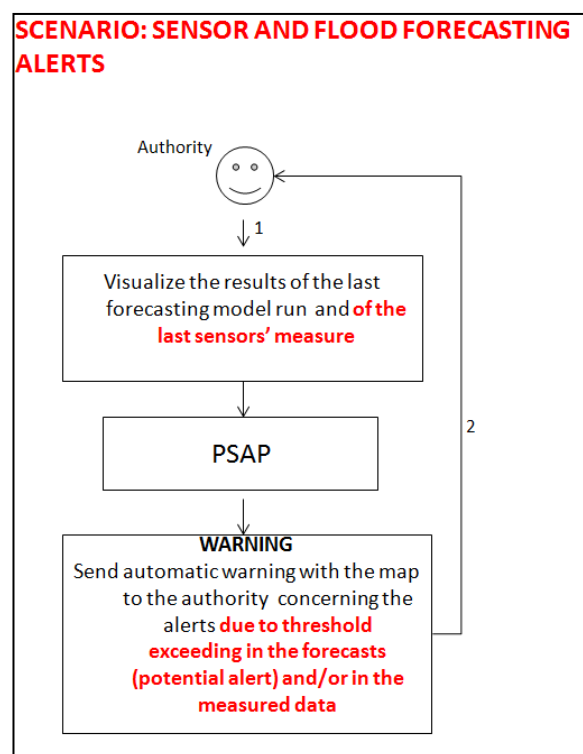


Figure 5. Block Diagram of the updated UC_108

Table 6. Updates from the UC_108

D2.1	D2.10
Name	Name
Flood forecasting alerts	Sensors and flood forecasting alerts
Diagram	Diagram

<pre> graph TD Authority[Authority] -- 1 --> QUERY[QUERY Visualize the results of the last forecasting model run] QUERY --> PSAP[PSAP] PSAP --> WARNING[WARNING Send automatic warning with the map to the authority concerning the potential alerts (red point in the map)] WARNING -- 2 --> Authority </pre>	<pre> graph TD Authority[Authority] -- 1 --> Visualize[Visualize the results of the last forecasting model run and of the last sensors' measure] Visualize --> PSAP[PSAP] PSAP --> WARNING[WARNING Send automatic warning with the map to the authority concerning the alerts due to threshold exceeding in the forecasts (potential alert) and/or in the measured data] WARNING -- 2 --> Authority </pre>
Explanation	Explanation
<p>Current Status (initial phase of the scenario)</p> <ul style="list-style-type: none"> Before a flood event <p>What is happening</p> <ul style="list-style-type: none"> Intense rainfall event is forecasted <p>Outcome</p> <ul style="list-style-type: none"> The Mayor can visualize if there are overtopping of alert thresholds in the modeled river cross sections Warnings are sent automatically to the authority concerning potential alerts 	<p>Current Status (initial phase of the scenario)</p> <ul style="list-style-type: none"> Before a flood event and/or in its initial phase <p>What is known to the beAWARE system already</p> <ul style="list-style-type: none"> Weather forecast Sensors of the weather stations for water level measurements Predefined alert thresholds of river water level <p>What is happening</p> <ul style="list-style-type: none"> Intense rainfall event is forecasted The system compares the forecasted data with the fixed thresholds and detects a possible threshold exceeding [New] The system compares the real-time measured data with the pre-defined alarm threshold and detects a threshold exceeding [New] <p>Outcome</p> <ul style="list-style-type: none"> The Mayor can visualize if there are overtopping of alert thresholds in the modeled river cross sections The Mayor can visualize if there are overtopping of alert thresholds in the sensor's measures Warnings are sent automatically to the authority concerning the threshold exceeding

	<p>(both regarding forecasts and/or measured data)</p> <ul style="list-style-type: none"> The authority can decide if sent these warning to Citizen as public alerts.
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UC_109: Acquiring images and video from drones and static cameras for flood risk management

This use case is related to the images and videos taken by drones and installed static cameras as well as their visual analysis in order to:

- Detect the water level (Low/Medium/High)
- Detect the extension of flooded area
- Detect the presence of people/car in the river

This Use Case has been specifically added after the introduction of the drones' and static cameras in the flood scenario in the beAWARE Grant Agreement and after discussion with one of the main stakeholders of the flood pilot, "Alta Pianura Veneta" Land Reclamation Consortium, who made available the area for executing the drone flight in beAWARE.

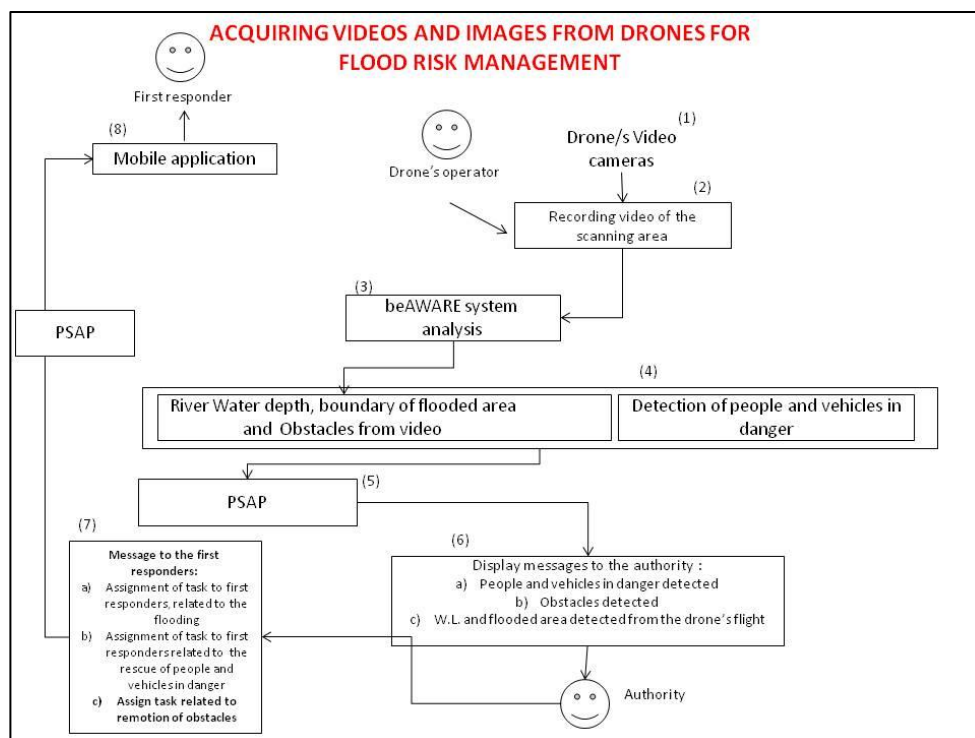


Figure 6. Block Diagram of the updated UC_109

Current Status (initial phase of the scenario)

- During the flood

What will happen:

- Video and images from drones and installed surveillance (static) cameras arrive to the beAWARE system.
- Visual analysis is applied to media files in order to detect the water level, the extension of the flooded area and the potential presence of people and vehicles in the river.

Outcome

- Once the presence of people and car in danger is detected, the authority (e.g. mayor) assigns tasks to first responders

UC_110: Management of the sand packs distribution points and of Safe Places

During the implementation of the 1st prototype, the technology for the management of the place of relief (UC_305) was developed and successfully tested during the heatwave pilot. As consequence, it has been decided to create a similar UC for the management of the safe waiting areas and of the sand packs distribution points that are established during the flood in Vicenza.

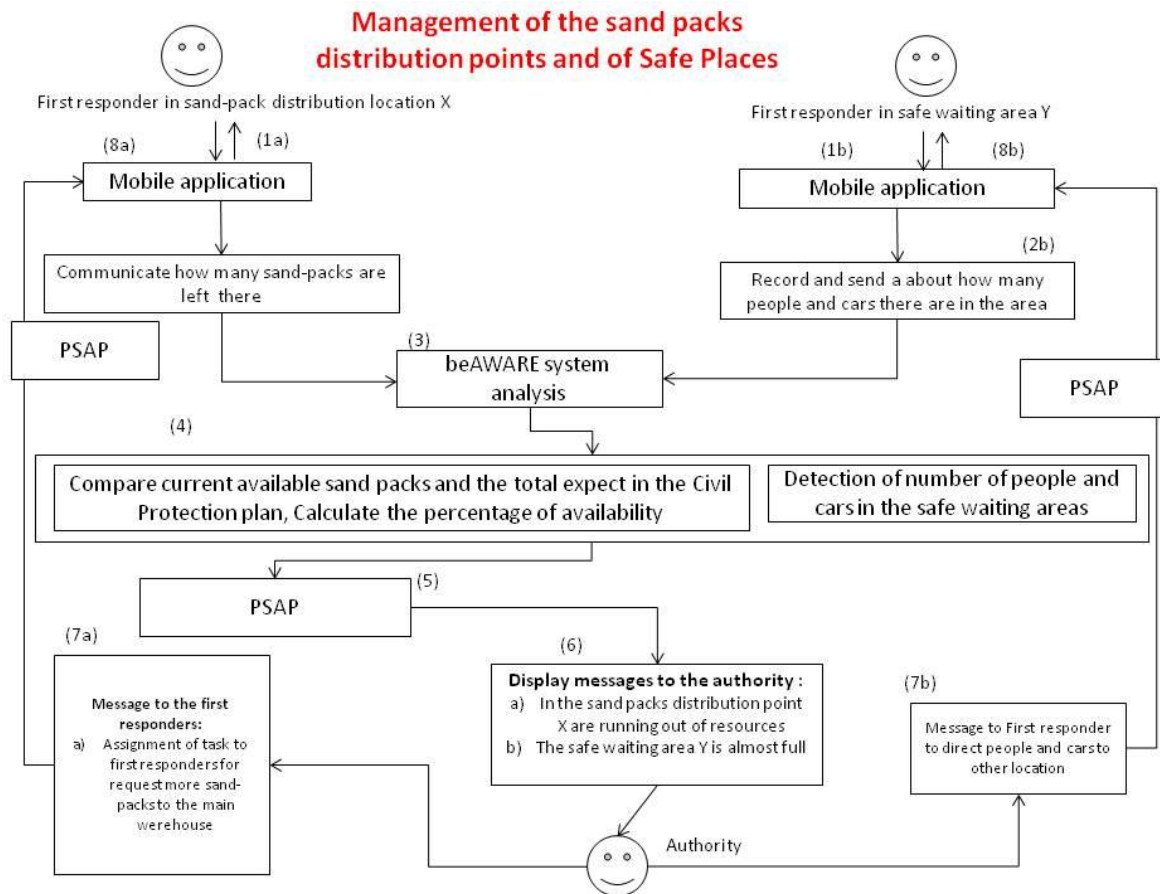


Figure 7. Block Diagram of the updated UC_110

More in detail, the Use Case 110 concerns the monitoring of the safe places and the points of distribution of Sand Packs during the flood, when first responders are sending to Authority continuous updates about the capacity of the safe waiting areas and of the availability of resources (sand packs) in the distribution points; the Authority is able to real-time monitor this information from the dashboard of PSAP and requests to the rescue teams, if necessary, to bring more resources from the main warehouse or to direct people in other safe waiting areas.

Current Status (initial phase of the scenario)

- During the flood

What is known to the beAWARE system already:

- Weather forecast
- Current status of occupancy of the safe waiting areas
- Capacity of each place
- Current number of Sand packs in the distribution points
- Number of sand packs for each place indicated by the Civil Protection Plan

What is happening:

- A first responder or the person in managing the place is recording a video of the crowded safe waiting areas
- A first responder sends a report updating about the sand packs available in the distribution point
- The system is able to detect from the video that a safe waiting area is almost full
- The system calculates the percentage of sand-packs available respect to the total requested by the Civil Protection Plan

Outcome

- The authority informs first responders to direct people to other places
- The authority sends notifications to citizens regarding the occupancy of each place and suggests alternative places
- The status of each place is shown on the PSAP's screen
- The authority assigns to the first responders the task to ask for more sand packs from the main warehouse
- The status of each distribution point is shown on PSAP's screen

2.2 Initial and Final User Requirements

After the delivery of D2.1, requirements development and implementation continued to evolve throughout the program, with the completion of intermediate prototype versions and the final version.

Due to the technical development and a more detailed outline of the beAWARE platform, some modification to the initial list of User Requirements have been necessary.

As for the Use Cases, some User Requirements have been added or more detailed to take in account of new features of the platform which were proposed after the submission of the D2.1 and that regarded mainly:

- Integration of the real time measures from the weather stations in Vicenza through the SensorThings Server: this led to the update of UR_101 and UR_103 and to the addition of UR_141
- New activities related to the usage of drones in the flood pilot: this led to the update of UR_111, UR_114, UR_115 and to the addition of UR_132, UR_136 and UR_137

The development of the platform and many discussions with the technical partners of the consortium highlighted that new clarifications and specifications were required regarding the mobile app, whose initial requirements were quite generic. In particular, two versions of the mobile app should be developed: one, simpler and more intuitive, for the Citizen and the other one for the first responders, which allows to specify more types of incident reports (such as a report of a flooding, a report of a river overtopping, a report of a river breach, a

report of a bridge obstruction etc). Moreover, in order to develop Crisis Classification algorithms to prioritize the various incidents report and to assign them a level of risk according to Flood Risk Management Plan (AAWA, 2017), all the user should be allowed to specify some details about their incident report, such as an estimation of the water level or the indication of the elements at risk. These considerations about have been translated in the update of the UR_112 and UR_128, and in the addition of the UR_133 and UR_135.

The management of the shelters through beAWARE, implemented in the 1st prototype and tested in the heatwave pilot, has been an inspiration for translating a similar technology to the Sand Pack distribution points and to the safe waiting areas that are established during the flood in Vicenza, according to the Municipal Civil Protection Plan. The importance of guarantee, during the emergency, an efficient management of the sand packs distribution locations and of the safe waiting areas was well highlighted by the stakeholders during the survey that took place in Vicenza the 26th of November. In that occasion in fact were also organized some meetings between the Consortium and some the main stakeholders of the flood pilot. That was indeed a very productive opportunity, not only for the planning of the pilot, but also for discussing about the updates of the User Requirements. As direct consequence, UR_139 and UR_140 have been added to the list. Finally, in occasion of the international conference on Citizen Observatories for natural hazards and Water Management (COWM 2018, organized by AAWA from November 27th to 30th 2018) both national and international Stakeholders of the flood pilot were gathered together, starting from delegates of Vicenza Municipality, to international expertise on risk management. These stakeholders provided to AAWA many feedbacks about the pilot and the Update of Use Cases and User requirements. It was highlighted that the Authorities in charge to the emergency management have to provide data gathered during the crisis even after its occurrence, if requested; for that reason, a system of backup of all the raw data should be improved in beAWARE, so the UR_138 was added.

The following table shows all the Use Requirement for the flood scenario, the ones that have been updated from D2.1 are on blue rows, while the ones added in D2.10 are in green rows.

Table 7. Flood pilot User Requirements Updates

UR#	UC#	Requirement name	Requirement description
UR_101	All	Type of visualization	Display information to authorities in a web-GIS platform (citizen and first responders' reports by calls, apps, social media, Sensor measurements, etc.)
UR_102	101, 102, 103 104, 105, 106, 108	Map of the AMICO Flood EWS results	Display reliable and trustful flood forecasts, potentially dangerous situations and the forecasted level of risk to the authorities, based on the results of the Early Warning System AMICO (improved with the assimilation of Satellite data (snow cover, soil moisture, etc.) and Meteorological forecasts data with a finer spatial resolution provided by FMI)
UR_103	101, 102, 103 104, 105, 106, 108	Flood warnings	Provide authorities/citizens with automatic warnings on river levels overtopping some predefined alert thresholds, based both on forecast results (pre-emergency phase) and on real-time measurements by the sensors
UR_104	102, 103, 104, 105, 106	Send/receive emergency reports	Allow citizens to send text, images, audio and video messages from their mobile phone (for the different operative systems) and from their social media account to the authority during bad weather conditions when the GPS signal is low
UR_105	104	Send task reports	Allow First Responders to send reports about their assignments from their mobile phone to local authorities
UR_106	103,106	Visualize video cameras	Display streamed video from video cameras to the authorities/citizens
UR_107	102,103, 104, 105,106	Localize video, audio and images	Provide authorities with the ability to localize videos, audio and images sent by citizens from their mobile phones
UR_108	104	Localize task status	Provide authorities with the ability to localize first responders reports regarding the status of their assigned tasks

UR_109	102	Localize tweets	Provide authorities with the ability to localize Twitter messages concerning a flood event
UR_110	102	Localize calls	Provide authorities with the ability to localize Phone Calls (mobile application) to an emergency number concerning a flood event
UR_111	102, 109	Detect flooded elements from video	Provide authorities with the ability to detect and count flooded elements (e.g. cars and people inside the river) from video and images sent from mobile phones, social media and taken by drones
UR_112	102	Detect element at risk from reports	Provide authorities with the ability to detect the number of elements at risk and the degree of emergency by filling specific fields on the mobile app or from text sent by the mobile app and by social media
UR_113	102	Detect element at risk from calls	Provide authorities with the ability to detect the number of elements at risk and the degree of emergency from emergency calls
UR_114	102, 103, 106, 109	Detect water depth and velocity	Provide authorities with the ability to detect water level and water velocity from video and images sent by static cameras
UR_115	all	Real time flood mapping	Display flooded areas in real time to authorities/citizens coming from different sources (such as pre-defined risk maps, images taken by drones, etc.)
UR_116	102, 103, 105, 106, 108	Warning people approaching flood areas	Provide authorities with the ability to warn people in danger with warning messages, once they are approaching a flooded area
UR_117	102	Manage assignments in case of new emergencies	Provide authorities with the ability to manage first responder assignments
UR_118	106	River overtopping	Provide authorities/citizens with the ability to know if the river level is overtopping predefined alert thresholds

UR_119	103	Manage assignments based on river level overtopping	Provide authorities the ability to assign task to first responder teams related to the overtopping of predefined river level thresholds
UR_120	107	Map of rescue teams and task evaluation	Display to authorities the location in time of first responder teams in all the municipality and provide the ability to evaluate in real time the execution of the assigned tasks with a global visualization of the activities performed
UR_121	105	Detect rainfall volume and duration	Provide authorities with the ability to detect rainfall volume and duration from videos (static cameras)
UR_122	105	Rainfall warnings	Provide authorities/citizens with the ability to know in real time if the rainfall intensity is overtopping predefined alert thresholds
UR_123	106	Detect embankment exceeding	Provide authorities with the ability to detect from video, automatically, if a river embankment is overtopping and/or breaking. The module will detect overtopping in certain locations from static cameras. It requires a dedicated camera and feature for the specific location
UR_124	106	Embankment warnings	Provide authorities/citizens with the ability to know in real time if a river embankment is overtopping by employing static cameras which are calibrated to the characteristics of the specific locations
UR_125	102,106	Traffic warnings	Provide authorities with the ability to send warnings to citizens in order to avoid interferences inside the area involved by civil protection activities
UR_126	101	Map of Satellite data and weather forecasts	Display updated satellite images in case they are fed to the system and weather forecasts.
UR_127	all	Filters	Provide advanced filters in the data management platform (visualize and list information selected by filters/query)

UR_128	101, 102, 103, 105, 106	Evaluation of the level of risk	Provide authorities with the ability to evaluate the level of risks associated to the Citizens' and/or first responders' incident reports, based on all the available dataset, in particular on the information sent by citizen through mobile application
UR_129	all	Automatic translation from a foreigner applicant	Make easy the communication between people with different languages. This feature refers to an automatic language detection, by performing speech recognition using all language models and then by comparing the scores
UR_130	all	Traffic Status	Display to the authorities the current traffic situation so that they can decide where to direct the first responders or inform them which routes to avoid
UR_131	all	Traffic warnings	Provide authorities with the ability to send warnings to citizens in order to avoid a certain area that is jammed with traffic
UR_132	109	Map of Drones images	Display updated images taken by the drone.
UR_133	102	Send water level estimation from mobile app	Provide the Citizen and first responders with the ability to estimate roughly the river water level by choosing a pre-defined water level category from a specific list in the mobile app.
UR_134	102	Send specific type of incident reports	Provide to the Citizen and the first responders the ability to use their mobile applications so as to specify the type of incident report from a pre-defined list of incidents.
UR_135	All	Specific mobile app for first responder and citizen	Provide different versions of the mobile app for citizen and first responders based on their different roles
UR_136	103	Detection of obstacles	Provide authorities with the ability to detect objects in the river (such as trunks, debris, etc.) that can impede the flow (in particular near bridge's openings, sluices, etc.) from video cameras and drones. The analysis module requires an extended amount of video samples to enable the robust detection of some types of obstacles.

UR_137	109	Detection the boundary of flooded area	Provide the authority the ability to visualize the extension of a flooded area from video taken by Drones. The analysis module requires extended samples to enable the image registration method and also the geo-location of every pixel in the image should be provided.
UR_138	All	Backup	Allow the authority to access and download in every moment, even after the occurrence of the flood, all the measurements and the forecasts, the text of all the incidents reports send by citizen or first responders, the list of the tasks assigned to the rescue teams and the texts of all the public alerts.
UR_139	110	Capacity of the safe areas	Provide to the authority the current level of crowding of the safe areas.
UR_140	110	Available resources at the sand packs distribution locations	Provide to the authority the current level of availability of the resources in all the sand-packs distribution points.
UR_141	,102,103, 108	Map of the Sensors measurements	Display the measurements taken from the available sensors of the weather stations.

2.2.1 Initial and Final User Requirements Comparison

This section provides a comparison between the User Requirements modified in D2.10 and their original version in D2.1.

Table 8. Flood pilot User Requirements Comparison

UR	Requirement Name	Initial description provided (D2.1)	Final description provided (D2.10)
UR_101	Type of visualization	Display information to authorities in a web-gis platform (citizen and first responders' reports by calls, apps, social media, etc...)	Display information to authorities in a web-gis platform (citizen and first responders' reports by calls, apps, social media, Sensor measurements etc...)
UR_103	Flood warnings	Provide authorities/citizens with automatic warnings on river levels overtopping some predefined alert thresholds, based on forecast results	Provide authorities/citizens with automatic warnings on river levels overtopping some predefined alert thresholds, based both on forecast results (pre-emergency phase) and on real-time measurements by the sensors
UR_110	Localize calls	Provide authorities with the ability to localize Phone Calls to an emergency number concerning a flood event	Provide authorities with the ability to localize Phone Calls (mobile application) to an emergency number concerning a flood event
UR_111	Detect flooded elements from video	Provide authorities with the ability to detect and count flooded elements (e.g. cars and people inside the river) from video and images sent from mobile phones and social media	Provide authorities with the ability to detect and count flooded elements (e.g. cars and people inside the river) from video and images sent from mobile phones, social media and taken by drones
UR_112	Detect element at risk from reports	Provide authorities with the ability to detect the number of elements at risk and the degree of emergency from text sent by the mobile app and by social media	Provide authorities with the ability to detect the number of elements at risk and the degree of emergency by filling specific fields on the mobile app or from text sent by the mobile app and by social media
UR_114	Detect water depth and velocity	Provide authorities with the ability to detect water depth and water velocity from video and images sent by the mobile app and social media	Provide authorities with the ability to detect water level and water velocity from video and images sent from static cameras

UR_115	Real time flood mapping	Display flooded areas in real time to authorities/citizens	Display flooded areas in real time to authorities/citizens coming from different sources (such as pre-defined risk maps, image taken by drones etc.)
UR_121	Detect rainfall volume and duration	Provide authorities with the ability to detect rainfall volume and duration from videos (fixed and mobile cameras, social media and mobile app)	Provide authorities with the ability to detect rainfall volume and duration from videos (static cameras)
UR_123	Detect embankment exceeding	Provide authorities with the ability to detect from video, automatically (fixed and mobile cameras, social media and mobile app), if a river embankment is overtopping and/or breaking	Provide authorities with the ability to detect from video, automatically, if a river embankment is overtopping. The module will detect overtopping in certain locations from static cameras. It requires a dedicated camera and feature for the specific location
UR_124	Embankment warnings	Provide authorities/citizens with the ability to know in real time if a river embankment is overtopping and/or breaking; the comprehensive and reliable real-time information about the situation, especially the breach enlargement and discharge, the spatial and temporal development of the inundation and the damages	Provide authorities/citizens with the ability to know in real time if a river embankment is overtopping by employing static cameras which are calibrated to the characteristics of the specific locations
UR_126	Map of Satellite data and weather forecasts	Display updated satellite images and weather forecasts	Display updated satellite images in case they are fed to the system and weather forecasts
UR_128	Evaluation of the level of risk	Provide authorities with the ability to evaluate the forecasted level of risks (based on all the available dataset)	Provide authorities with the ability to evaluate the level of risks associated to the Citizens' and/or first responders' incident reports, based on all the available dataset, in particular on the information

			sent by citizen through mobile app.
UR_129	Automatic translation from a foreigner applicant	Make easy the communication between people with different languages	Make easy the communication between people with different languages. This feature refers to an automatic language detection, by performing speech recognition using all language models and then by comparing the scores

2.3 Flood Pilot implementation

The detailed steps for the implementation of the pilot are still in discussion between all the technical partners and AAWA, as main responsible for the pilot. Besides, the technological development of the beAWARE platform for the pilot is ongoing.

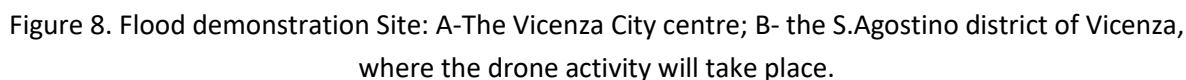
For that reason, in the paragraph below are presented the main guidelines that will be follow to the definition of the storyline and the general contest of the implementation of the pilot. More specific details about the pilot will be provided in the evaluation report of the pilot itself.

It should be finally noticed that, since the flood pilot will test the 2nd prototype of the beAWARE platform, not all the URs mentioned above and which represents the list of the final user requirements, will be fully implemented during the flood pilot.

2.3.1 Final Flood Demonstration site

The flood pilot will take place in parallel in two different districts of the Vicenza Municipality:

- **Vicenza City centre**: where the COC room is located and where will take place the most of the pilot. First responders and Citizen will be divided in teams located in the most critical points (in terms of flood risk) along the Bacchiglione River, in order test the technologies.
- **The S.Agostino district**: this area is located in the southern of the Municipality of Vicenza, Crossed by the River Retrone. In this district will take place the autonomous drone flight.



City Centre Area

The headquarters of the pilot will be established in the COC room in the AIM Palace (Contrà Pedemuro S. Biagio, 72, 36100 Vicenza VI).

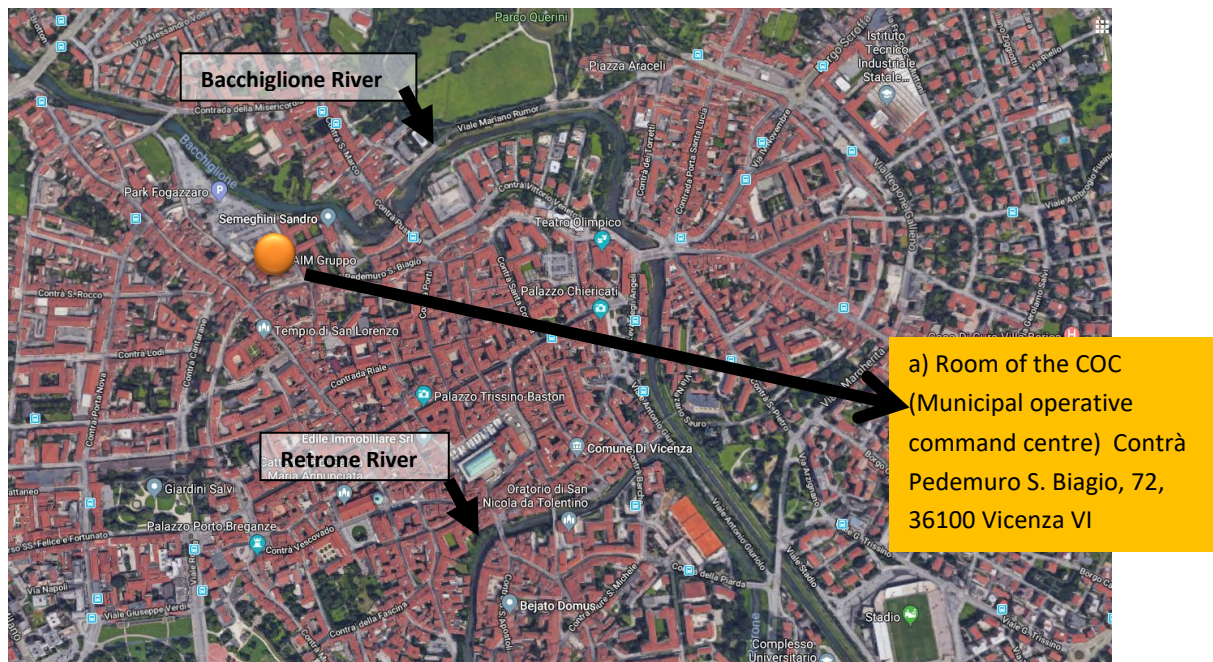


Figure 9. The Vicenza City Centre and the location of the COC room

From there as a centre, other areas of the city centre will be reached by the team of first responders for the purpose to test the beAWARE technology in a contest as realistic as possible. For that reason, the others ‘interest places’ for the pilot will be chosen among:

- **The most critical points in case of flood**, identified by the Municipal Civil Protection plan - as well as in the AAWA’s flood risk maps - such as the area nearby the bridge ‘Ponte degli Angeli’, which is one of the most critical section in the Bacchiglione River and where is also located a water level sensor which is the trigger for the most of the preventive measures in case of flood. In fact, for each one of these critical points, the Municipal Civil Protection Plan has defined a set of specific tasks to be accomplished in the pre-emergency phase or at the beginning of the flood, based on the comparison between the water level measured by the sensors in Ponte degli Angeli and fixed thresholds.
- **The sand packs distribution points, the safe waiting areas for the people or the safe parking areas.** All these areas are well defined by the Civil Protection Plan for the whole Municipality of Vicenza;
- **Historical buildings** where are established specific procedure for the monitoring and the evacuation in case of flood, such as the Olympic theatre and the Chiericati Palace.

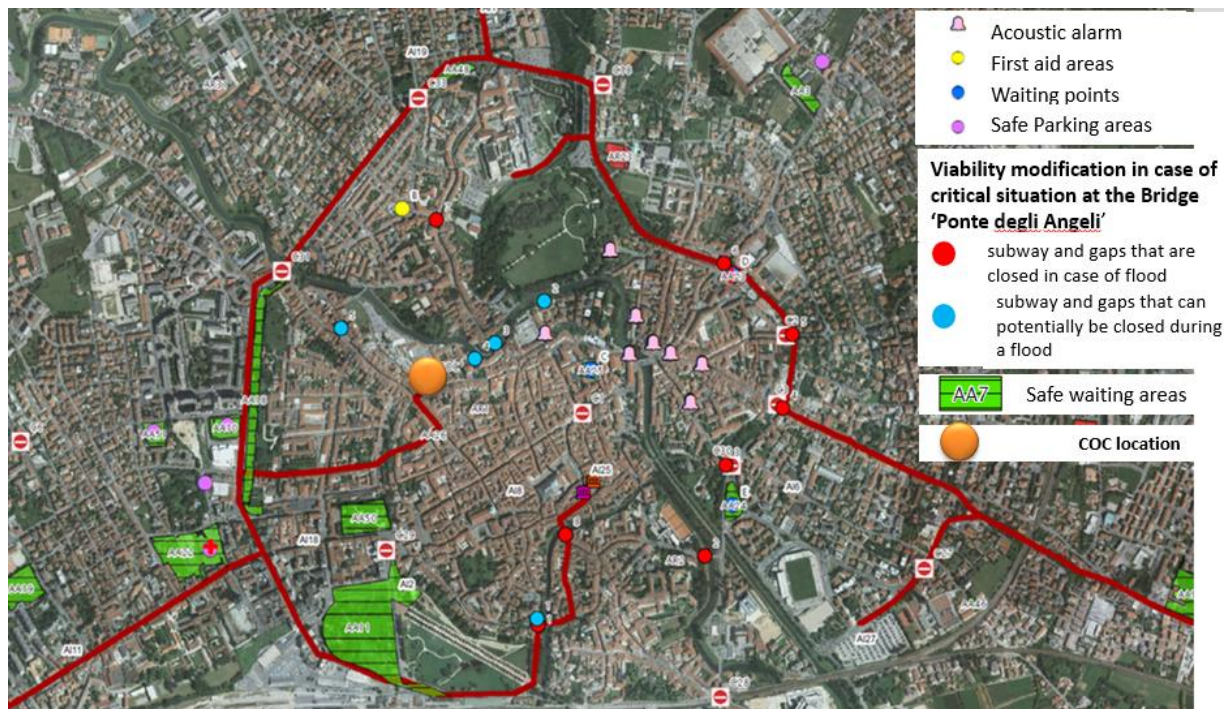


Figure 10. Identification of the potential interest points from the pilot (Source: Civil Protection office of the Municipality of Vicenza)

Moreover, near the bridge 'Ponte degli Angeli' the Municipality of Vicenza had installed a fixed video Camera for monitoring the River Bacchiglione and that is going to be integrated in beAWARE taking advantage of the video analysis algorithms.

S.Agostino District

Due to the Italian regulation about drones, the areas for the flight test has to be located outside the city centre. For that reason, the joint between the Retrone River and the Cordano Channel has been chosen. This area, located in the S.Agostino river district above 7km far away from the City Centre, is property of the "Alta Pianura Veneta" Land Reclamation Consortium, one of the stakeholders for the flood pilot.

In this area is located also one of the weather stations, part of the sensor's network included in beAWARE, allowing a real-time monitoring of the water level from the PSAP in the Control Room, together with two of the old measures rods. Moreover, here are located specific hydraulic devices (sluices with gates, dewatering pumps) that are of particular interest for the Land Reclamation Consortium.

Moreover, in this area is going to be installed a new fixed video Camera inside the beAWARE project, with the purpose to monitoring the water level of the River Retrone, taking advantage of the old measure rod for calibrating the video Analysis algorithms and of the existing sensors to verify the results.

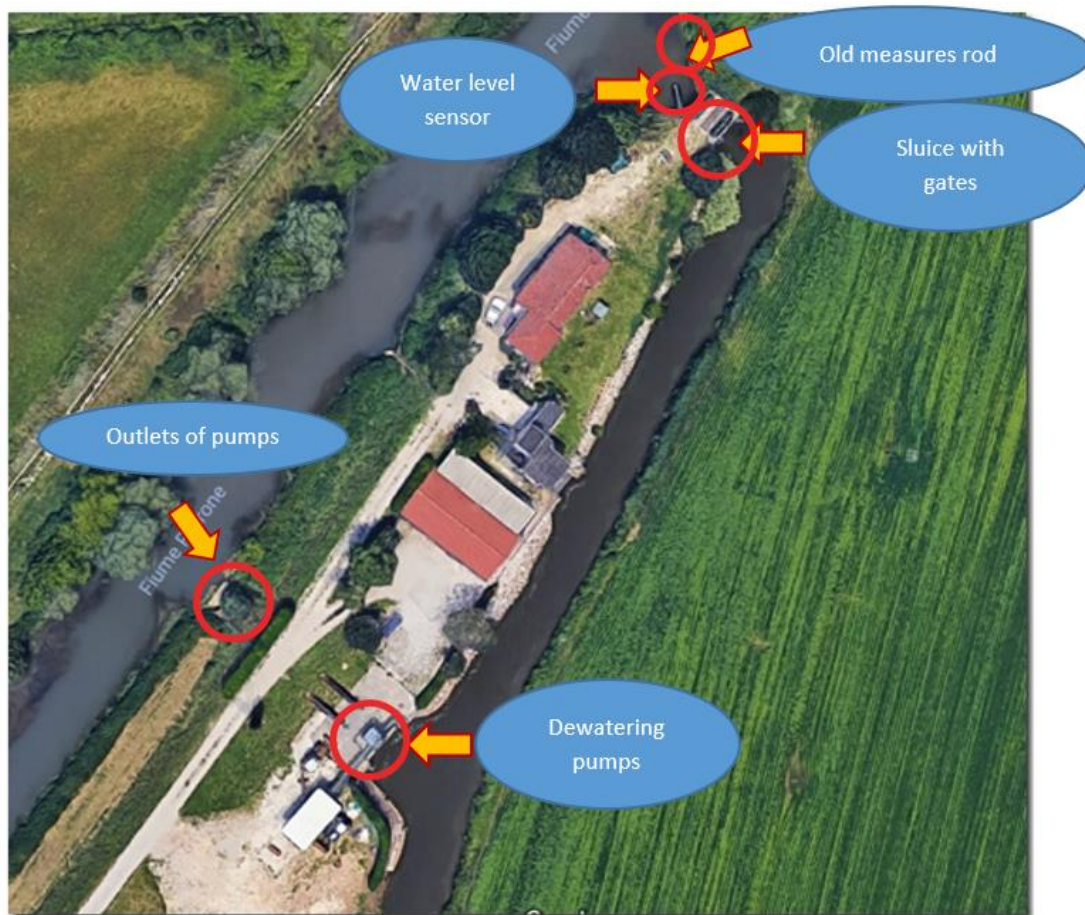


Figure 11. The Drone's flight area in the S. Agostino District of Vicenza.

2.3.2 Flood Scenario storyline-execution

The story line for the flood pilot will be divided in three sessions that globally will cover all the flood Use Cases.

More in detail, one session will be dedicated to the pre-emergency phase, while two session will regards the emergency itself.

Each session will be performed twice: the first time without the beAWARE platform, only with legacy tools (which are: telephone - stable and mobile lines, VHF, email and press releases); the second time, the session will be executed with the beAWARE platform and the end-user tools (PSAP, mobile app and SensorThings Server).

The first session will be specific for the pre-emergency phase, before the occurrence of the flood, which focuses on the EWS and forecasting models; the others will reproduce the occurrence of the flood, taking example from what had happened during real past events (i.e. the flood of the 1st November 2010) and simulating tasks, protocols and procedures from the Municipal Civil Protection Plan.

The second session will concern the first phase of the emergency, when the event forecasting during the pre-emergency phase is occurring and the water level is growing higher, gradually exceeding all the alert threshold defined in the section of ‘Ponte degli Angeli’ in the Bacchiglione river basin. Every exceeding of these thresholds triggers a pre-defined set of tasks that have to be performed by the volunteers, according to the civil protection plan.

The second phase of the emergency starts when the Bacchiglione river in Vicenza overtops the embankments and starts to flood the nearby areas. When this happens, Citizens send incident reports to notify the authorities that there are flooding in various areas of the city centre. In this case, the tasks that the volunteers have to perform are not pre-defined ones, as in the previous phase, but they depend strictly on the ongoing situation and on the flood incident reports provided inside the city.

The main roles that will be covered during the pilot are: Decision Maker, Control room operators, First responders and Citizen. The Decision Maker and Control room operators will have access to the PSAP and remain in the COC room, while first responders and Citizen will be deployed through the city centre areas and in the S.Agostino District.

While a detailed time lapse and sessions division has not been defined yet, because is strictly dependant on the technological development still ongoing, however the story line that will provide the general reference for the pilot execution is presented.

The story-line starts with the pre-emergency phase, when AMICO produces a forecast indicating a possible flood event in the next days, with predicted water level above all the thresholds in the section of the Bacchiglione River near the Bridge ‘Ponte degli Angeli’. Promptly the beAWARE platform informs the Decision Maker about the situation stand out from this forecast.

Then the Decision Maker activates the COC (Crisis Operational Centre), thus all the proper pre-emergency management measures are taken and a general alert is sent through beAWARE platform.

After this point, the situation is constantly monitored by the Decision Maker by the PSAP, focusing now on the real-time measurements taken by the water level sensors along the Bacchiglione River in Vicenza.

The next day, as forecasted, the flood is starting and the level in Bacchiglione River at Vicenza is constantly growing higher. As consequence, the observed water level at Ponte degli Angeli river section exceeds gradually all the three alert thresholds.

In this phase, the Civil Protection has a set of pre-defined tasks to the first responders teams; More in detail, very exceeding of a different threshold at 'Ponte degli Angeli' can trigger a set of pre-defined tasks in the Civil Protection plan in all the 'critical' points of the city. This process can be rapidly performed through beAWARE platform. Moreover, specific public alerts are spread through the citizens.

Shortly after the exceeding of the third threshold, the Bacchiglione River starts overtopping at the Bridge 'Ponte degli Angeli', flooding the nearby areas. Then, the system collects a large amount of information about the current emergency from different areas of the city, such as: incident reports, video from fixed video cameras and drones, images and videos taken by the mobile app, voice recordings, Tweets etc.

Regardless of the various sources and their format, the incoming data is analysed by the proper tool of beAWARE platform. The outcomes of the analysis are presented in an efficient and meaningful manner to the PSAP and the Dashboard assisting the Decision Maker to consider useful information concerning the incident, such as its location, its level of severity etc. Moreover, the system provides a report describing the incident details; thus, Decision Maker is now aware of the details about the incidents and can make the appropriate decisions, take actions such as to send the proper rescue teams if the incidents are recognized as severe.

During the emergency the Decision Maker is also constantly updated by the rescue teams about their location in the city, the status of accomplishment of their tasks, the availability of the resources in the sand-packs distribution point, the level of crowding of the safe waiting areas and parking.

More details about the proposed story line can be found in the table below.

Table 9. Flood Pilot Storyline

Description	Legacy tools	beAWARE	Trigger	Expected behaviour	Players	Observers - Evaluators	Evaluation
Session A – Pre-emergency GOAL: early warning, understand the problem, send the first alerts							
AMICO produces a forecast indicating a possible flood event in the next day, with predicted water level above all the thresholds in the section of Bacchiglione river near the Bridge 'Ponte degli Angeli'	E-mail, internet	The results of the forecasts are presented in PSAP's dashboard and event map. The section of 'Ponte degli Angeli' has a red colour in the map	AMICO's result collected by beAWARE system and Crisis Classification Run	Consider all the forecast and decide to activate the COC (Operational Centre),	The actor who play as 'decision maker',	4 observers in control room	
Sent a General alert to the Population about the	E-mail, sms, web site	Provide a pre-defined set of public alert and specific automatic warnings		Send public alerts	The actor who play as 'decision maker'; The actors who play as 'Control room	4 observers in control room	

activation of the COC, the results of forecasted scenario, information about how to behave in case of flood		on the forecasted river levels overtopping the 3 rd threshold			Operators'; the actors who play the roles of Citizen, the actors who play the roles of 'First responders')		
Some groups of volunteers are requested by the control room to accomplish preventive measures like check the sand-pack available in the warehouse	Phone calls, VHF	PSAP allows task assignment to the rescue team		Assign to the rescue teams their locations and tasks	The actors who play as 'Control room Operators', the actors who play the roles of 'First responders')	4 observers in control room, 2 observers for each rescue team (estimated a total of 5 rescue teams)	
Session B – Emergency phase 1 (Before the river overtopping) GOAL: river monitoring, trigger pre-defined set of measures, spread alerts							
The Decision Maker is informed that water level at	Phone call	The PSAP will show in the emergency map a yellow light in the section of Ponte	Sensor measurements collected by beAWARE platform	Consider the sensor's measurements and understand the current	The actor who play as 'decision maker'; The actors who play as 'Control room	4 observers in control room	

Ponte degli Angeli river section exceeds the first threshold		Angeli, while the dashboard will display the real time measurements taken by the water level sensors along the Bacchiglione River in Vicenza	and Crisis Classification Run	level of crisis	Operators'		
The Decision Maker sends public alert about exceeding of the 1 st threshold	sms, web site	Provide specific automatic warnings on river levels overtopping the 1 st threshold		Send public alert	The actor who play as 'decision maker'; The actors who play as 'Control room Operators'; the actors who play the roles of 'Citizens', the actors who play the roles of 'First responders')	4 observers in control room	
Because of the exceeding of the 1 st threshold at 'Ponte Angeli' a set of specific measures,	Phone calls, VHF	PSAP presents all the pre-defined tasks that, according to the Civil Protection Plan, have to be performed after the exceeding of the 2 nd		Assign to the rescue teams their locations and tasks	Actors who play the roles of 'First responders', Control Room operators	4 observers in control room, 2 observers for each rescue team (estimated a total of 5 rescue teams	

defined in the civil protection plan, have to be taken. For that reason, a certain number of rescue teams is sent in the city centre with specific tasks assigned (for example prepare the specific sand-packs distribution point identified in the civil protection plan)		threshold at the river section 'Ponte degli Angeli'					
The leaders of each rescue team communicate first when they arrived in the	Phone calls, VHF	Provide in the map the position of the rescue team, the location of the sand-packs distribution point.		Understand the location of the rescue teams in the city centre, the level of accomplishment of their assigned task and the number of available	Actors who play the roles of 'First responders', Control Room operators	4 observers in control room, 2 observers for each rescue team (estimated a total of 5	

proper location; then they inform the control room about their tasks. In particular, the rescue teams that have to prepare the sand-packs distribution point communicate the total number of available sand-packs		Provide in the dashboard adequate metric about the status of the assigned tasks and the available resources (i.e sand packs)		resources		rescue teams	
The Decision Maker is informed that water level at Ponte degli Angeli river section exceeds the second threshold	Phone call	The PSAP, in the emergency map, will present an orange light in the section of Ponte degli Angeli. In the dashboard will display the real time measurements taken by the water	Sensor measures collected by beAWARE platform and Crisis Classification Run	Consider the sensor's measurements and understand the current level of crisis	The actor who play as 'decision maker'; The actors who play as 'Control room Operators';	4 observers in control room	

		level sensors along the Bacchiglione River in Vicenza					
Because of the exceeding of the 2 nd threshold at 'Ponte degli Angeli' a set of specific measures, defined in the civil protection plan, have to be taken. For that reason, a certain number of rescue teams is sent in the city centre with specific tasks assigned (for example prepare the sand-pack location points,	Phone calls, VHF	PSAP shows all the pre-defined tasks that, according to the Civil Protection Plan, have to be performed after the exceeding of the 2 nd threshold at the river section 'Ponte degli Angeli'		Assign to the rescue teams their locations and tasks	Actors who play the roles of 'First responders', Control Room operators	4 observers in control room, 2 observers for each rescue team (estimated a total of 5 rescue teams	

monitor Palazzo Chiericati and the Olympic Theatre)							
The leaders of each rescue team communicate first when they arrived in the proper location; then they inform the control room about their tasks. In particular, the rescue teams that have to prepare the sand-packs distribution point communicate the total number of available sand-	Phone calls, VHF	Provide in the map the position of the rescue team, the location of the sand-packs distribution point. Provide in the dashboard adequate metric about the status of the assigned tasks and the available resources (i.e sand packs)	Status of the tasks provided through first responders' mobile app	Understand the location of the rescue teams in the city centre, the level of accomplishment of their assigned task and the number of available resources	Actors who play the roles of 'First responders', Control Room operators	4 observers in control room, 2 observers for each rescue team (estimated a total of 5 rescue teams	

packs							
The Decision Maker sends public alert about exceeding of the 2 st threshold and the opening of the sand-packs distribution points	sms, web site	Provide specific automatic warnings on river levels overtopping the 2 st threshold; provided alert which contains the list of the sand packs distribution point, and about the status		Send public alert	The actor who play as 'decision maker'; The actors who play as 'Control room Operators'; the actors who play the roles of Citizens, the actors who play the roles of 'First responders')	4 observers in control room	
The Decision Maker is informed that water level at Ponte degli Angeli river section exceeds the third threshold	Phone call	The PSAP will show, in the emergency map, a red light in the section of Ponte Angeli. The dashboard will present the real time measurements taken by the water level sensors along the Bacchiglione River in Vicenza.	Sensor measurements collected by beAWARE platform and Crisis Classification Run	Consider the sensor's measurements and understand the current level of crisis	The actor who play as 'decision maker'; The actors who play as 'Control room Operators';	4 observers in control room	
The Decision	sms, web site	Provide specific		Send public alert(s)	The actor who play	4 observers in	

Maker sends public alert about exceeding of the 3 rd threshold		automatic warnings on river levels overtopping the 2 st threshold; provided alert which contains the list of the sand packs distribution point, and about the status			as 'decision maker'; The actors who play as 'Control room Operators'; the actors who play the roles of Citizens, the actors who play the roles of 'First responders')	control room	
Session c – Emergency phase 2 (After the river overtopping) GOAL: understand the ongoing situation, management of the rescue teams, management of the resources							
Video from fixed video camera in Ponte Angeli confirms that the Bacchiglione is going to over top	Phone calls from the Video Camera Manager	There's a streaming from the video Camera to beAWARE platform; the results of the video analysis are shown on the PSAP		Understand the water level from the video analysis recordings from the static video camera of Ponte degli Angeli	The actors who play as 'Control room Operators'	4 observers in control room,	
The first incident reports about flooding areas are provided by citizen trough mobile	Phone calls, sms, social networks	The platform clusters Incident reports from the various sources (social media, images, mobile App	Incident report sent Mobile app (Citizen's version), Crisis classification of the reports	Consider all the clustered incident report and the attachment. Understand what is happening and where; understand in what areas of the city centre the situation is	The actors who play as 'Control room Operators'; the actors who play the roles of 'Citizens'	4 observers in control room, 2 observers for each rescue team (estimated a total of 5	

app and social media. The incident reports contain also multimedia like vide, image, voice calls		etc). The PSAP shows on the map all the incident report, with different icons based on the type of incident and with different colors based on the evaluated risk level or severity. The PSAP allows also to see all the multimedia attached (video, image, audio recordings) and the analysis		most critical		rescue teams), 2 observers for each group of citizens (estimated a total of 3 groups of Citizens)	
Report about specific type of incidents are provided from first responders (i.e. bridge obstruction due to trunks, river breaches, etc.), with	Phone calls, sms, VHF	The PSAP shows on the map all the incident report, with different icons based on the type of incident and with different colors based on the evaluated risk level or severity. The PSAP allows also to	Incident report sent Mobile app (First responders version), Crisis classification of the reports	Consider all the incident report and the attachment. Understand what is happening and where; understand in what areas of the city centre the situation is most critical	Actors who play the roles of 'First responders', Control Room operators	4 observers in control room, 2 observers for each rescue team (estimated a total of 5 rescue teams)	

attached multimedia (video and image)		see all the multimedia attached (video, image, audio recordings) and the analysis					
Recording of the fixed video camera confirm the previous incident reports	Phone calls from the Video Camera Manager	There's a streaming from the video camera to beAWARE platform; the results of the video analysis are shown on the PSAP	New Video from the fixed Video Camera	Understand the situation from the video analysis of the fixed Video camera's recording	The actors who play as 'Control room Operators'	4 observers in control room, 2 observers for each rescue team (estimated a total of 5 rescue teams)	
Control room operators assign to a first responder team the tasks firstly to monitor status of embankment that is going to breach and secondly to remove obstruction	Phone calls, sms, VHF	PSAP allows the user to insert a set of new tasks and to assign them, with new locations, to some of the available rescue teams		Assign to the rescue teams their locations and tasks	Actors who play the roles of 'First responders', Control Room operators	4 observers in control room, 2 observers for rescue team	

from a bridge							
Receive update about the number of available sand pack in the sand packs distribution point	Phone calls, sms, VHF	The dashboard shows the current and updated availability of sand packs in the various distribution point	Mobile App	Understand the current availability of the resources	Actors who play the roles of 'First responders', Control Room operators	4 observers in control room, 2 observers for the rescue team in the sand-pack distribution point	
Receive update about the capacity of the safe areas	Phone calls, sms, VHF	The dashboard shows the current and updated capacity of the safe areas	Mobile app	Understand the current level of crowding of the waiting areas	Actors who play the roles of 'First responders', Control Room operators	4 observers in control room, 2 observers for each rescue team (estimated a total of 5 rescue teams)	
Specific instructions are sent to the sand distribution points that are running out of sand packs and to the safe areas that are	Phone calls, sms, VHF	PSAP allows the user to insert a set of new tasks and to assign them, with new locations, to some of the available rescue teams		Assign to the rescue teams their locations and tasks	Actors who play the roles of 'First responders', Control Room operators	4 observers in control room, 2 observers for the rescue team in the sand-pack distribution point	

going to reach their full capacity							
Receive a Video by drone from the S.Agostino districts which shows that the Retrone River is flooding, there are a lot of trunks and obstacles at the joint with Cordano River and that there are people in danger here.		There's a streaming from the drone to beAWARE platform; the results of the video analysis are shown on the PSAP	New Video from the drone	Understand the situation from the video analysis of the drone's recording	The actors who play as 'Control room Operators'	4 observers in control room,	
Control room operators assign to a first responder team the task to go to in S.Agostino River district	Phone calls, sms, VHF	PSAP allows the user to insert a set of new tasks and to assign them, with new locations, to some of the available rescue teams		Assign to the rescue teams their locations and tasks	Actors who play the roles of 'First responders', Control Room operators	4 observers in control room, two observers in S.Agostino District	

AMICO produces a forecast indicating that the next day the situation of the rivers in Vicenza is going to get better	E-mail, internet	The results of the forecasts are shown in PSAP's dashboard	AMICO's result collected by beAWARE system and Crisis Classification Run	Consider all the forecast and understand the situation of the next days	The actor who play as 'decision maker'; The actors who play as 'Control room Operators';	4 observers in control room	
The Decision Maker is informed that water level at Ponte degli Angeli is progressively going down, above the alert threshold	Phone call	The PSAP will show the new forecast both in the event map, as colourer river section, both in the dashboard	Sensor measurements collected by beAWARE platform and Crisis Classification Run	Consider the sensor's measurement and understand the current level of crisis	The actor who play as 'decision maker'; The actors who play as 'Control room Operators';	4 observers in control room	
The Decision Maker sends public informing about the ending of the emergency	sms, web site	Allow the Composition a public alert		Send public alert	The actor who play as 'decision maker'; The actors who play as 'Control room Operators'; the actors who play the roles of Citizens, the actors who play the	4 observers in control room	

					roles of 'First responders')		
After the Public alert, the Decision Maker wants to download all the forecast, measures, incident reports from citizen and first responders in order to prepare a report to the Government		Allow the download of the requested information from PSAP and Sensor Things Server		Successfully download	Actors who play the roles of 'Decision Maker',	4 observers in control room	

The main objective of the proposed story line is to highlight that, in every phase, the beAWARE technology implemented in the 2st prototype is able to:

- a) furnish a detailed and update outline of the situation, merging together and analyzing information from incident reports, various type of multimedia (such as: social media; images; and voice recordings; video recorded by mobile phones, fixed video cameras and drone; etc.) physical sensors' measurements, forecasts and all the other available data;
- b) strengthen the communication between the various groups of practitioners. beAWARE technology offers in every moment a rapid, clear and trustful bidirectional channel of communication between authorities - first responders and authorities – Citizen;
- c) provide innovative and advanced tools for the management of the rescue teams and for the assignment of various kinds of tasks.

Regarding the communication from the Citizen to authorizes, the platform will provide a very intuitive and simple mobile app for send incident report and various kind of multimedia; finally, it also helps the rapid diffusion of global alert to all citizens.

2.3.3 Emergency protocols and communication procedures

The pilot story line will reflect strictly the current management of the flood emergency at the Municipal level, in order to ensure that the beAWARE technology will be fully incorporated in the Civil Protection Chain, providing a real decision support system.

In fact, currently the Mayor, as the head of the Civil protection chain at the municipal level, receives notifications of the bulletins from the early warnings and forecasting systems (e.g., meteorological National or Regional Weather forecasting services, AMICO flood bulletins, etc.).

In addition, the mayor receives measurements from sensors that cover the Veneto Region. If these data show a possible incoming flood, the mayor can decide to officially establish the COC (the Municipal Crisis Operational Centre) and summon the local civil protection volunteer group to safeguard the city centre from the passage of the flood wave.

The COC members (AAWA, Municipal technicians, Fire fighters, Province of Vicenza, Municipal Police, Italian Red Cross, Vicenza Company for multi-utility services, Civil Protection Volunteers, etc.) are informed by using traditional telecommunications systems / institutional (radio, telephone, fax, etc.).

After the activation of the COC a set of pre-emergency procedures are performed, such as sending volunteers to monitor the water level. Other teams of civil protection volunteers are usually posted in the municipality's warehouse to prepare flood prevention equipment (aqua dike, sand packs). Sandbag distribution stations are listed in the Municipality's website). Sanitary provides also a medical post to rescue the population in case of flood.

All the decisions taken inside the COC, all the reports and the communications to/from the rescue teams (i.e. tasks assignment, the position of the rescue teams etc.) are recorded on paper register logs.

In the control room there are always some paper copies of the Municipal Civil Protection Plan, that are consulted to assign to the rescue team the proper pre-defined procedures, together with other useful document (such AAWA's flood risk management plan). All communications are conducted over radio communications using personal mobile radio devices (PMR) or mobile phones, leading to the loss and lack of suitable logging and tracking of information and reports. Many volunteers have no smartphone or internet reception.

During the emergency phase (e.g. during the occurrence of the flood), the Mayor and the COC decide on the actions that have to be taken to cope with the evolving crisis. Decisions include deployment of first responders, task assignment to first responders and rescue teams, determination of the level of alarm in the city, closure or evacuation of areas of the city, and declaring the end of the emergency.

Most of the communication is performed over Land Mobile Radio and are recorded on paper. Volunteers provide reports of the flood damage observed and of their actions during emergency to municipality technicians.

During the crisis the emergency numbers that can be called by the Citizen are:

- Local Police number 0444545311 (if necessary, it can also be activated the free municipal number 800127812).
- Other useful numbers:
 - ✓ Fire Department: 115
 - ✓ Ready Health Intervention (SUEM): 118
 - ✓ Carabinieri: 112
 - ✓ State Police: 113

Moreover, specific alarm system is established in the area city centre

- Acoustic warning system: they warn the population of the central areas (<http://www.comune.vicenza.it/uffici/dipterr/infrastruttureeverdepubblico/protcivile/sirenediallarme.php>);

- Speakers: outside the area covered by the acoustic warning system, the states of the PRE-ALARM and ALARM are announced by means of a speaker transiting in the affected areas.

Finally, Warnings are sent to people registered to the "text service". In order to register people, previously they need to send a text message, including name and surname, to the number 392 7338475. Warnings are published in various telecommunication mass media and social networks such, as:

- the website of the Bacchiglione river (www.bacchiglione.it),
- the web site of the city (www.comune.vicenza.it) and its Facebook and Twitter accounts (<https://www.facebook.com/cittadivicenza> ,@CittadiVicenza)
- local media, local television, from websites of local newspapers and local online newspapers

Also, they are provided by the Office of Public Relations (whose phone number is 0444221360).

When the emergency ends, the Mayor adjourns the COC and convenes a press conference to inform about the emergency status.

The Regional government may request the municipality to provide impact maps and data (flood damage estimation, flood expansion, etc.) plus all the list of all the reports and recording taken during the crisis.

Describing more in detail the specific emergency protocols established during the flood, the Municipal Civil Protection plan identifies the areas of the city which represent the most critical points (Figure 12) in case of flood (i.e. based on AAWA's flood risk maps and historical floods recordings). For each one it provides a set of standard tasks, that have to be accomplished when the water level, measured by the sensor in Ponte Angeli, exceeds a specific threshold. Some examples of these procedures are listed below (Table 10).



Figure 12. Map of the most critical areas in the city centre in case of flood (Source: Civil Protection office of the Municipality of Vicenza)

Table 10. List of standard tasks defined in the Municipal Civil Protection Plan for the most critical points of the Vicenza City Centre and their triggers.

Point N°	Location	Trigger for the task	Task to be taken by the volunteers
1	Ponte degli Angeli Bridge	W.L. measured at 'Ponte degli Angeli' above 2nd threshold	Place the Acquadike at the edges of the bridge
2	Largo Goethe Street	W.L. measured at 'Ponte degli Angeli' above 2nd threshold	Place the sluices along the railing
3	Contra' Vittorio Veneto	W.L. measured at 'Ponte degli Angeli' above 2nd threshold	place 800 sand packs along Nervesa Street
4	Stradella dei Munari	W.L. measured at 'Ponte degli Angeli' above 2nd threshold	check the status of the embankments. Check if there are sewers failure, check the status of the pumps. If there is power

			shortage advise COC
5	Contra' Chioare	W.L. measured at 'Ponte degli Angeli' above 2nd threshold	check the status of the embankments. Check if there is sewers failure, check the status of the pumps. If there is power shortage advise COC
6	Convitto San Marco	W.L. measured at 'Ponte degli Angeli' above 2nd threshold	Monitoring the Bacchiglione River
7	Querini Park	W.L. measured at 'Ponte degli Angeli' above 1st threshold	Close the sluice gate in the fish shop, place sand bags along Astichello River
8	Contra' Rumori	W.L. measured at 'Ponte degli Angeli' above 2nd threshold	Monitoring the sewers
9	Viale Ferrarin street	W.L. measured at 'Ponte degli Angeli' above 2nd threshold	Alert Citizen, prepare sandbags
10	Ponte Viale d'Alviano S.Croce	W.L. measured at 'Ponte degli Angeli' above 3rd threshold	Alert Citizen, close all the gates on the Bacchiglione Rivers
11	Viale Trento	W.L. measured at 'Ponte degli Angeli' above 3rd threshold	Verify the pumps. Verify the power generators, if there is power shortage advise COC
11b	Via Divisione folgore	W.L. measured at 'Ponte degli Angeli' above 3rd threshold	Verify the pumps. Verify the power generators, if there is power shortage advise COC
12	Contrà S.Apostoli	W.L. measured at 'Ponte degli Angeli' above 2nd threshold	prepare 250 sandbags, alert citizen
13	Viale Fusinato	W.L. measured at 'Ponte degli Angeli' above 1st threshold	Prepare 200 sandbags
		W.L. measured at 'Ponte degli Angeli' above 3rd threshold	Alert Citizen
18	Via Giuriolo	W.L. measured at 'Ponte degli Angeli' above 1st threshold	Prepare sluice
33	Matteotti square	bad weather condition	prepare 140 sand packs

Moreover, the Municipal Civil Protection Plan defines also specific detailed procedures for monitoring and, if necessary, evacuating specific historical buildings in the city centre, such as the Olympic theatre and the Chiericati Palace.

The story line of the flood pilot will reproduce, as well as possible, these emergency protocols; in particular beAWARE will provide, as part of the PSAP's pre-defined tasks list, the standard measures indicated by the plan for some of the critical points in the city centre, as well as the automatic trigger based on the comparison of the measured water level with thresholds. This can allow the pilot to achieve a great degree of likeness with the real civil protection procedures.

2.3.4 Equipment and participants of Flood Scenario

A total of more than 80 participants is expected to attend to the pilot, including to the consortium members, AAWA's staff, volunteers from the Municipal Civil Protection and from the "Alta Pianura Veneta" Soil Reclamation Consortium, more in detail this is a first estimation of the participants.

- beAWARE Consortium (25-30 people)
- Member of advisory board, Public Officer of the Project and EU commission Reviewers
- Stakeholders External to beAWARE (50 – 60 people)
 - 10-including the Decision Makers (members of the COC) and the staff of the Vicenza Municipality
 - 30 Civil Protection volunteers
 - About 5 People from the Land Reclamation Consortium (drone Area)
 - About 5 Delegates from AIM
 - 10 members of AAWA that are outside the project

The participants will have different roles during the emergency and will thus evaluate the beAWARE platform under different point of views, according to the designed task in the pilot. In particular:

- Participants who will act as '**Citizen**', so they will be spread out in different areas of Vicenza City Centre to provide various type of reports by beAWARE mobile app. This role will be performed by the volunteers of the Vicenza Municipality and the AAWA staff outside beAWARE project
- Participants who will act as '**First responders**': they will be divided in teams of about 3 people and spread in different areas of the city. For each team, a leader will be

chosen (indicatively, the one most experienced or who had actively participated as first responder in past flood events) for using mobile app for communicate with the control room. This role will be performed by the volunteers of the Vicenza Municipality (rescue team in the city centre) and of the Land reclamation consortium (rescue team in S. Agostino District).

- Participants who will be in control room acting as **‘Decision Maker’** and **‘Control room operators’** and using the PSAP and SensorThings Server. The roles of the **‘Decision Maker’** will be performed by the effective members of the COC who will participate to the pilot (including the Mayor or his delegate and AAWA’s delegate), while the control room operators will be chosen by the staff of the Vicenza Municipality. **‘The control Room operators’** will be the players who will use the PSAP and the other beAWARE tools in control room to perform action like managing rescue team or sending alerts, according to the directive of the **‘Decision Makers’**.
- **‘Observers’**, who will have the role to watch the end-user’s interaction during the pilot and to take notes about: the performed tasks, their timing, if there had been difficulties of any kinds etc. During the pilot, the observers will be divided between the control room (observers of the control room) and the various teams of first responders and citizen.

The first three roles are meant to participate actively to the training and to the pilot execution, intending with **‘active participation’** the direct usage of the beAWARE technologies; so, they will be called generically **‘actors’** or **‘players’** of the pilot in the following.

The roles of **‘players’** will be performed by the stakeholders of the heatwave pilot: members of the COC, Civil protection of Vicenza Municipality, volunteers of Civil protections, volunteers for the Land reclamation consortium and AAWA’s staff.

The **‘Observers’** will perform a passive role during the pilot, watching the **‘Actors’** using beAWARE technologies and taking notes and observations about the execution of the pilot, that will be used for evaluation process. During the pilot any interaction between the **‘observers’** and the **‘actors’** will be forbidden. This role will be performed both by Consortium’s members and by stakeholders.

All the participants will be properly informed about the beAWARE platform and the pilot goals; moreover, a specific training of the technologies will be provided to everyone, according to his own specific role.

For the implementation of the pilot, the equipment that will be used, are:

- 1 projector (in the control room)
- 3 screens (in the control room) for the PSAP and Sensor Thing Server
- Laptop (in the control room)
- One mobile device for each rescue team's leaders, with the first responders' beAWARE mobile app installed
- One mobile device for each 'Citizen', with the Citizen's beAWARE mobile app installed
- One VHF's devices for each rescue team's leaders and the control room operators.
- One dummy to simulate people in danger (Drone's test in S.Agostino district)
- Sand-packs
- One drones type DJI Mavic Pro, with its remote control and supply batteries (Drone's test in S.Agostino district)
- Mobile router (Drone's test in S.Agostino district)
- Laptop and mobile phone with the drone's software installed (Drone's test in S.Agostino district)
- Amphibious vehicle (Drone's test in S.Agostino district)

3 Fire Scenario final updates

The pilot location has been determined taking into account the final use case that will be tested. As the pilot will deal with an evacuation event, it has been negotiated with two educational centres inside the area (a primary school and a secondary education institute) that this pilot will be done as a part of the compulsory evacuation exercises that educational centres must do every year.

3.1 Initial and Final Use Cases

In D2.1 a general report of four different Use Cases fire pilot were made, consisting on the following ones:

UC_201: Management of forest fires emergencies

UC_202: Activation of first responders

UC_203: Pre-emergency level 3

UC_204: Evacuation management during an emergency

Initial use cases and user requirements were defined (in D2.1) when the beAWARE technologies were at the first stage of development. Now, a better understanding of the beAWARE tools and technologies and the addition of new technical features have helped us to further define an updated version of the use cases. Thus, the use cases UC_203 and UC_204 are updated so as to encapsulate the deployed beAWARE tools and technologies (Table 11).

Table 11. Fire scenario Use Cases Modification

USE CASES FIRE	HAS BEEN MODIFIED FROM D2.1?
UC_201: Management of forest fires emergencies	No
UC_202: Activation of first responders	Yes (data input from thermal/fixed camera detecting the fire, that were initially considered, have finally been discarded)
UC_203: Pre-emergency level 3 activation	Updated with data input (socio-cultural factors)
UC_204: Evacuation management during an emergency	Updated with the data from drone video and image analysis

The consortium has determined that UC_204 (evacuation management during an emergency) is an appropriate use case in order to test the beAWARE platform as it consolidates both the pre-emergency and emergency phase. It is worth to note that the UC_203 (Pre-emergency level 3 activation) will be considered as a pre-crisis phase of the UC_204.

Finally, the consortium has been decided that this pilot will be the third one, thus it will test all involved modules in their final stage of development.

3.1.1 Initial and Final Use Cases Comparison

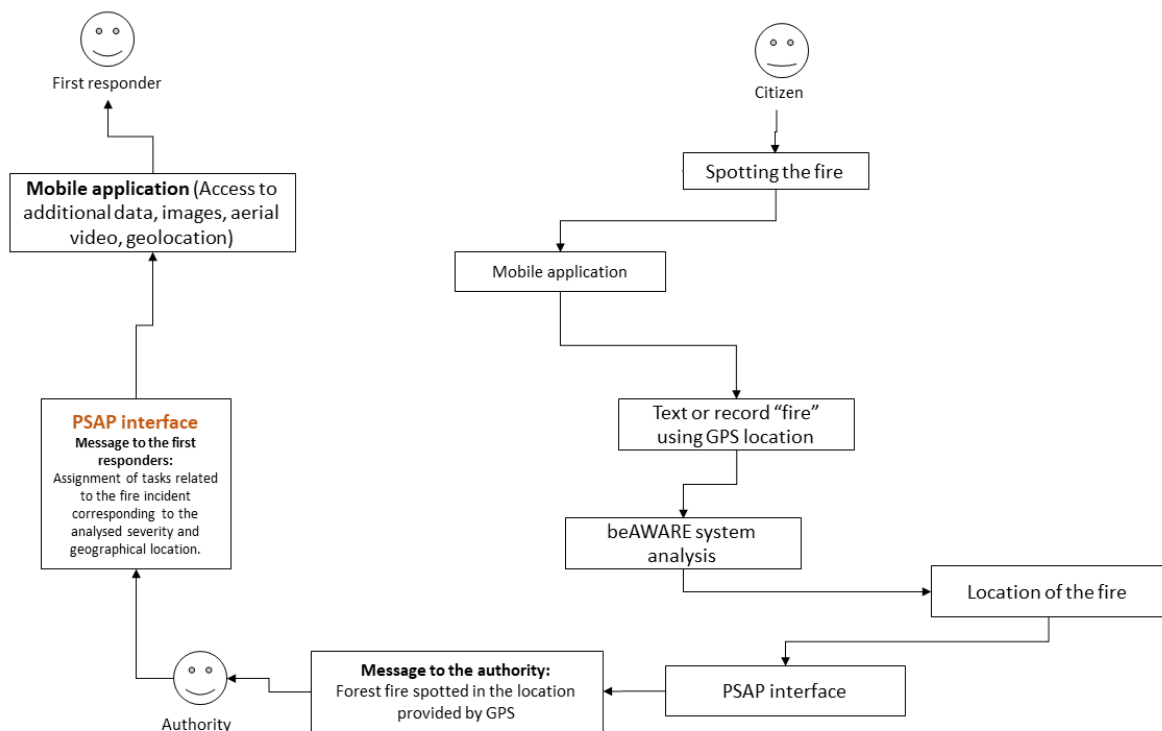
This section provides a description of all the differences between the initial use cases (D2.1) and the final list.

UC_202: Activation of first responders

This use case concerns the activation process of first responders from the moment when fire is detected to the moment when first responders receive their tasks. It shows the use of the mobile application as a tool to enter data into the beAWARE system, as well as when the decision for the activation of first responders has been made.

This use case has been updated after D2.1, as some data input that were initially considered have finally been discarded (thermal/fixed camera detecting the fire).

ACTIVATION OF FIRST RESPONDERS



The table below provided a comparison between the updated version of the UC and the initial one.

D2.1	D2.10
Name	Name
Activation of first responders	Activation of first responders
Diagram	Diagram
<p>ACTIVATION OF FIRST RESPONDERS</p> <pre> graph TD Citizen((Citizen)) -- "Spotting the fire" --> MA1[Mobile application] MA1 -- "Text or record 'fire' using GPS location" --> T1[Text or record "fire" using GPS location] T1 --> BSA[beAWARE system analysis] BSA --> LFF[Location of the fire] LFF --> PSAP_I[PSAP interface] PSAP_I -- "Message to the authority: Forest fire spotted in the location provided by GPS" --> Authority((Authority)) Authority -- "PSAP Message to the first responders: Assignment of tasks related to the fire incident corresponding to the analysed severity and geographical location." --> MA2[Mobile application] MA2 -- "Access to additional data, images, aerial video, geolocation" --> FR((First responder)) TCS[Thermal/fix camera system] --> MA2 </pre>	<p>ACTIVATION OF FIRST RESPONDERS</p> <pre> graph TD Citizen((Citizen)) -- "Spotting the fire" --> MA1[Mobile application] MA1 -- "Text or record 'fire' using GPS location" --> T1[Text or record "fire" using GPS location] T1 --> BSA[beAWARE system analysis] BSA --> LFF[Location of the fire] LFF --> PSAP_I[PSAP interface] PSAP_I -- "Message to the authority: Forest fire spotted in the location provided by GPS" --> Authority((Authority)) Authority -- "PSAP Message to the first responders: Assignment of tasks related to the fire incident corresponding to the analysed severity and geographical location." --> MA2[Mobile application] MA2 -- "Access to additional data, images, aerial video, geolocation" --> FR((First responder)) </pre>
Explanation	Explanation
<p>Current status (initial phase of the scenario)</p> <ul style="list-style-type: none"> Before the fire <p>What is known to the beAWARE system already</p> <ul style="list-style-type: none"> Weather forecast Drought index Available resources Access road <p>What is happening</p> <ul style="list-style-type: none"> A citizen spots the fire and alerts by using mobile application. This makes it possible to locate the position in the forest by GPS. <p>Outcome</p> <ul style="list-style-type: none"> By reporting the fire incident, the authorities are alerted and the available resources and first responders are assigned. 	<p>Current status (initial phase of the scenario)</p> <ul style="list-style-type: none"> Before the fire <p>What is known to the beAWARE system already</p> <ul style="list-style-type: none"> Weather forecast Drought index Available resources Access road <p>What is happening</p> <ul style="list-style-type: none"> A citizen spots the fire and alerts by using mobile application. This makes it possible to locate the position in the forest by GPS. <p>Outcome</p> <ul style="list-style-type: none"> By reporting the fire incident, the authorities are alerted and the available resources and first responders are assigned.

UC_203: Pre-emergency level 3 activation

This use case concerns the activation of pre-emergency level 3. In this case, all resources are mobilized in order to perform dissuasive surveillance in sensible areas and the population must be advised so that they extreme cautions.

This use case has been updated after D2.1, as new data inputs have been taken into account, and other data input that were initially considered have finally been discarded.

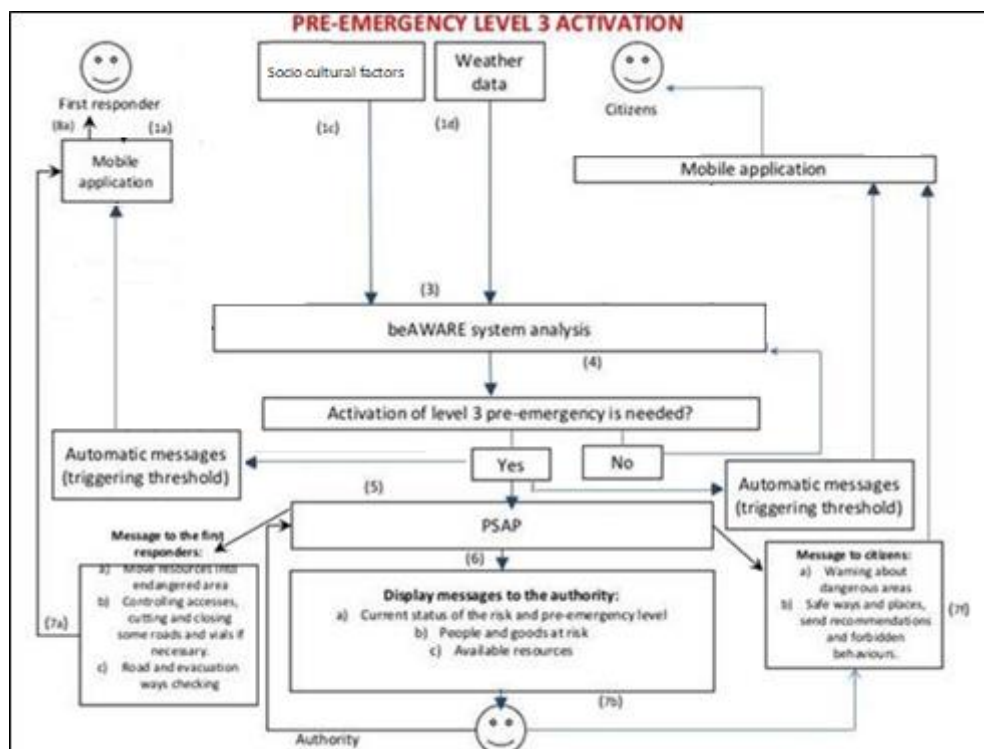
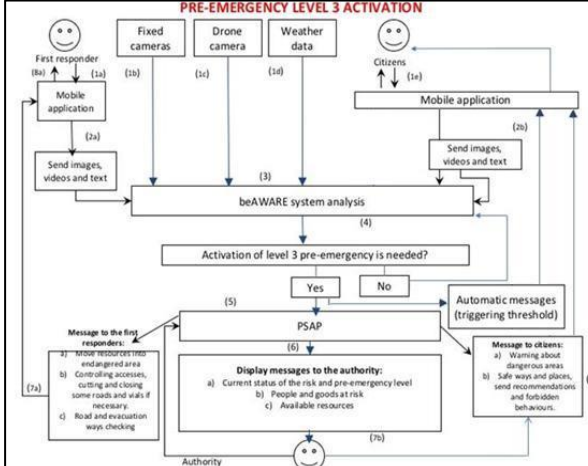
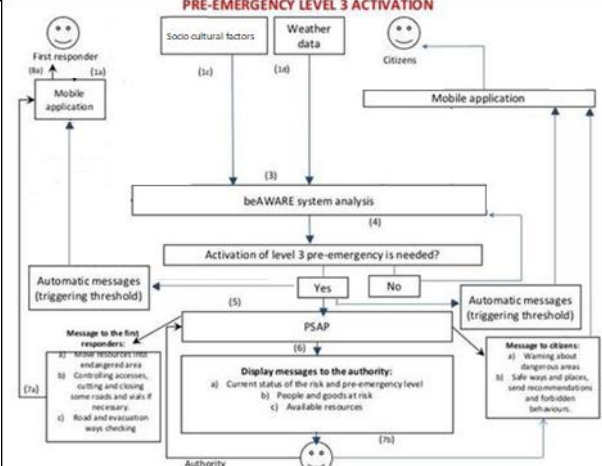


Figure 14. Block Diagram of the updated UC_203

The table below provided a comparison between the updated version of the UC and the initial one.

Table 13. Updates from the UC_203

D2.1	D2.10
Name	Name
Pre-emergency level 3 activation	Pre-emergency level 3 activation

Diagram	Diagram
 <p>The flowchart for the left diagram shows the process for PRE-EMERGENCY LEVEL 3 ACTIVATION. It starts with inputs from a First responder (1a), Fixed cameras (1b), Drone camera (1c), Weather data (1d), and Citizens (1e) into a Mobile application (1a). The Mobile application sends images, videos, and text (2a) to the beAWARE system analysis (3). The system analysis leads to a decision: 'Activation of level 3 pre-emergency is needed?'. If 'Yes', it triggers a PSAP (5) and displays messages to the authority (6). If 'No', it triggers automatic messages (triggering threshold) (5). The PSAP (5) sends a message to the first responders (7a) and displays messages to the authority (6). The authority (7a) sends a message to citizens (7b) and displays messages to the authority (6). The display messages to the authority (6) include: a) Current status of the risk and pre-emergency level, b) People and goods at risk, c) Available resources. The message to citizens (7b) includes: a) Warning about dangerous areas, b) Safe ways and places, send recommendations and forbidden behaviours.</p>	 <p>The flowchart for the right diagram shows the process for PRE-EMERGENCY LEVEL 3 ACTIVATION. It starts with inputs from a First responder (1a), Socio cultural factors (1c), Weather data (1d), and Citizens (1e) into a Mobile application (1a). The Mobile application sends images, videos, and text (2a) to the beAWARE system analysis (3). The system analysis leads to a decision: 'Activation of level 3 pre-emergency is needed?'. If 'Yes', it triggers a PSAP (5) and displays messages to the authority (6). If 'No', it triggers automatic messages (triggering threshold) (5). The PSAP (5) sends a message to the first responders (7a) and displays messages to the authority (6). The authority (7a) sends a message to citizens (7b) and displays messages to the authority (6). The display messages to the authority (6) include: a) Current status of the risk and pre-emergency level, b) People and goods at risk, c) Available resources. The message to citizens (7b) includes: a) Warning about dangerous areas, b) Safe ways and places, send recommendations and forbidden behaviours.</p>
Explanation	Explanation
<p>Current status (initial phase of the scenario)</p> <ul style="list-style-type: none"> There is no fire, and the BeAWARE system is analysing different inputs. <p>What is known to the beAWARE system already</p> <ul style="list-style-type: none"> It has already received input from weather forecast, and (if available) from fixed cameras, drones and mobile application users. <p>What is happening</p> <ul style="list-style-type: none"> The BeAWARE system is analysing the convenience of activation of the pre-emergency level 3. This level considers the risk of wildfire as extreme. In addition to the resources mobilized in Level 2, it will also mobilize the Guardia Civil, Autonomic Police, municipalities, brigades. <p>Outcome</p> <ul style="list-style-type: none"> The BeAWARE system sees the convenience of establishing level 3 pre-emergency, therefore it informs to the PSAP, and send automatic messages to the people through mobile app. 	<p>Current status (initial phase of the scenario)</p> <ul style="list-style-type: none"> There is no fire, and the BeAWARE system is analysing different inputs (weather data and pre-emergency levels established beforehand). Valencian region pre-establishes certain dates (yearly) which due to festivities and other socio-cultural factors are expected to have more risk than usual, therefore pre-emergency level 3 is activated months before knowing weather conditions of these specific dates. <i>[New]</i> <p>What is known to the beAWARE system already</p> <ul style="list-style-type: none"> It has already received input from weather forecast, and there is no previously established pre-emergency level 3 in this specific data. <p>What is happening</p> <ul style="list-style-type: none"> The beAWARE system is analysing the convenience of activation of the pre-emergency level 3. This level considers the risk of wildfire as extreme. <p>Outcome</p> <ul style="list-style-type: none"> The beAWARE system determines that level 3 of pre-emergency should be activated, therefore it informs to the PSAP, and send automatic messages to the people and first responders through mobile app. Besides this, authority is able to send specific messages to

each one.

UC_204: Evacuation management during an emergency

This use case concerns the evacuation management during a forest fire. In case of population at risk, the authority will order the evacuation and first responders will be given instructions to facilitate the evacuation.

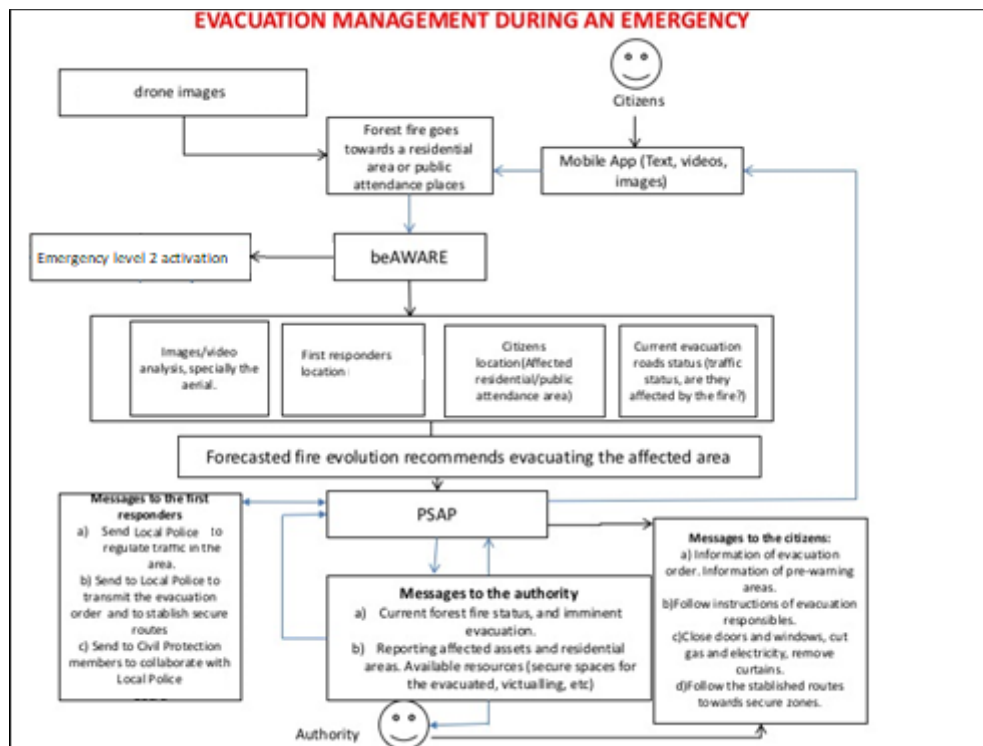
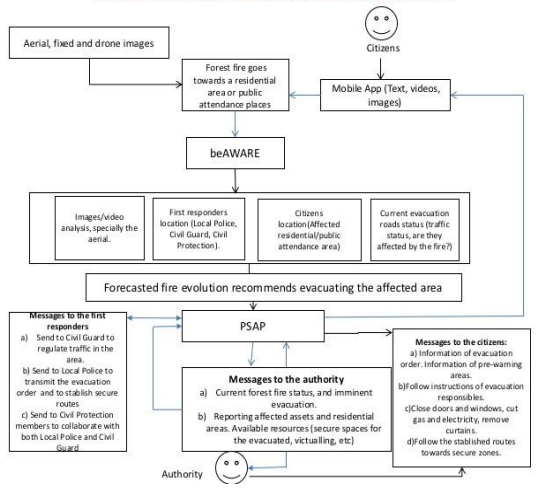
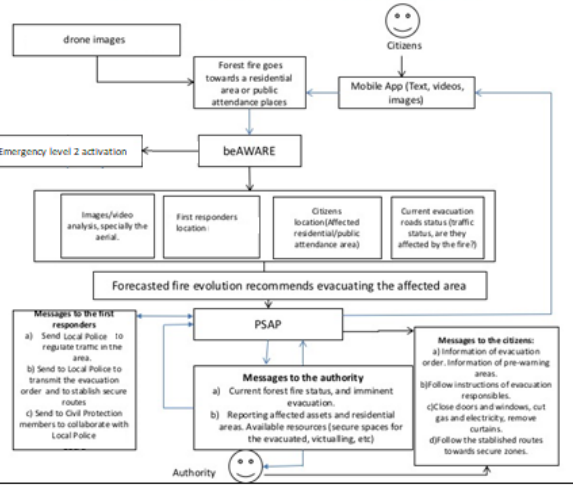


Figure 15. Block diagram of the updated UC_204

The table below provided a comparison between the updated version of the UC and the initial one.

Table 14. Updates from the UC_204

D2.1	D2.10
Name	Name
Evacuation management during an emergency	Evacuation management during an emergency
Diagram	Diagram

<p style="text-align: center;">EVACUATION MANAGEMENT DURING AN EMERGENCY</p>  <p>The flowchart illustrates the initial phase of an emergency evacuation. It starts with 'Aerial, fixed and drone images' and 'Citizens' sending data to 'Forest fire goes towards a residential area or public attendance places'. This triggers 'beAWARE', which then sends data to 'First responders location (Local Police, Civil Guard, Civil Protection)', 'Citizens location (Affected residential/public attendance area)', and 'Current evacuation roads status (traffic status, are they affected by the fire?)'. A 'Forecasted fire evolution recommends evacuating the affected area' leads to a 'PSAP' (Public Safety Answering Point). The PSAP sends 'Messages to the first responders' (a) and 'Messages to the authority' (a, b). The authority then sends 'Messages to the citizens' (a, b, c, d).</p>	<p style="text-align: center;">EVACUATION MANAGEMENT DURING AN EMERGENCY</p>  <p>This flowchart is similar to the left one but includes an additional step: 'Emergency level 2 activation'. This step is triggered by 'beAWARE' and leads to 'Messages to the first responders' (a, b, c, d) and 'Messages to the authority' (a, b). The authority then sends 'Messages to the citizens' (a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z).</p>
<p style="text-align: center;">Explanation</p>	<p style="text-align: center;">Explanation</p>
<p>Current status (initial phase of the scenario)</p> <ul style="list-style-type: none"> During a forest fire <p>What is known to the beAWARE system already</p> <ul style="list-style-type: none"> Weather forecast Location and direction of the fire Location of citizens at risk Location of first responders Road status and secure places locations. <p>What is happening</p> <ul style="list-style-type: none"> Citizens are sending text, video and images of a forest fire going towards a residential area or public attendance place. Aerial video and images are being sent as well. <p>Outcome</p> <ul style="list-style-type: none"> The authority informs citizens of evacuation order and the PSAP gives instructions to first responders in order to facilitate the evacuation. 	<p>Current status (initial phase of the scenario)</p> <ul style="list-style-type: none"> During a forest fire <p>What is known to the beAWARE system already</p> <ul style="list-style-type: none"> Weather forecast Location and direction of the fire Location of citizens at risk Location of first responders Road status and secure places locations. <p>What is happening</p> <ul style="list-style-type: none"> Citizens are sending text, video and images of a forest fire going towards primary and secondary educational centres. Aerial video and images are being sent by the drone as well. <p>Outcome</p> <ul style="list-style-type: none"> The system updates the crisis level to “emergency level 2” according to the received inputs. The authority informs affected citizens of the evacuation order and the PSAP gives instructions to first responders in order to facilitate the evacuation.

3.2 Initial and Final User Requirements

After the delivery of D2.1, requirements development and implementation continued to evolve throughout the program, with the completion of intermediate prototype versions and the final version.

Due to the technical development and a more detailed outline of the beAWARE platform, some modification to the initial list of User Requirements have been necessary.

As for the Use Cases, some User Requirements have been added or more detailed to take into account the new features of the platform which were proposed after the submission of the D2.1 and that regarded mainly:

- New activities related to the usage of drones in the flood pilot: this led to the update of UR_207, and the addition of UR_226.
- The addition of UR_227 to clarify that two versions of the mobile app are required (one for citizens and another one for first responders).
- The addition of UR_228 to provide with data input of socio-cultural factors that might increase the pre-emergency levels.

Besides this, the user requirements UR_208 “Access to road traffic cameras”, UR_218 “Automatic detection system” and UR_220 “Improvement of the signal for telephones and emergency communication” have been discarded because of being out of the scope. In the following table a justification of this action in each one of the above URs is provided.

Table 15. List of discarded User Requirements

UR	Requirement name	Initial description provided (D2.1)	Justification to omit
UR_208	Access to road traffic cameras	Allow authorities/first responders to have access to the cameras located at CV-500 (La Devesa main road) and CV-5010. Although there are already installed cameras, they are managed and visualized by autonomic resources.	These installed cameras work under an independent network which is not connected to Valencia Local Police camera network. It has finally not been possible to gain access to them because this kind of roads are not located inside urban nucleus, and local police forces only have competences in traffic issues at a local level.

UR_218	Automatic detection system	Having an automatic detection system of the forest fire, which is connected to firefighters and police officers	This UR was no longer needed or viable. The automatic detection system was an IR camera network that is no longer available to first responders.
UR_220	Improvement of the signal for telephones and emergency communication	Provide authorities/first responders with an accurate coverage of telephone mobile lines and emergency communication due to there is currently a lack of signal in some spots of the area.	These dark areas in which signal may be deficient are well defined. Once the pilot has been taking form, it is known that the area where it is set does not have these problems, as it is very close to the urban nucleus. Signal issues only happen in very specific locations deep inside the forest.

The following table shows all the User Requirement for the fire scenario, the ones that have been updated from D2.1 are on blue boxes, while the ones added in D2.10 are in green boxes. Besides, those marked in red are being taken out of the User Requirements.

Table 16. Fire pilot User Requirements Updates

UR#	UC#	Requirement name	Requirement description
UR_201	201, 204	Detection of people and goods in danger	Display information authorities/first responders to detect people and cars in danger.
UR_202	201,202,203,204	Detection of critical aspects	Provide authorities/first responders information in order to detect the following kind of situation, process, material or condition that can cause a wildfire or that could intensify its damaging impacts: Namely drought, air temperature and other weather aspects, fuel accumulation spots, crowds, etc.

UR_203	201,202,204	Study of the smoke behaviour	Provide information authorities/first responders with a study of the smoke behavior (vertical/inclined, column, smoke color). Extensive data samples are required for each specific type of smoke behavior for the training of the model.
UR_204	201,202,204	Identification of the fuel being burned	Provide information to authorities/first responders to know the type of fuel being burned by the color and the shape of the smoke. Extensive data samples are required for each specific type of fuel and various illumination changes due to daylight conditions, for the training of the model.
UR_205	201-202-204	Analysis of advancing fire	Provide authorities/first responders with an analysis of the advancing fire (flame progression, height and length). The analysis module requires extensive prior knowledge of the area of interest, such as maps of vegetation and combustible materials, terrain morphology, accurate weather forecast and study of the microclimate caused by the fire, along with geo-location and characteristics of the fire and the burned area.
UR_206	201,202,203,204	Specific weather data	Provide authorities/first responders and citizens with specific weather data of the Devesa place, as it has a specific microclimate that might be different from other places.

UR_207	201,202,204	Aerial images/video (drone)	Display authorities/first responders to visualize aerial images of the fire and the trajectory of the flames. It will provide information about the extension (in case where we can detect the fire in sequential video frames) and the track of the fire, vehicles and people around the spot, in order to indicate candidate suspects or victims. The coordination is difficult in the forest especially when a fire is in progress. Thus, the aerial images could assist coordination between authorities and first responders by providing more information about forest fires evolvement.
UR_209	201,202,203,204	Electronic traffic panels	Display authorities/first responders to display in electronic traffic panels useful information and evacuation instructions in case. In the last year, Valencia Local Police has received a new car fleet which are equipped with led traffic panels that can display messages and useful information such as evacuation instructions and traffic information to citizens.
UR_210	201,202,204	Mobile application	Provide citizens to communicate a fire alert, detected neglects or other risk situations and even send visual data through a mobile application.
UR_211	201, 202, 203, 204	Location of personnel involved	Display authorities/first responders to visualize GPS location and/or real time footage of personnel on the incident site. Transmitted to an online map where the coordination centres can follow both the development of the incident and the location and amount of resources. The online map will also provide the possibility of interacting with the police and other agencies involved.
UR_212	201, 202, 204	Traffic warnings	Sending warnings to citizens in order to avoid interferences inside the area.

UR_213	201, 202, 203, 204	Recommendations	Sending recommendations to citizens.
UR_214	203	Warnings	Sending warnings of pre-emergency alerts to citizens by authorities
UR_215	201, 204	Evacuation orders	Ordering evacuations of citizens at risk.
UR_216	201, 202, 203, 204	Internal sharing of information	Sharing data (images, videos, geolocation, reports) regarding the forest fire among authorities & first responders
UR_217	201, 202, 203, 204	Twitter analysis and warning	Warning authorities/first responders about Twitter messages concerning the forest fire event.
UR_219	201,202,203,204	Coordination and communication between different resources	Provide communication between authorities and first responders, in order to improve their coordination.
UR_221	201,202,203,204	Geolocalitation of telephone calls	To geolocalize a mobile phone citizen call by sending a request permission message to the citizen, who would accept to be tracked temporarily.
UR_222	201,202	Filter of the emergency messages	Transfer emergency voice messages sent with mobile app by writing (only minor emergencies or only information call). The aim is to save time operator and do not lose emergency calls.
UR_223	201	Automatic selection of the level of emergency	This can be doing only with the operator's supervision. The aim is to save time and do not lost emergency messages sent through mobile app.
UR_224	201,202	Automatic translation from a foreigner applicant through mobile app	Make easy the communication between PSAP operator and people with different languages.
UR_225	201,202	Quick search of events and applicants	Data storage, in order to improve indexation of information relative to events and applicants.

UR_226	201,202,204	Video/image analysis	Detect people and vehicles in danger of the received video/images from drone and/or mobile application, and provide these inputs to our PSAP. Furthermore, if drone aerial images/video provide thermal information it can be used for looking over the fire perimeter once it has been extinguished, in order to locate sleeper fire and to avoid possible reproduction.
UR_227	201, 202 203 204	Specific mobile app for first responder and citizen	Provide different versions of the mobile app for citizen and first responders based on their different roles and knowledge.
UR228	203	Socio-cultural factors inputs	Provide with data input of socio-cultural factors that might increase the pre-emergency severity levels.

3.2.1 Initial and Final User Requirements Comparison

Bearing in mind that the beAWARE project has so far undergone a significant developmental phase where the experience, skills and knowledge of the project's technical partners as well as the knowledge and experience of the end-users could be best integrated into the project platform itself and it is quite expected for the initial user the requirements should be considered so as to apply the above mentioned.

In addition, there should be recommended focus on information management, i.e. information sharing among authorities/first responders and citizens. Also, there should be recommended focus on coordination of resources and activities of authorities, first responders, and citizens. It should be defined “which”, “who”, “how”, “why”, “when”.

This section provides a comparison between the User Requirements modified in D2.10 and their original version in D2.1, as well as the new additions that have been considered.

Table 17. Initial and Final User Requirements for the Fire pilot

UR	Requirement Name	Initial description provided (D2.1)	Final description provided (D2.10)
UR_201	Detection of people and goods in danger	Display information authorities/first responders to detect people, cars and buildings in danger.	Display information authorities/first responders to detect people and cars in danger.

UR_203	Study of the smoke behaviour	Provide information to authorities/first responders with a study of the smoke behavior (vertical/inclined, column, smoke color...).	Provide information to authorities/first responders with a study of the smoke behavior (vertical/inclined, column, smoke color). Extensive data samples are required for each specific type of smoke behavior for the training of the model.
UR_204	Identification of the fuel being burned	Provide information to authorities/first responders to know the type of fuel being burned by the colour and the shape of the smoke	Provide information to authorities/first responders to know the type of fuel being burned by the color and the shape of the smoke. Extensive data samples are required for each specific type of fuel and various illumination changes due to daylight conditions, for the training of the model.
UR_205	Analysis of advancing fire	Provide authorities/first responders with an analysis of the advancing fire (flame progression, height and length).	Provide authorities/first responders with an analysis of the advancing fire (flame progression, height and length). The analysis module requires extensive prior knowledge of the area of interest, such as maps of vegetation and combustible materials, terrain morphology, accurate weather forecast and study of the microclimate caused by the fire, along with geo-location and characteristics of the fire and the burned area.

UR_207	Aerial images/video (drone)	Display authorities/first responders to visualize aerial images of the smoke and the trajectory flames. It will provide information about the extension and the damages (kind of damages, and so on), the tracking of the fire, vehicles and people around the spot, in order to find out possible suspects or victims. Furthermore, if these aerial images provide thermal information it can be used for looking over the fire perimeter once it has been extinguished, in order to locate sleeper fire and to avoid possible reproduction. These aerial images are a must, because the use case is in a forest, and we have not referenced in the forest, the only tool that can help the coordination center and first responders are aerial images to have information about forest fires (extension, direction of fires, damages, appropriate mobilization of resources, an soon)	Display authorities/first responders to visualize aerial images of the fire and the trajectory of the flames. It will provide information about the extension (in case where we can detect the fire in sequential video frames) and the track of the fire, vehicles and people around the spot, in order to indicate candidate suspects or victims. The coordination is difficult in the forest especially when a fire is in progress. Thus, the aerial images could assist coordination between authorities and first responders by providing more information about forest fires involvement.
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UR_209	Electronic traffic panels	Display authorities/first responders to display in electronic traffic panels useful information and evacuation instructions in case.	Display authorities/first responders to display in electronic traffic panels useful information and evacuation instructions in case. In the last year, Valencia Local Police has received a new car fleet which are equipped with led traffic panels that can display messages and useful information such as evacuation instructions and traffic information to citizens.
UR_211	Location of personnel involved	Display authorities/first responders to visualize GPS location and/or real time footage of vehicles and personnel on the incident site. Transmitted to an online map where the coordination centres can follow both the development of the incident and the location and amount of resources. The online map will also provide the possibility of interacting with the police and other agencies involved.	Display authorities/first responders to visualize GPS location and/or real time footage of personnel on the incident site. Transmitted to an online map where the coordination centres can follow both the development of the incident and the location and amount of resources. The online map will also provide the possibility of interacting with the police and other agencies involved.
UR_222	Filter of the emergency messages	Transfer emergency calls by writing (only minor emergencies or only information call). The aim is to save time operator and do not lose emergency calls	Transfer emergency voice messages sent with mobile app by writing (only minor emergencies or only information call). The aim is to save time operator and do not lose emergency calls.
UR_223	Automatic selection of the level of emergency	This can be doing only with the operator's supervision. The aim is to save time and do not lost emergency calls	This can be doing only with the operator's supervision. The aim is to save time and do not lost emergency messages sent through mobile app.

UR_224	Automatic translation from a foreigner applicant through mobile app	Make easy the communication between people with different languages	Make easy the communication between PSAP operator and people with different languages.
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3.3 Fire Pilot implementation

3.3.1 Final Fire Demonstration site

The fire spot will finally be located close to the centres which will be evacuated, as this image shows:

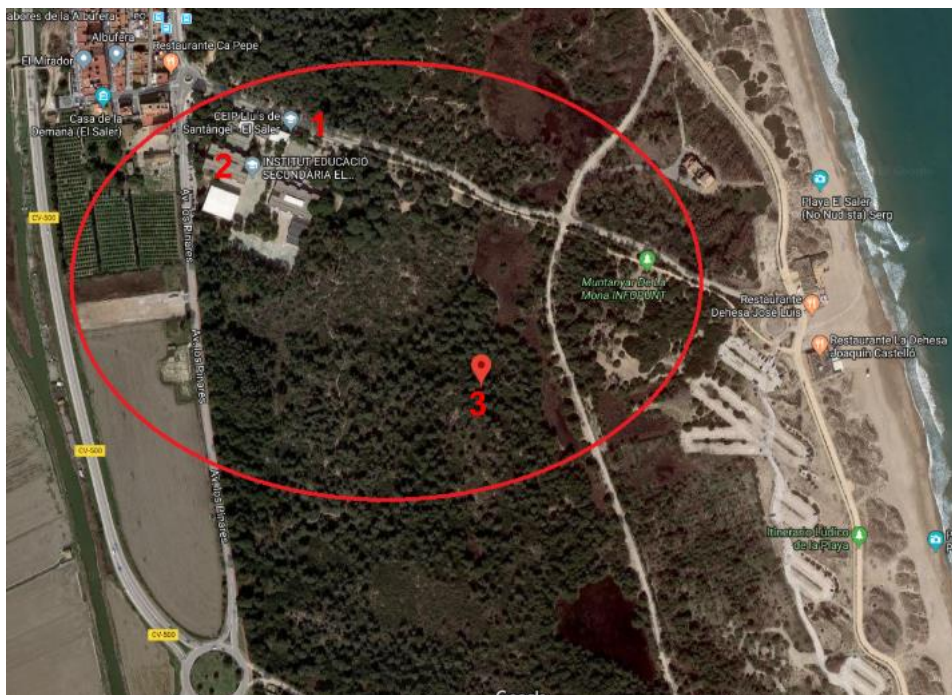


Figure 16. Main area of Fire pilot (1: Primary educational centre; 2: Secondary educational centre; 3: Fire spot)

The beAWARE center of command will be located at our Local Police Headquarters inside Valencia urban area, being 16 kilometers (16 minutes by car) from the fire spot. On the other hand, the fire station is only 3 kilometers (3 minutes by car) away of the fire spot. The following image shows a general view of these places:

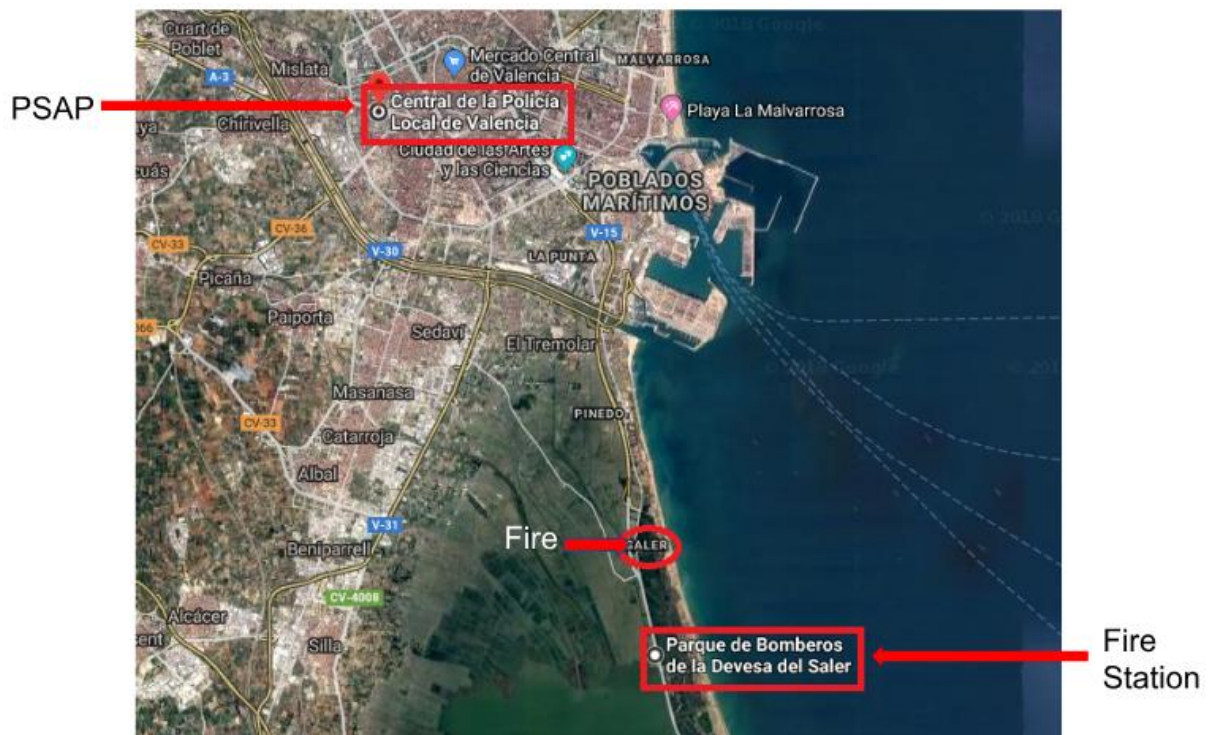


Figure 17. General area of Fire pilot execution

The evacuation management will involve approximately 400 students and 50 teachers. Besides them, there are key figures that develop fundamental roles inside these educational centres in the compulsory emergency exercises. These are: General coordinator; floor coordinator; responsible of alarm activation; responsible of disconnecting power supplies; responsible of handicapped people and responsible of first aid.

3.3.2 Fire Scenario storyline-execution

The storyline developed will have four stages as follows:

- 1) Pre-emergency activation (level 3, extreme risk of fires).
- 2) Spotting a fire (emergency level 0 activation).
- 3) Worsening of the situation (emergency level 1 activation).
- 4) Evacuation management of educational centres (emergency level 2 activation)
- 5) Fade out

It has to be noted that not all players should have a smartphone with the mobile app installed, as usually patrols are formed by two or more people, and there is no need on duplicating material resources.

Table 18. Fire pilot story line

Description	Legacy tools	beAWARE	Trigger	Expected behaviour	Players	Observers - Evaluators	Evaluation
Session A - Pre crisis GOAL: early warning, understand the problem, send the first alerts							
According to the weather forecast pre-emergency level 3 must be declared. Emergency Coordination Center (CCE) issues a warning (fax and/or e-mail) to the affected municipalities. All public safety agencies related with the fire emergency plan are in a state of alert.	Phone call, walkie-talkie (TETRA)	Crisis classification -> PSAP forecast data Highest temperature/wind/humidity values Average values	Crisis Classification run	See all the metrics and decide if there is an extreme risk of fire or not	3 PSAP operators (these roles will be there the whole time of the pilot in all sessions)	4 PSAP (these roles will be there the whole time of the pilot in all sessions)	
Authorities are issuing a warning informing the	Press, social media.	Public alert -> mobile app		Send three alerts <ul style="list-style-type: none"> • Message for public • Message for 	4 end users with app 4 citizens with the app	2 in each team (total 4) 2 in the citizens group	

general public, and will mobilize the resources to be prepared for extreme risk of fires.				authorities • Message for first responders			
General instructions are given to the general public through the press, social media and public releases.		Public alert->mobile app		More specific instructions based on location are given through the beAWARE mobile app.	4 end users with app 4 citizens with the app	2 in each team (total 4) 2 in the citizens group	
Session B – Spotting a fire GOAL: Testing image/video/voice sharing by citizen for an early warning							
The day of the forest fire starts at 11 a.m. when a citizen calls to the PSAP/112 reporting a fire and provides information regarding the fire spot. If the PSAP receives	Phone call	Crisis classification → PSAP (Emergency level 0) Mobile app → PSAP (Image/video/voice+geolocation)	Crisis Classification run	Early warning is done faster thanks to the mobile app, and image/video provides more information than usual phone calls	3 PSAP operators (these roles will be there the whole time of the pilot in all sessions) 1 Citizen (spots the fire)	4 PSAP (these roles will be there the whole time of the pilot in all sessions)	

the call, then it redirects the call to 112 number (CCE). Then the pre-emergency level switches to emergency level 0. Authorities are notified through phone calls and text messages.							
An initial crew of firefighters and police officers are sent to the area	Phone call, walkie-talkie (TETRA)	Public alert → mobile app		All public authorities' agencies related with the fire are in a state of alert, and a dedicated warning is issued by the beAWARE platform to all its users.	4 end users with app (2 policemen, 1 firefighter unit) 2 citizens with the app	1 in each end user (total 2) 2 in the citizens group	
PSAP receives new information about the crisis	Walkie-talkie (TETRA)	Mobile app → PSAP	Crisis Classification run	End user send a report to PSAP	4 end users with app (2 policemen, 1 firefighter unit)	1 in each end user (total 2)	

Session C – Situation Worsening (switch to emergency level 1) GOAL: Testing image/video/voice sharing by end user for an early warning							
At 11.30 due to the extreme weather conditions, forest fire has worsened and emergency level increases to level 1	Phone call, walkie-talkie (TETRA).	Mob app, text report, social media (live tweets)	The call centers are receiving numerous calls of citizens and school staff that are seeing the forest fire or a big smoke column		2x (2 end users in the field)	2 observers with them	
More resources are mobilized to the forest fire (one police patrol and two firefighters' units) An advanced control post is established	Phone call, walkie-talkie (TETRA)	Public alert → mobile app	Inform the authority of the new emergency level and that the advanced control post has been established	A flight with the drone is done from the advanced control post to assess the danger	2 citizens with the app 2 policemen (one patrol) 2 firefighters' unit (5-7 members)	2 in the citizens group 3 in the end users groups	
A general warning is issued and citizens closer (or inside the natural park) receive more specific instructions	Phone call, walkie-talkie (TETRA)	Public alert → mobile app	Crisis Classification run	Public is advised with updated instructions through the beAWARE mobile app (Stay away and/or confinement measures)	2 citizens with the app 2 policemen (one patrol) 2 firefighters' unit (5-7 members)	2 in the citizens group 3 in the end-users groups	

Session D – Evacuation Management of educational centres							
Thanks to the images provided by the drone we can determine that forest fire is heading towards urban areas and protective measures for citizens may be necessary. Therefore, emergency level is switched to level 2	Phone call, walkie-talkie (TETRA)	PSAP → mobile app Drone → Mobile app Mobile app → PSAP	Crisis Classification run	Updated instructions through the beAWARE mobile app are sent to citizens (Stay away and/or evacuation/confinement measures)			
Educational centers inside the affected area are sent a notification informing of the necessity of evacuating these centers	Phone call, public address system, door by door warning/ notification to janitors	Public alert → mobile app		Primary school and secondary education institute activate the evacuation management in case of emergencies	4 inside educational centers (2x General coordinator and 2x responsible of alarm activation) 1 police patrol	3 (2 inside educational centers and one with new police patrol)	
Teachers and students go to a safe area. End	Phone call, walkie-talkie (TETRA)	Public alert → mobile app			4 inside educational centers (2x	3 (2 inside educational centers and one	

users coordinate the evacuation					General coordinator and 2x responsible of alarm activation) 1 police patrol	with new police patrol)	
All people in danger are in the safe area, only end users are close to the fire spot	Phone call, walkie-talkie (TETRA)	Mobile-app		Reports from safe area with images and videos			
Session E - fade out							
Report from the team in the field, they determine that the fire has been extinguished	Phone call, walkie-talkie (TETRA)	Mobile app → PSAP		Students and teachers can safely go back to the educational centers. Normal circulation and behavior is reestablished	1 Firefighter unit (chief in the Advanced control post)	2 observers	

3.3.3 Emergency protocols and communication procedures

Pre-Emergency Levels: Preventive Actions

The State Meteorological Agency of Spain (AEMET), through the Meteorological Centre (CMT) in Valencia, determines each day, for a 48 hours period, a daily rate of forest fire hazard (combined index of ignition and propagation) by area, based on three levels of severity. From this index, and once considered other socio-cultural factors and situations that can raise the level of severity, the Generalitat (regional government) declares, through the Autonomous CCE, the corresponding level of pre-emergence. The selected pre-emergency level for the pilot is described below:

- Level 3 EXTREME RISK OF WILDFIRE: In addition to the resources mobilized in Level 2 (volunteers, forest rangers, BRE and deterrent surveillance) it will also mobilize the Guardia Civil, autonomous police, municipalities and brigades.

The declaration of LEVEL 3 PRE-EMERGENCE (extreme risk of forest fires) is received by the Mayor, as the head of the Civil Protection in the Municipality, via the Regional Coordination Centre (CEE). It will mobilize local resources, with a view to establishing Deterrent Surveillance Services in the most vulnerable areas of the municipality, so the CECOM (Municipal coordination Centre) of the Fire Brigade will alert their own and other local resources (local forest guards, civil protection Volunteers).

When the pre-emergence 3 is activated, other resources will be also alerted, Guardia Civil, autonomous police, forest brigades of the Valencia Provincial Council, for the preventive surveillance of forest fires. Moreover, the Mayor will issue an EDICT, in which the situation will be reported, indicating that it has been declared a level pre-emergence 3 “EXTREME RISK OF FOREST FIRES” and reminding about the preventive compulsory measures referred to in Decree 98/1995, of May 16.

Phases of emergency at a local level

The emergency phase will start at:

LEVEL 0

Level 0 refers to fires that can be controlled using the fire-fighting resources foreseen in the Local Emergency Plan, and which pose no danger to persons or properties.

When the situation has worsened, emergency level will update to:

LEVEL 1

Which refers to fires that can be controlled with the mass extinction of the local emergency plan but sees the need for protective measures for people and goods different to forest nature.

Operational communications

LEVEL 0:

The regional CCE will be alerted, communicating EMERGENCY level 0 and requesting air assets to be put on alert. The municipal resources (technical, forest rangers and volunteers from local civil protection) will be alerted.

LEVEL 1:

Depending on its severity, air assets will be requested. The communication with them will take place through air band stations. If necessary, the presence of an air coordinator in the PMA will be asked. Outer-resources will be asked from the Local Coordination Centre (CECOM) to the Centre for regional coordination (CCE) PMA –PUESTO DE MANDO AVANZADO (ADVANCED CONTROL HUB)

As stated before, the PMA's leadership will be exercised by the highest-rank officer in the Fire Brigade, who will determine the place to locate it. This will be the place where those responsible for acting services will be heading. Each performer will carry a radio station to communicate with their resources. The main Transmissions Centre will stay in touch in real time with the provincial CCE, where the emergency occurs. Communication will take place through the Director, who will request the necessary resources. In the event of a disaster, the traffic management in the area will be carried out by the Local Police and the Civil

Guard. In the event that the precautionary evacuation of some area is necessary, it will be held with local resources. The head of the Advanced Control Hub will order evacuation. The Local Police and Civil Guard Traffic establish safe evacuation routes, each in their jurisdiction.

If there is a threat of imminent danger, the protective measures will be ordered by the head of the Security Basic Unit, who will notify immediately to the Technical Director of PMA. The Civil Protection volunteers will collaborate with the local police in the evacuation tasks. The population will receive an evacuation order through their entry phones and over loudspeakers. The final declaration of emergency will correspond to the emergency' leader (PMA Director, Technical, or Plan Director) and will be communicated to the mobilized units (Intervention, Security, Logistics, Health).

Population warning systems

The warning systems are intended to alert and inform the population about the most appropriate action in each event and about the implementation of protective measures: self-protection, confinement, withdrawal and evacuation. At level one, they may use public address systems to inform the population about the imminent protective measures. In a second level, public warnings are made through the media (radio, television), specifically RNE-1, TVE-1, Radio 9, which will spread the messages provided by the Communication Cabinet assigned to the Steering Committee.

3.3.4 Equipment and participants of Fire Scenario

PARTICIPANTS (approximately)

- Fire-fighters: 20
- Police officers: 12-14 (3-4 patrol, 3-4 PSAP operator, 2 drone pilots)
- Forest Guards: 2-4
- Citizens: 400 students, 50 teachers, 5 citizens/neighbours.

EQUIPMENT TO BE USED

- 1 tablet with the app installed for Fire-fighters.
- 1 tablet with the app installed for Local Police.
- 15 mobile phones with the app installed for first responders.
- 1 laptop with the app installed for the PMA

4 Heatwave Scenario execution

Currently in Greece the Emergency Services operates and manage the heatwave extreme events in a fragmented way employing their own operational coordination centres and resources. Initially the National Meteorological Service analyse the weather forecast and informs the General Secretariat of Civil Protection which notifies the Hellenic Fire Brigade and the National Ambulance Service as well as the Prefectures and the Municipalities. The Hellenic Fire Brigade and the National Ambulance Service employ their PSAP and Coordination Centres to cope with the emergency incidents that they receive during a heatwave crisis event individually. Furthermore, each one informs the general public independently.

The goal of beAWARE through the heatwave pilot is to interconnect all these local agencies, distribute wisely the resources that they provide and facilitate the communication with the rescue teams and the citizens. Heatwave pilot aims to highlight that in every phase of a crisis event, the beAWARE technology is able to provide detailed outline of the situation enabling firstly the interconnectivity between stakeholders, secondly the efficient manipulation of the data that they receive and thirdly the effective management of the emergency incidents via the beAWARE PSAP platform. Furthermore, the beAWARE technological solution supports seamless, direct and easy communication, between national authorities, rescue teams and citizens.

The heatwave pilot took place at Thessaloniki from 19 to 20 of November 2018. HRT's headquarters were the main meeting place where, the training, the presentation of the project to other rescue teams and Civil Protection authorities took place. Finally, it was the place where the PSAP was hosted for the implementation of the heatwave pilot.

The execution of the heatwave pilot consists of three sessions covering every phase of crisis management in a heatwave crisis. In each session, the scenario was performed exploiting legacy tools and beAWARE solution. This process indicates that the legacy tools to face an upcoming or ongoing heatwave crisis event are quite primitive, therefore the sophisticated beAWARE technology can fulfil the user requirements, as have been defined in deliverable D2.1.

4.1 Initial and Final Use Cases

In deliverable D2.1 'Use Cases and Initial User Requirements' a general report of all Use Cases for the heatwave pilot was made. The proposed Use Cases aim on one hand to consider the impact of a heatwave extreme event in the population of Thessaloniki who lives in urban, suburban and nearby forest areas and on the other hand to investigate the preparedness of civil protection mechanism to face, simultaneously, the occurrence two

extreme hazardous events such as the forest fire and heatwave by employing the beAWARE platform. Hence, the initial list of use cases achieves these goals, so the use cases doesn't need to change during the implementation of the final version of the beAWARE system.

Table 19. Use Cases Heatwave Pilot

USE CASES HEATWAVE	HAS BEEN MODIFIED FROM D2.1?
UC_301: Heatwave forecasting alert	NO
UC_302: Heatwave fire risk assessment	NO
UC_303: First Responder Management	NO
UC_304: Management of traffic emergencies	NO
UC_305: Management of Places of relief	NO
UC_306: Response to Power Outage	NO

4.1.1 Pilot Tested Use Case

Due to the maturity stage of the beAWARE platform (1st Prototype) at the time of the Heatwave pilot, four user requirements were evaluated, including the early warning module during the heatwave pre-emergency phase, the management of the traffic emergencies and the places of relief as well as the authority's response to power outage during the emergency phase. They are highlighted as green in the following table. The remaining two use cases will be evaluated during the deployment of the final version of the beAWARE platform.

Table 20. Tested Use Cases Heatwave pilot

USE CASES HEATWAVE	TESTED AT HEATWAVE PILOT
UC_301: Heatwave forecasting alert	YES
UC_302: Heatwave fire risk assessment	NO
UC_303: First Responder Management	NO
UC_304: Management of traffic emergencies	YES
UC_305: Management of Places for relief	YES
UC_306: Response to Power Outage	YES

4.2 Initial and Final User Requirements

A general report of all User Requirements for the heatwave pilot was made. Because User Requirements are related to the Use Cases, and as it is presented in subchapter 4.1, since there was not any modification on the Use Cases there is a few changes should be carried out in the User Requirements for the final version of the beAWARE system. The table below presents the initial User Requirements with their name and their description. Also, an updated description of the requirements, wherever it is needed, are provided and highlighted with the blue color.

Table 21. User Requirements Heatwave Pilot Updates

UR#	UC#	Requirement name	Requirement description
UR_301	301, 302, 305, 306	Real time weather forecast	Provide the authorities with real time weather forecast in relation to the progression of the heatwave phenomenon
UR_302	301	Automatic warning	beAWARE system to generate and provide the authorities with an automatic warning when an imminent heatwave phenomenon is forecasted
UR_303	302	Risk assessment for a forest fire	Provide the authorities with a risk assessment regarding the probability of a forest fire to occur during or in the upcoming period after a heatwave. The relevant authorities will have an assessment of a fire risk based on the weather forecast during a heatwave and especially during the following days
UR_304	301, 302, 303, 305	Heatwave intensity	Provide the authorities with a risk assessment regarding the intensity of the upcoming and/or ongoing phenomenon in the city. Provide an estimation of the heatwave impact on the population by assess the Discomfort Index.

UR#	UC#	Requirement name	Requirement description
UR_305	303, 304, 305	Possible locations for incidents	Display to the authorities, visual information about possible locations in the city (or outside the city) where a situation is more likely to develop that will require rescue team intervention (for example, based on past experience, traffic jam and/or accidents will be more likely to occur at a main street intersection/ public park/ entrance to hospitals or banks... etc.). In such cases a decision might be made to send rescue teams in advance to shorten response time if/when an incident occurs
UR_306	301, 302, 303, 305, 306	Number of people affected	Provide the authorities an estimation of the people that might be affected from the phenomenon and in which areas. Also, the assessment of the Discomfort Index of the upcoming and/or ongoing heatwave extreme event is provided.
UR_307	306	Power needs	Provide the authorities an estimation on the power needs during a heatwave based on its foreseen progression
UR_308	303, 306	Infrastructure overload	Provide the authorities an estimation of damage/overload to the city's infrastructure (phone lines, electricity, water, etc)
UR_309	303	False Alarms	Provide to the authorities a procedure to confirm necessity of rescue teams so they are not sent needlessly to one place instead of somewhere else where they are needed more urgently, therefore the ability to handle false alarms.

UR#	UC#	Requirement name	Requirement description
UR_310	303, 304, 305	City-wide overview of the event	Provide the authorities to have a city-wide overview of the event – allow decision making authorities an overall view of all incidents handled at any point in time/ see where all rescue teams are located in real-time to allow them to make informed decisions regarding who to send where etc.
UR_311	301, 302, 303, 304, 305, 306	Information Storage	Provide the authorities, with access to all historical information by providing storage for all information for future lessons-learned purposes, so that after the heat wave situation is over, decision making authorities can review the information gathered and handled during the event, and set-up better procedures to handle future events more efficiently
UR_312	301, 304, 305, 306	Warning citizens	Provide to citizens warnings through the beAWARE app, of an imminent heatwave and a list of proactive measures and how to reduce its effects
UR_313	303	First responders status	Provide to the authorities the current status and location of all first responders when they are performing their tasks
UR_314	303	Assign tasks to first responders	Allow authorities to assign additional tasks to those first responders who are available or even instruct those who are able to assist other responders
UR_315	303, 304	Traffic Status	Facilitate the authorities by providing monitoring capabilities of the current traffic situation from installed surveillance (static) cameras, so that they can decide where to direct the first responders or inform them which roots to avoid.

UR#	UC#	Requirement name	Requirement description
UR_316	305	Capacity of relief places	Provide to the authorities the current state of the available capacity of all relief places that are available to the public. The assessment is performed by the analysis of the video from static or mobile camera.
UR_317	303, 304, 306	Areas with power outage	Display to the authorities the areas where there is a power outage
UR_318	303, 306	Trapped citizens	Allow authorities to know if there are people trapped (e.g. in an elevator) and display where
UR_319	303, 306	Trapped elders at home	Allow authorities to know if there are elder people trapped in houses without an A/C and display where
UR_320	303, 306	Hospital availability	Show to the authorities the current availability of the hospitals
UR_321	301, 306	Affected area	Provide to the authorities an assessment for the forecasted or the observed Crisis Level which indicates the impact of heatwave crisis event in the region of interest
UR_322	304, 305	Information for incident status from Social Media	Provide to the authorities, information regarding potential risks in case there is a situation inside the city (eg car accident, etc.) gathered from social media
UR_323	305, 306	Information for Hospital Status from Social Media	Provide to the authorities, information regarding overcrowded hospitals and places offered to the public with a/c, gathered from social media
UR_324	304	Information for existing situation in the Social Media	Provide to the authorities, information regarding existing traffic conditions all over the city grid gathered from social media

UR#	UC#	Requirement name	Requirement description
UR_325	305	Suggested places for relief	Provide citizens with information regarding the suggested places for relief through an app.
UR_326	301, 302, 303, 304, 305, 306	Type of visualization	Display to the authorities/citizens all the information in a web-gis platform
UR_327	304, 305, 306	Send emergency reports	Allow citizens to send text, images and video messages from their mobile phone (for the different operative systems) and from their social media account to the authority
UR_328	303, 304	Send task reports	Allow First Responders to send reports about their assignments from their mobile phone to local authorities
UR_329	304, 305	Visualize video cameras	Display streamed video from video cameras to the authorities/citizens
UR_330	303, 304, 305, 306	Localize video and images	Provide authorities with the ability to localize videos and images sent by citizens from their mobile phones
UR_331	303	Localize task status	Provide authorities with the ability to detect the location of first responders
UR_332	304, 305, 306	Localize tweets	Provide authorities with the ability to localize Twitter messages
UR_333	304, 305, 306	Localize calls	Provide authorities with the ability to localize voice messages sent with mobile app by writing to an emergency number concerning citizens who are trapped. The aim is to save time operator and do not lose emergency calls
UR_334	303	Manage assignments in case of new emergencies	Provide authorities with the ability to manage first responder assignments
UR_335	303	Map of rescue teams and task evaluation	Display to authorities the movements of first responder teams in all the municipality and provide the ability to evaluate in real time the execution of the assigned tasks with a global visualization of the activities performed

UR#	UC#	Requirement name	Requirement description
UR_336	304	Traffic warnings	Provide authorities with the ability to send warnings to citizens in order to avoid a certain area that is jammed with traffic
UR_337	303	Location of vehicles and personnel involved	Allow authorities/first responders to visualize GPS location and/or real time footage of vehicles and personnel on the incident site. Transmitted to an online map where the coordination centres can follow both the development of the incident, and the location and amount of resources. The online map will also provide the possibility of interacting with the police and other agencies involved
UR_338	304, 305, 306	Warnings	Allow authorities to send warnings of pre-emergency alerts to citizens.
UR_339	303	Evacuation orders	Allow authorities to order evacuations of citizens at risk.
UR_340	303, 304, 305, 306	Internal sharing of information	Allow authorities and first responders to share data (images, videos, geolocation, reports)
UR_341	304, 305, 306	Twitter analysis and warning	Allow authorities/first responders to be warned by Twitter messages concerning traffic jam, availability of places of relief, potential hazards or people in danger
UR_342	303, 304, 305, 306	Coordination and communication between different resources	Provide communication between authorities and first responders, in order to improve their coordination

4.2.1 Initial and Final User Requirements Comparison

This section provides a comparison between the User Requirements modified in D2.10 and their original version in D2.1. Mainly, the enhancements of the User Requirements focus on the provide capabilities to the authorities to assess the impact of a heatwave extreme event to the population. Risk and impact maps are useful to facilitate the decision makers to assess the risk of hazardous event. Furthermore, it was requested the utilisation static surveillance cameras in order to facilitate the authorities and empower their monitoring capabilities of

the current traffic situation. Also, it is judged necessary to refine the description of the User Requirement UR_321 so as to be more meaningful and comprehensive to all stakeholders.

Table 22. Initial and Final User Requirements for the Heatwave pilot

UR	Requirement Name	Initial description provided (D2.1)	Final description provided (D2.10)
UR_304	Heatwave intensity	Provide the authorities with a risk assessment regarding the intensity of the phenomenon in the city	Provide the authorities with a risk assessment regarding the intensity of the upcoming and/or ongoing phenomenon in the city. Provide an estimation of the heatwave impact on the population by assess the Discomfort Index
UR_306	Number of people affected	Provide the authorities an estimation of the people that might be affected from the phenomenon and in which areas	Provide the authorities an estimation of the people that might be affected from the phenomenon and in which areas. Also, the assessment of the Discomfort Index of the upcoming and/or ongoing heatwave extreme event is provided
UR_315	Traffic Status	Display to the authorities to monitor the current traffic situation so that they can decide where to direct the first responders or inform them which roots to avoid	Facilitate the authorities by providing monitoring capabilities of the current traffic situation from installed surveillance (static) cameras, so that they can decide where to direct the first responders or inform them which roots to avoid
UR_316	Capacity of relief places	Provide to the authorities the current state of the available capacity of all relief places provided to the public	Provide to the authorities the current state of the available capacity of all relief places that are available to the public. The assessment is performed by the analysis of the video from static or mobile camera

UR_321	Affected area	Provide to the authorities with a prediction of the affected area	Provide to the authorities an assessment for the forecasted or the observed Crisis Level which indicates the impact of heatwave crisis event in the region of interest
UR_333	Localize calls	Provide authorities with the ability to localize Phone Calls to an emergency number concerning citizens who are trapped	Provide authorities with the ability to localize voice messages sent with mobile app by writing to an emergency number concerning citizens who are trapped. The aim is to save time operator and do not lose emergency calls

4.2.2 Pilot tested User Requirements

As mentioned above, due to the early maturity stage of the beAWARE platform (1st Prototype) at the time of the Heatwave pilot, some user requirements are not fully matured as the technological tools are not fully deployed. Moreover, some user requirements haven't evaluated yet and will be tested during the execution of the Use Cases UC_302 and UC_303 at the final deployment of the beAWARE platform.

The following table summarises the status of user requirements concerning their evaluation during the heatwave pilot due to the technological maturity level. Thus, user requirement that is highlighted with green color means that the beAWARE technologies are in such a level of maturity that they can cover fully the specific requirement. With orange color indicates the user requirements where the beAWARE technologies can satisfy them partially and would be evaluated again during the final release of the system. Finally, the blue ones are those user requirements that either the use cases are not evaluated in the Heatwave pilot either the beAWARE technologies are in a primitive level of maturity. These user requirements should be definitely evaluated at the final prototype of the beAWARE platform.

Table 23. Tested User Requirements Heatwave Pilot

UR#	UC#	Requirement name	Level of Maturity	Justification
UR_301	301, 302, 305, 306	Real time weather forecast	Partially	The execution of the pilot took place on November, so the weather forecast data were simulated
UR_302	301	Automatic warning	Fully	-
UR_303	302	Risk assessment for a forest fire	No	-
UR_304	303, 305	Heatwave intensity	Partially	An estimation of the heatwave impact on the population has been provided by the assessment of the Discomfort Index. However, more refinement of the heatwave severity should be done in both phases of the crisis
UR_305	303, 304, 305	Possible locations for incidents	Fully	-
UR_306	303, 305, 306	Number of people affected	Partially	Estimations of the number of people infected relied on those who have found shelter in Places of Relief
UR_307	306	Power needs	No	-
UR_308	303, 306	Infrastructure overload	No	-
UR_309	303	False Alarms	No	-
UR_310	303, 304, 305	City-wide overview of the event	Partially	The management of the first responders will be fully provided with the final release of the system

UR#	UC#	Requirement name	Level of Maturity	Justification
UR_311	301, 302, 303, 304, 305, 306	Information Storage	Fully	-
UR_312	301, 304, 305, 306	Warning citizens	Fully	-
UR_313	303	First responders status	No	-
UR_314	303	Assign tasks to first responders	No	-
UR_315	303, 304	Traffic Status	Partially	The traffic status was able to be tested only from rescuers and citizens mobile phones and send their reports with photos and videos to PSAP, only from a small area of the entire city
UR_316	305	Capacity of relief places	Fully	-
UR_317	303, 304, 306	Areas with power outage	No	-
UR_318	303, 306	Trapped citizens	Partially	For the evaluation of this UR, data obtained from the mobile application via voice messages is utilised. However, it needs to be re-evaluated and scale up by using data from heterogeneous sources

UR#	UC#	Requirement name	Level of Maturity	Justification
UR_319	303, 306	Trapped elders at home	Partially	See UR_318
UR_320	303, 306	Hospital availability	No	-
UR_321	301, 306	Affected area	Partially	Due to the maturity level of the beAWARE platform the estimation of the Crisis Level fuse only on the forecast and observed weather data and did not combine severity level generated from other heterogeneous sources
UR_322	304, 305	Information for incident status from Social Media	Partially	Need to re-evaluated by scale up the data from heterogeneous sources
UR_323	305, 306	Information for Hospital Status from Social Media	No	-
UR_324	304	Information for existing situation in the Social Media	Fully	-
UR_325	305	Suggested places for relief	Fully	-
UR_326	All	Type of visualization	Partially	beAWARE dashboard would be refined and empowered with new features and charts in the final version of the platform
UR_327	304, 305, 306	Send emergency reports	Fully	-
UR_328	303, 304	Send task reports	No	-
UR_329	304, 305	Visualize video cameras	Fully	-

UR#	UC#	Requirement name	Level of Maturity	Justification
UR_330	303, 304, 305, 306	Localize video and images	Fully	-
UR_331	303	Localize task status	No	-
UR_332	304, 305, 306	Localize tweets	Partially	Due to GDPR restrictions and ethical legislations, the ability to localize tweets was done only with codes for the locations
UR_333	304, 305, 306	Localize calls	Partially	See UR_332
UR_334	303	Manage assignments in case of new emergencies	No	-
UR_335	303	Map of rescue teams and task evaluation	No	-
UR_336	304	Traffic warnings	Fully	-
UR_337	303	Location of vehicles and personnel involved	No	-
UR_338	304, 305, 306	Warnings	Fully	-
UR_339	303	Evacuation orders	No	-
UR_340	303, 304, 305, 306	Internal sharing of information	Fully	-
UR_341	304, 305, 306	Twitter analysis and warning	Fully	-

UR#	UC#	Requirement name	Level of Maturity	Justification
UR_342	303, 304, 305, 306	Coordination and communication between different resources	Partially	Currently, beAWARE platform supports the one-way communication from authorities (PSAP) to first responders. In the final version of the system, two-way communication would be provided

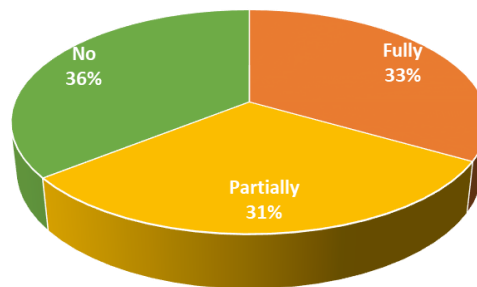


Figure 18. Level of Maturity of User Requirements

As presented in the table above, it is beyond any doubt that although the maturity level of the platform was at its first version and that heatwave was the first pilot, above 60% of URs are either fully covered either partially.

4.3 Heatwave Pilot implementation

For the implementation of the pilot methodological steps took place. First of all, discussions took place between all technical partners and HRT (from the end users side) as main responsible for the heatwave pilot. Secondly, the maturity level of beAWARE platform, the Use Cases and User Requirements, the available resources and finally, the storyline were discussed and finalized and presented below.

4.3.1 Final Heatwave Demonstration site

The Demonstration site of the Heatwave pilot is divided in different locations which are presented in the picture below. The main demonstration site was HRT Headquarters, in which the main room was renovated in order to set up the PSAP and also to give the ability to consortium members, Civil Protection authorities, rescuers to view the action that was taking place. The next place which employed for the purpose of the pilot was the place of

[illegible]

Figure 19. General overview of Heatwave pilot area

4.3.2 Heatwave Scenario storyline-execution

Before the execution of the heatwave pilot, during constant telecommunications and physical meetings, HRT along with technical partners created a storyline based on the Use Cases and User Requirements that would be tested during the pilot based also on the maturity level of the platform. This story line had 2 main pillars: (a) Legacy Tools only (without beAWARE platform) and (b) With beAWARE platform and mobile application

The first one was to execute the entire scenario **without** beAWARE platform, only with legacy tools which were: telephone (stable and mobile lines), VHF, email and press releases. The second one was to execute the entire scenario **with** beAWARE platform and mobile app. The storyline, had 3 Sessions:

1. Pre – Crisis
2. Traffic Jam and Power Outage
3. Places of Relief

Below the entire structure, of the heatwave pilot as planned and executed is presented.

Table 24. Heatwave Pilot storyline

Description	Legacy tools	beAWARE	Trigger	Expected behavior	Players	Observers - Evaluators	Evaluation
Session A - Pre-crisis GOAL: early warning, understand the problem, send the first alerts							
According to the weather forecast there is an estimate that a severe heatwave is coming in 3 days.	Email, phone call, VHF	Crisis classification -> PSAP o forecast data o highest temperature value o Average value from 4 places	Crisis Classification run	See all the metrics and decide if there is a heatwave or not	3 PSAP operators (these roles will be there the whole time of the pilot in all sessions)	4 PSAP (these roles will be there the whole time of the pilot in all sessions)	
Authorities are issuing a warning informing the general public, public authorities and first responders to be prepared for high temperatures for the next days.	Email, phone call, VHF	Public alert -> mobile app		Send three alerts <ul style="list-style-type: none"> • Message for public • Message for authorities • Message for first responder 	4 end users with app 4 citizens with the app	2 in each team (total 4) 2 in the citizen's group	
General instructions are given to the general public	Email, phone call, VHF	Public alert->mobile app		More specific instructions based on location and age group are given	4 end users with app 4 citizens with the app	2 in each team (total 4) 2 in the citizens group	

through the press, social media and public releases.				through the beAWARE mobile app base on age location			
<i>A risk assessment regarding a forest fire which occurs after a heatwave is provided</i>	<i>Email, phone call</i>	<i>Crisis classification -> PSAP o forecast data o highest temperature value Average value from 4 places</i>		<i>More specific and detailed information and data will be analyzed and the PSAP based on those will take actions (eg inform Rescue Teams, Authorities etc)</i>	<i>3 PSAP operators</i>	<i>2 observers with them</i>	
<p align="center">Session B - Traffic Jam</p> <p align="center">GOAL: understand the status of the heatwave, the problem of the electrical supply and the streets that are blocked</p>							
The day of the heatwave starts with 39°C at 11.00 AM. The alert system changes to yellow. All public authorities agencies related with the heatwave are in a state of alert.	no extra information	Crisis classification -> PSAP o forecast data o highest temperature value o Average value from 4 places	Crisis Classification run	See all the metrics and decide if there is a heatwave or not	3 PSAP operators (these roles will be there the whole time of the pilot in all sessions)	4 PSAP (these roles will be there the whole time of the pilot in all sessions)	

The day of the heatwave starts with 39°C at 11.00 AM. The alert system changes to yellow. All public authorities agencies related with the heatwave are in a state of alert, and a dedicated warning is issued by the beAWARE platform to all its users.	Email, phone call, VHF	Public alert->mobile app		All public authorities agencies related with the heatwave are in a state of alert, and a dedicated warning is issued by the beAWARE platform to all its users.	2 end users with app 2 citizens with the app	2 in each team (total 4) 2 in the citizens group	
At 12.30 PM the temperature rises to 42°C. Due to the extreme temperatures and extensive AC use, the electrical supply system is overcharged and there is a power outage.	Call	Mob app, text report	inform them about the black out	End user send a report	2x(2 end users in the field)	2 observers with them	

	Email, phone call, VHF	Public alert->mobile app		The alert system changes to orange. The first responders are notified on the first cases that need to intervene through the platform and VHF	4 end users with app	2 in each team (total 4)	
Due to the power cut, the roads are blocked with heavy traffic. The places of relief are beginning to accept people who are seeking shelter there.	Email, phone call, VHF	Public alert->mobile app	inform the authority the places of relief are open	Public is advised with updated instructions through the beAWARE mobile app and guided to the nearest place of relief.	4 citizens with the app	2 in the citizens group	
<ul style="list-style-type: none"> At 14.30 the temperatures rises further to 45°C. The alert system is upgraded to red. The authorities issue a warning through press releases, mass media and through posts on social media 	Email, phone call, VHF						

accounts.							
	Email, phone call, VHF	mob app report 4 images 4 videos from the street	inform them when to send the reports (every 5 minutes)	report about the traffic	2 end users in the field	2 observers with them	
	Email, phone call, VHF	Public alert->mobile app	inform the authority the places of relief are open	Due to the power cut, the roads are blocked with heavy traffic. The places of relief are beginning to accept people who are seeking shelter there. The platform notifies the public of the nearest available location.	4 citizens with the app	2 in the citizens group	
<i>Authorities track the movements of first responder teams in all the municipality and provide the ability to evaluate in real</i>	<i>Email, phone call, VHF</i>	<i>mobile app</i>	<i>inform the authorities with the position of the rescuers</i>	<i>Map of rescue teams and task evaluation</i>	<i>2 rescuers with the mobile app</i>	<i>1 observer with them</i>	

<i>time the execution of the assigned tasks with a global visualization of the activities performed</i>							
<i>Give specific evacuation orders to First Responders of people trapped inside a building/elevator etc</i>	<i>Email, phone call, VHF</i>	<i>mobile app</i>	<i>inform the rescuers after a call or at tweet that a person asks for help</i>	<i>specific instructions are sent through the beAWARE mobile app to the rescuers to rescue people in danger</i>	<i>2 rescuers with the mobile app</i>	<i>1 observer with rescuers</i>	
<i>Another incident occurs near the first one and PSAP send part of the active team in the area to deal with the new incident</i>	<i>Email, phone call, VHF</i>	<i>mobile app</i>	<i>new incident from phone call, tweet which is near the active team on the field</i>	<i>specific instructions are sent through the beAWARE mobile app to the rescuers to assist in the new danger</i>	<i>2 rescuers with the mobile app</i>	<i>1 observer with rescuers</i>	
Session C - Place of relief							
At 14.30 the temperatures rises further to 45°C. The alert system is upgraded to	Email, phone call, VHF	Public alert->mobile app		The public is advised through the beAWARE platform and mobile app to stay at home, in cool areas or seek shelter			

red.				to air-conditioned places.			
			The call centers of public authorities are receiving numerous calls of elderly with health people who are stuck in their houses without AC and elevator, and require immediate attention.				
All the main roads are blocked due to the jam and lack of traffic lights.							
Some of shelters are beginning to arrive to the critical 80% of capacity and specific		social media	live tweets				

Some of shelters are beginning to arrive to the critical 80% of capacity and specific		social media	dataset				
Some of shelters are beginning to arrive to the critical 80% of capacity and specific	Email, phone call, VHF	Mob-app		Reports from shelters with images and videos			
<i>Assign task to first responder to go from one relief place to another to help the situation</i>	<i>Email, phone call, VHF</i>	<i>mobile app</i>	<i>Second place of relief, needs assist, request from mobile app</i>	specific instructions are sent through the beAWARE mobile app to the rescuer to go from one relief place to the other	<i>1 rescuer with the mobile app</i>	<i>1 observer with the rescuer</i>	
specific instructions are sent through the beAWARE mobile app to the public to show which relief place is still open and easier to access	Email, phone call, VHF	Public alert->mobile app		specific instructions are sent through the beAWARE mobile app to the public to show which relief place is still open and easier to access			

<i>Give specific evacuation orders to First Responders</i>	<i>Email, phone call, VHF</i>	<i>mobile app</i>	<i>After an incident evacuation orders are given from mobile app to the rescuers for a specific place of relief</i>	specific instructions are sent through the beAWARE mobile app to the rescuers to evacuate the relief place.	<i>3 rescuers with the mobile app, 10 citizens</i>	<i>2 observer with rescuers</i>	
Session C(2) - fade out							
Report from the team in the field	Email, phone call, VHF	Public alert->mobile app		Using the analysis with media from traffic of the platform and by notifying the general public to avoid taking cars, the traffic is progressively decreasing in the road and by 16.00 the roads are clearer. The temperature for the first time drops to 43°C.			

Gradually, the phenomenon is managed, the temperature drops below 36 °C, power is restored and people return to their homes from the shelters. Nevertheless, to the weather forecast for the next days, authorities are on alert to manage any event that might rise during the duration of the phenomenon.	Email OR phone call OR VHF	Crisis classification -> PSAP o forecast data o highest temperature value o Average value from 4 places	Crisis Classification run				
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4.3.3 Equipment and participants of Heatwave Scenario

The participants at the heatwave pilot were more than 50 people. In addition to the consortium members, volunteers from the Hellenic Rescue Team, volunteers from other rescue organizations, and members of the Civil Protection of the Region of Central Macedonia participated at the implementation of the pilot. From them, 30 citizens participated in the relief place Session, at the 6th KAPI.

For all participants, the same procedure was followed, which is:

1. Communicating with organizations, rescue teams and authorities.
2. Everyone was informed for beAWARE platform and the heatwave pilot.
3. Everyone was informed about GDPR and other personal data protection rules.
4. Signature and consent of participants based on point 3.
5. Participants were informed about their roles
6. Heatwave pilot execution

For all participants, PSAP operators, first responders, observers, authorities' representatives and members of the consortium, personal data protection papers were created. Those were signed from all participants and are presented in the ANNEX.

Consent form No 1 and No2 are in Greek because the majority of the citizens that were involved in the relief place were elders and it was decided to have them in Greek in order to inform them in a language that can fully understand.

Consent form No 3 is in English and was given to all participants at HRT Headquarters on Monday 19 and Tuesday 20 of November 2018.

Moreover, regarding the equipment that were used for the implementation of the heatwave pilot those were:

1. 5 VHF's
2. 10 laptops
3. 2 projectors
4. 40 mobile devices

The two main places that Heatwave pilot took place were:

1. HRT Headquarters
2. Relief place building (6th KAPI)

The participants of the Heatwave pilot were:

5. 30 citizens only for the relief place
6. 25 rescuers, citizens and observers

All the above were used in order to support the scenario and the role that every participant had in it and also to set up the PSAP in HRT headquarters in order to be used during the pilot.

5 Conclusion

An in-depth analysis of this deliverable with all the updates for each scenario was performed. Initially, the Use Cases and User Requirements based on D2.1 and D2.3 were analyzed, compared, and updated for the flood and fire pilots as for the heatwave pilot, the tested Use Cases and User Requirements were mentioned and analyzed. Additionally, as mentioned in the deliverable, the untested Use Cases from heatwave pilot, will be tested in future tabletop exercises or the two remaining pilots. For the two remaining pilots, the storylines were developed based on the implementation of the first one as also, the requirements of the end users and the continuous cooperation between end users and technical partners having in mind the maturity level of the beAWARE platform.

The successful completion of the heatwave pilot gave a very significant boost to the other end users of the consortium through participation and observation and in full cooperation with the technical partners to reflect their needs for the successful completion of their beAWARE pilot and overall. Finally, for all pilots the demonstration sites with maps, the storyline of the pilots with their updates, the equipment, the participants and the places were described.

It is very important to note down that as the beAWARE platform evolves, and due to the ongoing discussions and cooperation between technical partners and first responders, changes, clarifications and more specialization and analysis for all the pilots is taking place. These changes and updates that have been captured on this deliverable are intended to demonstrate the future steps for the successful implementation of the 2 remaining pilots, and the importance of the continuous and dynamic evolution of the beAWARE platform and mobile application and the project overall.

To sum up, in this deliverable the final and updated use cases and user requirements, as well as the final steps for the implementation of the pilots, were presented. The continuation and success of the project is based on the evolution of the platform, through a successful evaluation, on mutual understanding and cooperation between all members of the consortium, which is reflected in successful pilots' implementation and in the constant evolution of the beAWARE system.